

S.R.FATEPURIA COLLEGE

BELDANGA, MURSHIDABAD

PROGRAMME AVAILABLE IN THE INSTITUTION:

B.A.Honours: Bengali, History, Philosophy, Political Science, English, Arabic, Sanskrit, Education, Geography

B.A. General: Bengali, History, Philosophy, Political Science, English, Arabic, Geography, Education, Economics, Sanskrit, Physical Education

B.Sc.Honours: Physics, Chemistry, Mathematics, Environmental Science, Geography

B.Sc. General: Physics, Chemistry, Mathematics

B.Com Honours & General

OUTCOMES

U.G. Program Outcome Program Outcome of Bachelor of Arts (B.A.): Student seeking admissions for B.A. programme are expected to imbue with following quality which helps them in their future life to achieve the expected goals-

•Realization of human values & ethics. •Sense of social service. • Responsible and dutiful citizen. • Ability to Creative & independent and lifelong learning. • Understand critical thinking. • Learn effective communication skill. • Demonstrate social interaction & effective citizenship. • Understand environment and sustainability.

Program Outcomes of BACHELOR OF COMMERCE (B.COM): Students who have taken admission to this program of B.Com are expected to concentrate upon the following outcomes.

• Commercial sense. • Develop managerial skills. • Entrepreneurial skill. • Budgeting policy. • Human Resources Management. • Develop Numerical ability. • Well versed with business regularity framework.

Program Outcomes of BACHELOR OF PHYSICS: Student will be able to-

• Understand the depth knowledge of various subjects of Physics. • Demonstrate skills and competencies to conduct wide range of scientific experiments. • Identify their area of interest in academic and R&D. Perform job in various fields' viz.

Program Outcomes of BACHELOR OF CHEMISTRY: Student will be able to-

•Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry. • Solve the problem and also think methodically, independently and draw a logical conclusion. • Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions. • Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community. • Find out the green route for chemical reaction for sustainable development. • To inculcate the scientific temperament in the students and outside the scientific community. • Use modern techniques, decent equipments and Chemistry software"s

Program Outcomes of BACHELOR OF MATHEMATICS: Student will be able to-

- Demonstrate basic manipulative skills in algebra, geometry, trigonometry, and beginning calculus
- Apply the underlying unifying structures of mathematics (i.e. sets, relations and functions, logical structure) and the relationships among them
- Demonstrate proficiency in writing proofs
- Communicate mathematical ideas both orally and in writing
- Investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods
- Investigate and solve unfamiliar math problems

Program Outcomes of BACHELOR OF ENVIRONMENTAL SCIENCE: Aims of B.Sc. (Hons.) Environmental Science The aims of the B.Sc. (Hons) Environmental Science are to:

- Provide students with the scope to develop knowledge base covering all attributes of the environment and enable them to attain scientific/technological capabilities to find answers to the fundamental questions before the society with regards to human action and environmental effects with due diligence.
- Enhance the ability to apply this knowledge and proficiency to find solutions relating to environmental concerns of varied dimensions of present times
- Provide with a direction and technical capability to carry on lifelong learning and show teamwork and collaborative endeavour, and decision making
- Improve the employability of the graduates including the enhancement of selfemployment potential and entrepreneurial aptitude, and fill the technical resource gap especially in the Indian context
- Help graduates appreciate requirement of framing environmental policy guidelines.
- Motivate graduates to appreciate that they are an integral stakeholder in the environmental management of India irrespective of their future jobs or working environments in accordance of the provisions vide Article 48A (Directive Principles of State Policy) and Article 51A(g) (Fundamental Duties) of the Constitution of India.
- Help graduates to understand the concerns related to Sustainable Development Goals (SDGs) and the Indian obligations

FOR PROGRAMME SPECIFIC DETAILS KINDLY FOLLOW THE DETAILS SYLLABUS AS PER UNIVERSITY OF KALYANI GUIDELINES BELOW :-

The University of Kalyani



Syllabus for Three Year B.A. Honours

in

Arabic

Under Semester With C B C S

(w.e.f. 2018-2019)

Outline of the Choice Based Credit System

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. **Ability Enhancement Courses/ Skill Enhancement Courses:**

3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

This document contains following sections

A. Total number of course

- a. Table 1: Credit wise distribution
- b. Table-2: Semester wise distribution
- c. Table-3: Course & semester wise distribution

B. Semester-wise detail content of UG-CBCS syllabus

A. TOTAL Number of courses in UG-CBCS (B.A./B.Sc./B.Com. Hons.):

Types of course	Core course (CC)	Elective course		Ability enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course (GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

TABLE-1: DETAILS OF COURSES & CREDIT OF B.A. Arabic (HONOURS) UNDER CBCS

S. No.	Particulars of Course	Credit Point
1.	Core Course: 14 Papers	Theory + Tutorial
1.A.	Core Course: Theory (14 papers)	14x5 = 70
1.B.	Core Course (Tutorial)*(14 papers)	14x1 = 14
2	Elective Courses: (8 papers)	
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x5 = 20

2.B.	DSE (Practical / Tutorial)* (4 papers)	4x1 =4
2C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x5 = 20
2.D.	GE (Tutorial)* (4 papers)	4x1 =4
3.	Ability Enhancement Courses	
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4
	Total Credit:	140

**TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.A./B.SC./B.COM.
HONS**

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1			--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

COURSE CODE & COURSE TITLE:

A. Core Courses (CC)

1. ARB-H-CC-T-1: History of Arabic Literature (Pre-Islamic to Umayyad Period)
Gram. & Trans
2. ARB-H-CC-T-2: Arabic Prose [Islamic & Medieval -(Part- A)
3. ARB-H-CC-T-3: Hist. of Arabic Lit. (Abbasid period& Indian Arabic Lit.) ,Gram.&
Trans
4. ARB-H-CC-T-4: Arabic Prose [Islamic &Medieval - (Part-B)]
5. ARB-H-CC-T-5: Poetry (Pre-Islamic , Islamic & Umayyad period)

6. ARB-H-CC-T-6: History of Arabic Literature (Spain & Egypt) & Grammar and Translation
7. ARB-H-CC-T-7: Poetry (Abbasid & Fatimid)
8. ARB-H-CC-T-8: History of Arabic Literature (North+South America) & Grammar and Translation
9. ARB-H-CC-T-9: Prose (Modern Period, Unit-1)
10. ARB-H-CC-T-10: Poetry (Modern Period, Unit-2)
11. ARB-H-CC-T-11: History of Islam, Rhetoric, Prosody & Philology
12. ARB-H-CC-T-12: Prose (Modern Period Unit -II)
13. ARB-H-CC-T-13: Poetry (Modern Period Unit -II)
14. ARB-H-CC-T-14: Outline History of Modern Arab World & Composition

B. Discipline Specific Elective Courses (DSE)

1. ARB-H-DSE-T-1: Terminology & Vocabulary
2. ARB-H-DSE-T-2: Impact of the Holy Quran on Arabic Literature
3. ARB-H-DSE-T-3: Development of different kinds of knowledge in Abbasid period
4. ARB-H-DSE-T-4: Contribution of Indians to the development of Arabic Literature

C. Generic Elective Courses(GE):

1. ARB-H-GE-T-1: Any discipline other than Arabic
2. ARB-H-GE-T-2: Any discipline other than Arabic
3. ARB-H-GE-T-3: Any discipline other than Arabic
4. ARB-H-GE-T-4: Any discipline other than Arabic

D. Ability Enhancement Compulsory Courses (AECC):

1. AECC-1:Environmental Education
2. AECC-2: English Communication

E. Skill Enhancement Courses (SEC):

1. ARB-H-SEC-T-1: Translation (on the basis of grammatical rules)

2. ARB-H-SEC-T-2: Translation, Interpretation (from English-Arabic News Papers) & Communicative Skill.

B. A. Honours in Arabic

There will be six semesters in the three years B. A. Honours in Arabic . The curriculum consists 14 core courses(CC) , 2 Skill Enhancement Courses (SEC) and 4 Discipline Specific Elective (DSE) courses and 4 Generic Elective (GE) courses .

B. A. Honours in Arabic : 1st Semester

Course Code	Course Title	Course wise Class	Credit
ARB-H-CC-T-1	Hist. of Arabic Lit.(from Pre-Islamic to Umayyad period), Gram. & Trans	Core (60L+15T)	6 (5L+1T)
ARB-H-CC-T-2	Arabic Prose [Islamic & Medieval - (Part- A)]	Core (60L+15T)	6 (5L+1T)
ARB-H-GE-T-1	Any discipline other than Arabic	Core (60L+15T)	6 (5L+1T)
AECC-1	Environmental Education	AECC	2 (2L)
Total	4 Courses	Total	20

2nd Semester

Course Code	Course Title	Course wise Class	Credit
ARB-H-CC-T-3	Hist. of Arabic Lit. (Abbasid period& Indian Arabic Lit.) ,Gram.& Trans	Core (60L+15T)	6 (5L+1T)
ARB-H-CC-T-4	Arabic Prose [Islamic &Medieval - (Part- B)]	Core (60L+15T)	6 (5L+1T)
ARB-H-GE-T-2	Any discipline other than Arabic	GE (60L+15T)	6 (5L+1T)
AECC-2	Communicative English/MIL	AECC	2 (2L)
Total	4 Courses	Total	20

3rd Semester

Course Code	Course Title	Course Wise Class	Credit
ARB-H-CC-T-5	Poetry (Pre-Islamic , Islamic & Umayyad period)	Core (60L+15T)	6 (5L+1T)
ARB-H-CC-T-6	History of Arabic Literature (Spain & Egypt) & Grammar and Translation	Core (60L+15T)	6 (5L+1T)
ARB-H-CC-T-7	Poetry (Abbasid & Fatimid)	Core (60L+15T)	6 (5L+1T)
ARB-H-GE-T-3	Any discipline other than Arabic	GE (60L+15T)	6 (5L+1T)
ARB-H-SEC-T-1	Translation (on the basis of Grammatical Rules)	SEC-(25L)	2 (2L)
Total	5 Courses	Total	26

4th Semester

Course Code	Course Title	Course wise Class	Credit
ARB-H-CC-T-8	History of Arabic Literature (North+South America) & Grammar and Translation	Core (60L+15T)	6 (5L+1T)
ARB-H-CC-T-9	Prose (Modern Period, Unit-1)	Core (60L+15T)	6 (5L+1T)
ARB-H-CC-T-10	Poetry (Modern Period, Unit-2)	Core (60L+15T)	6 (5L+1T)
ARB-H-GE-T-4	Any discipline other than Arabic	GE (60L+15T)	6 (5L+1T)
ARB-H-SEC-T-2	Translation, Interpretation (from English – Arabic News papers) & Communicative Skill	SEC-(25L)	2 (2L)
Total	5 Courses	Total	26

5th Semester

Course Code	Course Title	Course Wise Class	Credit
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ARB-H-CC-T-11	History of Islam, Rhetoric, Prosody & Philology	Core (60L+15T)	6 (5L+1T)
ARB-H-CC-T-12	Prose (Modern Period Unit -II)	Core (60L+15T)	6 (5L+1T)
ARB-H-DSE-T-1	Terminology & Vocabulary	DSE (60L+15T)	6 (5L+1L)
ARB-H-DSE-T-2	Impact of the Holy Quran on Arabic Literature		6 (5L+1L)
Total	4 Courses	Total	24

6th Semester

Course Code	Course Title	Course Wise Class	Credit
ARB-H-CC-T-13	Poetry (Modern Period Unit -II)	Core (60L+15T)	6 (5L+1T)
ARB-H-CC-T-14	Outline History of Modern Arab World & Composition	Core (60L+15T)	6 (5L+1T)
ARB-H-DSE-T-3	Development of different kinds of knowledge in Abbasid period	DSE (60L+15T)	6 (5L+1T)
ARB-H-DSE-T-4	Contribution of Indians to the development of Arabic Literature		6 (5L+1T)
Total	4 Courses	Total	24
Total (All Semesters)	26 Courses	Total	140

B. A. Honours in Arabic

Semester-I

CC-1: History of Arabic Literature(from Pre-Islamic to Umayyad Period) , Gram. & Trans.

Total Classes-60 (Hist. of Arabic Lit.-30, Gram.&Trans-30)

A. Hist. of Arabic Literature(from Pre-Islamic to Umayyad Period)

1. Pre-Islamic Period (500 -622 A. D.)

(a).Brief history of Pre-Islamic literature (b) Al-Muallaqat and its poets.

2 .Islamic Period & Umayyad Period (622-750 A.D.)

(a) Al-Quran (b) Al-Hadith (c) Poetry with special reference to Al-Khansa, Hassan bin Thabit, Umar bin abi Rabiah, Al-Akhtal, Al- Farazdaq, Jarir

B. Grammar & Translation: The following topics:

(د) حروف الجر	(ا) الكلمة وأقسامها : الاسم والفعل والحرف
(ذ) حروف الاستفهام	(ب)العدد : واحد، تثنية ، جمع وأقسامه
(ر) أقسام الفعل: الماضي، المضارع ،الأمر، النهي	(ت) الأداة : النكرة والمعرفة
(ز) الفعل المجرد وأبوابه	(ث) الجنس : المذكر والمؤنث
(س) المضاف والمضاف اليه	(ج) اسم الإشارة
(ش) الموصوف والصفة	(ح) اسم الموصول
(ص) المبتدأ والخبر	(خ) الضمير وأقسامه

CC-2: Arabic Prose (Islamic & Medieval)

Total Classes- 60

The following topics:

القرآن الكريم	أ. ترجمة سورة الحجرات
القرآن الكريم	ب. ترجمة سورة بني إسرائيل (الركوع-2،3،4)
الإمام مسلم ابن الحجاج القشيري	ج. الصحيح (أحاديث منتخبة)
سيرة ابن هشام	د. خطبة النبي صلي الله عليه وسلم في حجة الوداع
د.عبد الرحمان رافت باشا	ه. سلمان الفارسي

Semester-II

CC-3: History of Arabic Literature (Abbasid Period & Indian Arabic Lit.),Gram. &Trans.:

Total Classes-60 (Hist. of Arabic Lit.-30, Gram. &Trans.-30)

A . Hist. of Arabic Lit. (Abbasid Period -750-1258) & Indian Arabic Lit.)

Abbasid Period & Indian Arabic Literature :

(a)Brief history of the PROSE Literature with special reference to -

الطبقات الأربعة للنثر العربي وأئمتها ، عبد الله بن المقفع ، الجاحظ ، الهمداني ، الحريري ، أبو الفرج الأصفهاني

(b) Brief history of POETRY with special reference to the following poets :

بشار بن برد ، أبو العتاهية ، أبو نواس ، أبو تمام ، المتنبي ، المعري

(c) Life and works of the following INDIAN Arabic Scholars:

- | | |
|---------------------------------|----------------------------------|
| (ا) غلام علي آزاد البلغرامي | (ث) الشيخ عبد الحق المدث الدهلوي |
| (ب) شاه ولي الله المحدث الدهلوي | (ج) الشيخ أبو الحسن علي الندوي |
| (ت) نواب صديق حسن خان | (ح) أبو محفوظ الكريم المعصومي |

B . Grammar & Translation : The following topics:

- | | |
|---|----------------------------------|
| أ. الفعل اللازم و المتعدي | ج . الحالة : الرفع ، النصب، الجر |
| ب. نواصب الفعل المضارع | ح . الحروف المشبهة بالفعل |
| ت. جوازم الفعل المضارع | خ . الأفعال الناقصة |
| ث. المصدر و الأسماء المشتقة : اسم الفاعل ، اسم المفعول ، اسم الظرف ، اسم الآلة ، اسم التفضيل ، اسم المبالغة ، الصفة المشبهة | د . العدد والمعدود |
| | ذ . المستثنى والمستثنى منه |

N.B.- Translation (Arabic to English & vice versa) should be exercised on the prescribed Grammatical topics pointed out wherever in the whole syllabus. This type of exercises of the GRAMMAR-BASED-TRANSLATION should be strictly followed.

CC-4 : Arabic Prose (Islamic & Medieval)

Total Class : 60

The following topics:

- | | |
|-----------------------------|---------------------|
| أ. خطبة عمر (رض) في الحكم | ابن هشام |
| ب. مؤامرة قريش | عبد الله بن المقفع |
| ج. القضاء و القدر | الجاحظ |
| د. بين قاض وقور و ذباب جسور | أبو الفرج الأصفهاني |
| هـ. أشعب و البخيل | ابن عبد ربه |
| و. القميص الأحمر | |

Semester- III

CC-5 : Poetry (Pre-Islamic , Islamic & Umayyad period)

Total Classes: 60

20 بيتا	1 – معلقة امرؤ القيس
20 بيتا	2 – معلقة لبيد بن ربيعة
(1) وقال يرثى النبي صلى الله عليه وسلم (2) وقال في يوم بدر	3 – حسان بن ثابت
العباس بن مرداس السلمي	4- الحماسة
يمدح سيدنا عليا زين العابدين	5 – الفرزدق
وله يرجو قضاء حاجة من عمر بن عبد العزيز	6 – جرير

CC-6 : History of Arabic Literature (Spain) & Grammar + Translation

Total Classes-60:[History of Arabic Literature -30, Grammar + Translation -30]

A. History of Arabic Literature in Spain /Andalusia Period

- Brief History of Andalusia Period Litature
- Prose:** with special reference to Ibn Abd Rabbihi, Ibn Khaldun and Lisanuddin Ibn Khatib.
- poetry:** with special reference to Muashsha , Ibn Zaidun and Ibn Hani Al-Adalusi.

B. Grammar & Translation : the following topics

الفعل المزيد فيه وأبوابه	(1)
خاصيات الأبواب : إفعال ، تفعيل ، افتعال ، استفعال ، مفاعلة	(2)
الأفعال المقترنة بالمضارع : المقاربة – الرجاء – الشروع	(3)
كم الاستفهامية والخبرية	(4)
الجمع واقسامه	(5)
المفاعيل الخمسة	(6)
حروف النداء	(7)

Grammar Based Translations on the Prescribed Items are Compulsory (Arabic to English –Marks 7.5 & vice versa)

CC-7 : History of Arabic Literature in Egypt:

- a) Napoleon's invasion (1798 A. D.) The Causes of Arab Renaissance.
- b) The Development of Modern Arabic Prose With special reference to Refaah Rafe Tahtawi, Muhammad Abduhu, Al- Manfaluti, Taha Hussain, Mohammad Hussain Haikal, Najib Mahfuz, Bahesatul Badiya And Taufiq Al- Hakim.
- c) Development of Modern Arabic poetry: Barudi, Shauqi, Hafiz Ibrahim, And Khalil Mutran.

Semester-IV

CC-8 : Poetry (Abbasid & Fatimid period)

Total Classes: 60

الزهد 14 بيتا	(1) ابن الرومي
نعد المشرفية والعوالي	(2) المتنبي
إلا في سبيل المجد ما أنا فاعل	(3) ابو العلاء المعري
شربنا علي ذكر الحبيب	(4) ابن الفارض

CC-9 History of Arabic Literature (North & South America/Adabul Mahjar) & Grammar + Translation Total Classes-60:[History of Arabic Literature -30, Grammar + Translation -30]

- 1- History of Mahjarite literature in North+South America /Adabul Mahjar
 - A. A brief history of Mahjarite literature with special reference to: Rabita Qalamiya (The Pen Association – New York), Jibran Khalil Jibran, Mikhail Nuaima & Iia Abu Madi,
 - B. Al- Usba Al- Undalusiya (Spaniard Association–Brazil) Rashid Salim Al- khouri & Fauzi Maluf & Michel Maluf

2. Grammar the following topics:

الحال وذو الحال	(1)
التمييز	(2)
المعرب والمبني	(3)
الممنوع من الصرف	(4)
حروف الشرط	(5)
"لا" لنفي الجنس	(6)

ما و لا المتشابهان بليس (7)

التوابع (8)

Grammar Based Translations on the Prescribed Items are Compulsory (Arabic to English & vice versa –Marks 7.5+ 7.5 = 15)

CC- 10: Development of Modern Arabic Novel, short-story, Drama & Formation of Literary Groups

- A. Introduction to the Diwan group with special reference to Abbas Mahmud Al-Aqad, Ibrahim Al-Mazeni & Abdur Rahman Al-Shukri
- B. Introduction to Appollo group with special reference to Ahmed Zaki Abu Shadi, Ibrahim Naji & Abul Qasim Al-Shabi
- C. Development of Modern Arabic short-story, Novel And Drama with special reference to Mahmud Taimur, Mohammed Hussain Haikal, Taufiq Al-Hakim
- D. Essay Writing : visit to famous city, prominent library, zoo and the personality you love most

Semester-V

CC-11 : Prose (Modern Period Unit -1)

Total Classes: 60

- | | |
|----------------------------|---------------------------------------|
| محمد حسين هيكل | (1) أول عهد يثرب |
| جبران خليل جبران | (2) مرتا البانية |
| حمد الحبيب المعلي التونسي | (3) حنان أب |
| د. طه حسين | (4) تجارة رابحة |
| السيد أبو الحسن علي الندوي | (5) منهج الأنبياء في الإصلاح والتغيير |

CC- 12 : Poetry (Modern Period Unit -I)

Classes : 60

- | | |
|---------------------|---------------------------------------|
| محمود سامي البارودي | (1) أين أيام لذتي وشبابي |
| أحمد شوقي | (2) (أ) صدى الحرب (ب) الهمزية النبوية |
| حافظ ابراهيم | (3) الأستاذ محمد عبده |
| الزهاوي | (4) جميل وبثين |

Semester-VI

CC-13 : Prose (Modern Period Unit -II)

Total Classes: 60

- | | |
|----------------------|-------------------------|
| مصطفى لطفى المنفلوطي | (1) الدفين الصغير |
| نجيب محفوظ | (2) حادثة (دنيا الله) |
| أحمد أمين | (3) الثقافة الهندية |
| على الطنطاوي | (4) بين الأمس واليوم |
| شكيب أرسلان | (5) المدنية الإسلامية |

CC-14 : Poetry (Modern Period Unit -II)

Total Classes: 60

- | | |
|-------------------|------------------------|
| عباس محمود العقاد | (1) سكران |
| عبد الرحمن الشكري | (2) عصفور الجنة |
| رشيد سليم الخوري | (3) حضن الأم |
| أبو القاسم الشابي | (4) صلوات في هيكल الحب |

Skill Enhancement Courses

Semester-III

SEC-1: Translation & Composition (on basis of Grammatical rules)

الإشياء و الترجمة على أساس المواد التالية:

- (1) أقسام الجملة : الاسمية , الفعلية , الشرطية , الإنشائية ، المبتدأ و الخبر ، مواضع تقديم المبتدأ على الخبر ، مواضع تقديم الخبر على المبتدأ و فعلا التعجب
- (2) التمرين بكتابة الرسائل في عناوين مختلفة وكتابة الطلب (Application) باللغة العربية

Semester-IV

SEC-2: Translation & Interpretation (from English into Arabic & vice versa from News papers) & Communicative Skill:

(أ) الترجمة من الصحيفة العربية و الإنجليزية: المواد العلمية , السياسية , الاجتماعية ، التجارية ، الاقتصادية والتكنولوجيا

(ب) المحادثة و الخطابة باللغة العربية في أي عنوان علمي (students must be prepared for written examination)

Discipline Specific Electives

Semester -V

DSE- 1 : History of Islam , Rhetoric, Prosody & Philology

Total Classes -60: [History of Islam -25, Rhetoric -15, Prosody & Philology -20]

1- History of Islam:

- 1) سيرة النبي صلى الله عليه وسلم من مولده إلى وفاته وتاريخ الخلفاء الراشدين
- 2) خلافة بني أمية : أمير معاوية رضي الله عنه ، واقعة كربلاء ،
- 3) خلافة بني العباس: أبو جعفر المنصور ، هارون الرشيد ، النهضة العلمية وتطور العلوم المختلفة في العهد العباسي

2- Philology / فقه اللغة

Semitic Language: Its chief characteristics , Hebrew, Aramaic ,Arabic & Syriac

DSE- 2 : Rhetoric & Prosody

(Total Classes -60)

1 Rhetoric/البلاغة

التشبيه وأقسامه – المجاز المرسل والعقلي – الاستعارة وأقسامها – الكناية – الجناس – التورية – الإطناب – الإيجاز – المساواة

2 Prosody / علم العروض

تعريف العلم العروض – المقطع – الأركان – الزحاف – العلة – القافية – البحر الكامل – البحر الوافر – البحر البسيط – التقطيع

Semester-VI

DSE-3: Outline History of Modern Arab World & Composition

Total Classes -60:

Outline History of Modern Arab World (The Following Countries)

- | | |
|-----------------|--------------|
| 1. Saudi Arabia | 1. Kuwait |
| 2. Yemen | 2. Jordan |
| 3. Iraq | 3. UAE |
| 4. Syria | 4. Bahrain |
| 5. Oman | 5. Lebanon |
| 6. Egypt | 6. Palestine |

DSE-4: Development of different kinds of knowledge in Abbasid Period , Terminology & Vocabulary

- A) Development of different kinds of knowledge in Abbasid period with special reference to history, philosophy, geography, sciences, mathematics & etc.
- B) Terminology & Vocabulary : social, political, economical, educational, technological.

Books Recommended for B.A (Hon.) Arabic (All Courses)

a) History of Arabic Literature:

جرجي زيدان	تاريخ آداب اللغة العربية	.I
أحمد حسن الزيات	تاريخ الأدب العرب	.II
شوقي ضيف	تاريخ الأدب العرب	.III
عمر فروخ	تاريخ الأدب العرب	.IV
R.A. Nicholson	A Literary History of Arabs	.V
Dr. Mohammed Shahidullah	Arabi Sahitter Itehas	.VI

b) Arabic Grammar & Translation:

علي الجارم و مصطفى أمين	1. النحو الواضح (المراحل الابتدائية والثانوية)
أبو محمد عبد الله جمال الدين بن هشام الأنصاري	2. شرح قطر الندى وبل الصدي
رفيع العماد فينان	3. ما يلزم من العربية
سيد علي مدراس	4. اللغة العربية للمبتدئين
ولي أختار الندوي	5. تعليم اللغة العربية :طريقة عملية

عبد الماجد الندوي و محمد رابع الحسني الندوي .6 .معلم الانشاء (1,2,3)

S. A. Rahman Teach Yourself Arabic .7

Obaidullah Al-Ubaidi Shuharwardi A Grammar of Arabic Language .8

Dr.Shamsuddin Mallick Arbi Byakaran –O-Anubader .9
Anginai (Part-III)

Dr. Mohammed Shahidullah Uchhotar Arabic Byakaran o .10
Anubad

C) Arabic Prose & Poetry

Arabic Selection- For B. A. Honors (under I+I+I Published by University of Calcutta
system , New Regulation - 2011)

D) Indian Writers, Arab World, Rhetoric & Prosody

السيد عبد الحي الحسني .I نزهة الخواطر

السيد غلام علي آزاد البلغرامي .II سبحة المرجان في آثار هندستان

السيد أبو الحسن علي الندوي .III المسلمون في الهند

د. علي رضا .IV تاريخ العصر العباسي المختصر

Suharabuddin Ahmad .V Muslim Jahan

Peter Mansfield .VI The Arabs

P. K. Hitti .VII History of Arabs

Syed Amir Ali .VIII A Short History of the Saracens

علي الجارم ومصطفى أمين .IX البلاغة الواضحة

E) History of Islam:

- | | |
|----------------------------|--|
| سميع عاطف الزين | (1) سيرة خاتم النبيين صلى الله عليه وسلم |
| السيد أبو الحسن علي الندوي | (2) الفاروق |
| السيد أبو الحسن علي الندوي | (3) المرتضى |
| السيد أبو الحسن علي الندوي | (4) حياة محمد صلى الله عليه وسلم |
| نجيب أكبر آبادي | (5) تاريخ الإسلام |
| K. Ali | (6) A study of Islamic History |

Interdisciplinary/ Generic Elective (GE)

(For the students of other discipline)

Semester-I

GE- 1 : History of Arabic Literature-(Pre- Islamic to Umayyad Period 500-750 A. D.) ,Gram. &Translation

(Total Class-40, Hist. of Arabic Lit.-20, Gram.& Trans.-20)

A. History of Arabic Lit.

1) Introduction of Pre-Islamic Period-(500-622 A.D.)

Al-Muallaqat with special reference to Imraul Qais, Zuhair bin Abi Sulma and Labid bin Rabia.

2) Islamic Period & Umayyad Period (622 -750 A.D.)

(a) Al-Quran (b) Al-Hadith (c) Poetry with special reference to-Al-Khansa , Hassan bin Thabit , Al-Akhtal , Al-Farazdaq, Jarir.

B. Grammar & Translation: The following topics-

(ا) الكلمة و أقسامها: اسم ، فعل ، حرف	(ح)الفعل الثلاثي المجرد و أبواب والمزيد فيه
(ب) الأداة : النكرة و المعرفة	(خ) الضمير وأقسامه
(ت) الجنس: المنكر والمؤنث	(د) المضاف و المضاف اليه
(ث) العدد : الواحد، التثنية ، الجمع	(ذ) المبتدأ والخبر
(ج) الفعل : الماضي ، المضارع ، الأمر ، النهي	(ر) الموصوف والصفة

N.B.- Translation (Arabic to English & vice versa) should be exercised on the prescribed Grammatical topics pointed out wherever in the whole syllabus. This type of exercises of the GRAMMAR-BASED-TRANSLATION should be strictly followed .

Semester-II

GE-2 : History of Arabic Literature-(Abbasid Period, 750- 1258 A. D.) ,Gram. &Translation

(Total Class-40, Hist. of Arabic Lit.-20, Gram.& Trans.-20)

A. Abbasid Period

(1) Prose Literature with special reference to :

Ibn-ul-Muqaffa, Al-Jahiz, Al-Hariri and Al-Hamadani

(2) Poetry with Special Reference to:

Bashar ibn Burd, Abu Nuas, Abul Atahiah, Abu Tammam, Al-Mutanabbi

B. Grammar & Translation. The following topics:

(ا) نواصب المضارع	(خ) الحالة : رفع ، نصب ، جر
(ب) جوازم المضارع	(د) حروف الجر
(ت) اسم الإشارة	(ذ) حروف الاستفهام
(ث) اسم الموصول	(ر) حروف الشرط
(ج) اسم الفاعل واسم المفعول	(ز) المعرب والمبني

Semester-III

GE- 3 : Prose : (Islamic, medieval, & Modern Period)

Total Classes-40

القرآن الكريم	1 سورة الحجرات
الإمام مسلم بن الحجاج	2 الجامع الصحيح (أحاديث منتخبة)
عبد الرحمن رأفت الباشا	3 سلمان الفارسي
سيرة ابن هشام	4 أصحاب الفيل
أحمد أمين	5 الدين الصناعي

Semester-IV

GE-4: Poetry : (Islamic, medieval, & Modern Period)

Total Classes-40

وقال يرثي النبي صلى الله عليه وسلم	1 حسان بن ثابت
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وله في الوعظ	2 أبو العتاهية
حال لسان اللغة العربية	3 حافظ ابراهيم
أيا صوفيا	4 أحمد شوقي
العباس بن مرداس السلمي	5 الحماسة
ألا في سبيل المجد	6 أبو العلاء المعري

Books Recommended for GE 1 to GE-4

a) History of Arabic Literature:

جرجي زيدان	أ . تاريخ آداب اللغة العربية
أحمد حسن الزيات	ب) تاريخ الأدب العربي
شوقي ضيف	ت) تاريخ الأدب العربي
عمر فروخ	ث) تاريخ الأدب العربي

b) Arabic Grammar & Translation:

علي الجارم و مصطفى أمين	ا) النحو الواضح (المراحل الابتدائية والثانوية)
سيد علي مدراس	ب) اللغة العربية للمبتدئين
د. ولي أختار الندوي	ت) تعليم اللغة العربية :طريقة عملية
عبد الماجد الندوي و محمد رابع الحسن الندوي	ث) معلم الانشاء (123)
رفيع العماد فينان	ج) يلزم من العربية
S. A. Rahman	ح) Teach Yourself Arabic
Obaidullah Al Ubaidi Shuhrahwardi	خ) A Grammar Of Arabic Language
Dr. Md. Shamsuddin Mallick	د) Arbi Byakaran-O-Anubader Anginai (Part III)

c) Arabic Prose & Poetry

Arabic Selection- For B. A. General (under I+I+I system , New Regulation - 2011), University of Calcutta .

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Proposed Syllabus For
B.Com. (Honours) and B.Com. (General) Course

Under
Choice Based Credit System
(Approved in the meeting of UGBS in Commerce held on 12/02/2018)

(To be Effective from the Academic Session 2018-19)

University of Kalyani
West Bengal



February, 2018

B. Com. (Honours) Three-Year (6-Semester) CBCS Programme
Basic Structure: Distribution of Courses

SL. NO.	COURSE	TOTAL NO. OF PAPERS	CREDIT PER PAPER	TOTAL CREDIT
1.	Ability Enhancement Compulsory Course (AECC)	2	2	$2 \times 2 = 4$
2.	Skill Enhancement Elective Course (SEC)	2	2	$2 \times 2 = 4$
3.	CORE COURSE	14	6	$14 \times 6 = 84$
4.	Discipline Specific Elective (DSE)	4	6	$4 \times 6 = 24$
5.	Generic Elective (GE)	4	6	$4 \times 6 = 24$
Total				140

B. Com. (General) Three-Year (6-Semester) CBCS Programme
Basic Structure: Distribution of Courses

SL. NO.	COURSE	TOTAL NO. OF PAPERS	CREDIT PER PAPER	TOTAL CREDIT
1.	Ability Enhancement Compulsory Course (AECC)	2	2	$2 \times 2 = 4$
2.	Skill Enhancement Elective Course (SEC)	4	2	$4 \times 2 = 8$
3.	CORE COURSE	12	6	$12 \times 6 = 72$
4.	Discipline Specific Elective (DSE)	4	6	$4 \times 6 = 24$
5.	Generic Elective (GE)	2	6	$2 \times 6 = 12$
Total				120

Three year B.Com. Honours Course
Structure of Syllabus under Semester System with CBCS
to be effective from the Academic Session 2018-19

	CC – 6 Credit	DSE– 6 Credit	GE– 6 Credit	AECC - 2 Credit	SEC- 2 credit	Total
Sem. I	2 Papers		1 Paper	1 Paper		4 Papers
	Financial Accounting 1		Fundamentals of Financial Accounting (Note 1)	Environmental Studies		
	Principles of Management					
Sem. II	2 Papers		1 Paper	1 Paper		4 Papers
	Business Mathematics		Fundamentals of Income Tax (Note 1)	Communicative English		
	Human Resource Management and Marketing Management					
Sem. III	3 Papers		1 Paper		1 Paper	5 Papers
	Financial Accounting 2		Fundamentals of Goods and Service Tax (Note 1)		<i>Any one of the following:</i> (A) E-Commerce and Computer Applications in Business (B) Office Management and Secretarial Practice	
	Business Laws					
	Income Tax Law					
Sem. IV	3 Papers		1 Paper		1 Paper	5 Papers
	Cost Accounting		Fundamentals of Cost and Management Accounting (Note 1)		<i>Any one of the following:</i> (A) Tax Returns and e-Filing of Tax Returns (B) Fundamentals of Investment	
	Indirect Tax Laws					
	Company Law					
Sem. V	2 Papers	2 DSE Optional Papers				4 Papers

	Financial Management	<i>Any one of the following:</i> (A) Management Accounting (B) Advertising				
	Auditing	<i>Any one of the following:</i> (A) Indian Financial System (B) Banking and Insurance				
Sem. VI	2 Papers	2 DSE Optional Papers				4 Papers
	Corporate Accounting	<i>Any one of the following:</i> (A) Business Communication and Entrepreneurship Development (B) Corporate Governance and Social Responsibility of Business				
	Project Work	<i>Any one of the following:</i> (A) Accounting For Local Bodies (B) International Business				
Total no. of Courses	14 Papers	4 Papers	4 Papers	2 Papers	2 Papers	26 Papers
Total Credit	14×6 = 84 Credit	4×6 = 24 Credit	4×6 = 24 Credit	2×2 = 4 Credit	2×2 = 4 Credit	140 Credit

CC stands for *Core Course*

DSE stands for *Discipline Specific Elective*

GE stands for *Generic Elective*

AECC stands for *Ability Enhancement Compulsory Course*

SEC stands for *Skill Enhancement Course*

Three year B.Com. Honours Course
Semester wise Structure of Syllabus with CBCS
to be effective from the Academic Session 2018-19

Year I: Semester I

Course Code*	Course Title	Credit	No. of Classes per Week**		No. of Classes per Week**	
			L	T	L	P
BCOM-H-1.1-CC-1-T	FINANCIAL ACCOUNTING 1	6	5	1		
BCOM-H-1.2-CC-2-T	PRINCIPLES OF MANAGEMENT	6	5	1		
BCOM-H-1.3-GE-1-T	FUNDAMENTALS OF FINANCIAL ACCOUNTING (<i>Note 1</i>)	6	5	1		
BCOM-H-1.4-AECC-1-T	ENVIRONMENTAL STUDIES	2				
Total		20				

*In Course Code, 'H' stands for Honours, 'T' stands for Theory and 'P' stands for Practical.

**Under 'No. of Classes per Week', 'L' stands for Lecture, 'T' stands for Tutorial and 'P' stands for Practical.

Year I: Semester II

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-2.1-CC-3-T	BUSINESS MATHEMATICS	6	5	1		
BCOM-H-2.2-CC-4-T	HUMAN RESOURCE MANAGEMENT AND MARKETING MANAGEMENT	6	5	1		
BCOM-H-2.3-GE-2-T	FUNDAMENTALS OF INCOME TAX (<i>Note 1</i>)	6	5	1		
BCOM-H-2.4-AECC-2-T	COMMUNICATIVE ENGLISH	2				
Total		20				

Year 2: Semester III

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-3.1-CC-5-T	FINANCIAL ACCOUNTING 2	6	5	1		
BCOM-H-3.2-CC-6-T	BUSINESS LAWS	6	5	1		
BCOM-H-3.3-CC-7-T	INCOME TAX LAW	6	5	1		
BCOM-H-3.4-GE-3-T	FUNDAMENTALS OF GOODS AND SERVICE TAX (<i>Note 1</i>)	6	5	1		
BCOM-H-3.5-SEC-1-T+P (A)	<i>Any One of the Following:</i> (A) E-COMMERCE AND COMPUTER APPLICATIONS IN BUSINESS	2				
BCOM-H-3.5-SEC-1-T (B)	Or (B) OFFICE MANAGEMENT AND SECRETARIAL PRACTICE					
Total		26				

Year 2: Semester IV

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-4.1-CC-8-T	COST ACCOUNTING	6	5	1		
BCOM-H-4.2-CC-9 -T	INDIRECT TAX LAWS	6	5	1		
BCOM-H-4.3-CC-10 -T	COMPANY LAW	6	5	1		
BCOM-H-4.4-GE-4-T	FUNDAMENTALS OF COST AND MANAGEMENT ACCOUNTING <i>(Note 1)</i>	6	5	1		
BCOM-H-4.5-SEC-2-T+P (A)	<i>Any One of the Following:</i> (A) TAX RETURNS AND E-FILING OF TAX RETURNS	2				
BCOM-H-4.5-SEC-2-T (B)	Or (B) FUNDAMENTALS OF INVESTMENT					
Total		26				

Year 3: Semester V

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-5.1-CC-11-T	FINANCIAL MANAGEMENT	6	5	1		
BCOM-H-5.2-CC-12-T	AUDITING	6	5	1		
BCOM-H-5.3-DSE-1-T (A)	<i>Any One of the Following:</i> (A) MANAGEMENT ACCOUNTING	6	5	1		
BCOM-H-5.3-DSE-1-T (B)	OR (B) ADVERTISING					
BCOM-H-5.4-DSE-2-T (A)	<i>Any One of the Following:</i> (A) INDIAN FINANCIAL SYSTEM	6	5	1		
BCOM-H-5.4-DSE-2-T (B)	OR (B) BANKING AND INSURANCE					
Total		24				

Year 3: Semester VI

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-6.1-CC-13-T	CORPORATE ACCOUNTING	6	5	1		
BCOM-H-6.2-CC-14-T+ P	PROJECT WORK	6				
BCOM-H-6.3-DSE-3-T (A)	<i>Any One of the Following:</i> (A) BUSINESS COMMUNICATION AND ENTREPRENEURSHIP DEVELOPMENT OR	6	5	1		
BCOM-H-6.3-DSE-3-T (B)	(B) CORPORATE GOVERNANCE AND SOCIAL RESPONSIBILITY OF BUSINESS					
BCOM-H-6.4-DSE-4-T (A)	<i>Any One of the Following:</i> (A) ACCOUNTING FOR LOCAL BODIES OR	6	5	1		
BCOM-H-6.4-DSE-4-T (B)	(B) INTERNATIONAL BUSINESS					
	Total	24				

Note 1:

The following four GE Papers are offered to the students (Honours) of any department other than students of commerce department.

- i) Fundamentals of Financial Accounting (GE 1)
- ii) Fundamentals of Income Tax (GE 2)
- iii) Fundamentals of Goods and Service Tax (GE 3)
- iv) Fundamentals of Cost and Management Accounting (GE 4)

[If GE papers under B.Com. (Honours) Syllabus are allowed by the University Authority to be opted by students of commerce departments as well as students of any other department, then above four GE Papers are to be substituted by the following four GE Papers (*detailed syllabus of which are provided in Appendix A*):

- i) Micro Economics (GE 1)
- ii) Business Statistics (GE 2)
- iii) Macro Economics (GE 3)
- iv) Indian Economics (GE 4)]

Three year B.Com. General Course
Structure of Syllabus under Semester System with CBCS
to be effective from the Academic Session 2018-19

	CC – 6 Credit	DSE– 6 Credit	GE– 6 Credit	AECC - 2 Credit	SEC- 2 credit	Total
Sem. I	1 Paper			1 Paper		4 Papers
	Financial Accounting 1			Environment al Studies		
	Principles of Management					
	Language L ₁ - 1					
Sem. II	2 Papers			1 Paper		4 Papers
	Human Resource Management and Marketing Management			Communicati ve English		
	Business Laws					
	Language L ₂ - 1					
Sem. III	3 Papers				1 Paper	4 Papers
	Financial Accounting 2				<i>Any one of the following:</i> (A) E-Commerce and Computer Applications in Business (B) Personal Selling and Salesmanship	
	Income Tax Law					
	Language L ₁ - 2					
Sem. IV	3 Papers				1 Paper	4 Papers
	Cost Accounting				<i>Any one of the following:</i> (A) Tax Returns and e-Filing of Tax Returns (B) Advertising	
	Indirect Tax					

	Laws					
	Language L ₂ - 2					
Sem. V	2 Papers	2 DSE Optional Papers	1 Paper		1 Paper	4 Papers
		<i>Any one of the following:</i> (A) Corporate Accounting (B) Banking and Insurance	Basic Financial Accounting (<i>Note 2</i>)		<i>Any one of the following:</i> (A) Business Communication and Entrepreneurship Development (B) Auditing	
		<i>Any one of the following:</i> (A) Management Accounting (B) Indian Financial System				
Sem. VI	1 Paper	2 DSE Optional Papers	1 Paper		1 Paper	4 Papers
		<i>Any one of the following:</i> (A) Financial Management (B) Corporate Governance And Social Responsibility of Business	Basic Income Tax (<i>Note 2</i>)		Project Work	
		<i>Any one of the following:</i> (A) Accounting For Local Bodies (B) Fundamentals of Investment				
Total	12 Papers	4 Papers	2 Papers	2 Papers	4 Papers	24 Papers

CC stands for *Core Course*

DSE stands for *Discipline Specific Elective*

GE stands for *Generic Elective*

AECC stands for *Ability Enhancement Compulsory Course*

SEC stands for *Skill Enhancement Course*

Three year B.Com. General Course
Semester wise Structure of Syllabus with CBCS
to be effective from the Academic Session 2018-19

Year I: Semester I

Course Code*	Course Title	Credit	No. of Classes per Week**		No. of Classes per Week**	
			L	T	L	P
BCOM-G-1.1-CC-1-T	FINANCIAL ACCOUNTING 1	6	5	1		
BCOM-G-1.2-CC-2 -T	PRINCIPLES OF MANAGEMENT	6	5	1		
BCOM-G-1.3-CC-3-T	LANGUAGE L ₁ - 1	6	5	1		
BCOM-G-1.4-AECC-1-T	ENVIRONMENTAL STUDIES	2				
Total		20				

*In Course Code, 'G' stands for General, 'T' stands for Theory and 'P' stands for Practical.

**Under 'No. of Classes per Week', 'L' stands for Lecture, 'T' stands for Tutorial and 'P' stands for Practical.

Year I: Semester II

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-2.1-CC-4-T	HUMAN RESOURCE MANAGEMENT AND MARKETING MANAGEMENT	6	5	1		
BCOM-G-2.2-CC-5 -T	BUSINESS LAWS	6	5	1		
BCOM-G-2.3-CC-6-T	LANGUAGE L ₂ - 1	6	5	1		
BCOM-G-2.4-AECC-2-T	COMMUNICATIVE ENGLISH	2				
Total		20				

Year 2: Semester III

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-3.1-CC-7-T	FINANCIAL ACCOUNTING 2	6	5	1		
BCOM-G-3.2-CC-8 -T	INCOME TAX LAW	6	5	1		
BCOM-G-3.3-CC-9-T	LANGUAGE L ₁ - 2	6	5	1		
BCOM-G-3.4-SEC-1-T+P (A)	<i>Any one of the following:</i> {A} E-COMMERCE AND COMPUTER APPLICATIONS IN BUSINESS	2				
BCOM-G-3.4-SEC-1-T (B)	OR {B} PERSONAL SELLING AND SALESMANSHIP					
Total		20				

Year 2: Semester IV

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-4.1-CC-10-T	COST ACCOUNTING	6	5	1		
BCOM-G-4.2-CC-11 -T	INDIRECT TAX LAWS	6	5	1		
BCOM-G-4.3-CC-12-T	LANGUAGE L ₂ - 2	6	5	1		
BCOM-G-4.4-SEC-2-T+P (A)	<i>Any one of the following:</i> (A) TAX RETURNS AND E-FILING OF TAX RETURNS	2				
	OR					
BCOM-G-4.4-SEC-2-T (B)	(B) ADVERTISING					
	Total	20				

Year 3: Semester V

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-5.1-DSE-1-T (A)	<i>Any one of the following:</i> (A) CORPORATE ACCOUNTING	6	5	1		
	OR					
BCOM-G-5.1-DSE-1-T (B)	(B) BANKING AND INSURANCE					
BCOM-G-5.2-DSE-2-T (A)	<i>Any one of the following:</i> (A) MANAGEMENT ACCOUNTING	6	5	1		
	OR					
BCOM-G-5.2-DSE-2-T (B)	(B) INDIAN FINANCIAL SYSTEM					
BCOM-G-5.3:GE-1-T	BASIC FINANCIAL ACCOUNTING (<i>Note 2</i>)	6	5	1		
BCOM-G-5.4-SEC-3-T (A)	<i>Any one of the following:</i> (A) BUSINESS COMMUNICATION AND ENTREPRENEURSHIP DEVELOPMENT	2				
	OR					
BCOM-G-5.4-SEC-3-T (B)	(B) AUDITING					
	Total	20				

Year 3: Semester VI

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-6.1-DSE-3-T (A)	<i>Any one of the following:</i> (A) FINANCIAL MANAGEMENT OR (B) CORPORATE GOVERNANCE AND SOCIAL RESPONSIBILITY OF BUSINESS	6	5	1		
BCOM-G-6.1-DSE-3-T (B)						
BCOM-G-6.2-DSE-4-T (A)	<i>Any one of the following:</i> (A) ACCOUNTING FOR LOCAL BODIES OR (B) FUNDAMENTALS OF INVESTMENT	6	5	1		
BCOM-G-6.2-DSE-4-T (B)						
BCOM-G-6.3-GE-2-T	BASIC INCOME TAX (<i>Note 2</i>)	6	5	1		
BCOM-G-6.4-SEC-4-T+P	PROJECT WORK	2				
	Total	20				

Note 2:

The following two GE Papers are offered to the students (General) of any department other than students of commerce department.

- i) Basic Financial Accounting (GE 1)
- ii) Basic Income Tax (GE 2)

[If GE papers under B.Com. (General) Syllabus are allowed by the University Authority to be opted by students of commerce departments as well as students of any other department, then above two GE Papers are to be substituted by the following two GE Papers (*detailed syllabus of which are provided in Appendix B*):

- i) Business Economics (GE 1)
- ii) Business Mathematics and Statistics (GE 2)]

Detailed Syllabus

B.Com. (Honours)

Year I: Semester I

Course Code*	Course Title	Credit	No. of Classes per Week**		No. of Classes per Week**	
			L	T	L	P
BCOM-H-1.1-CC-1-T	FINANCIAL ACCOUNTING 1	6	5	1		
BCOM-H-1.2-CC-2 -T	PRINCIPLES OF MANAGEMENT	6	5	1		
BCOM-H-1.3-GE-1-T	FUNDAMENTALS OF FINANCIAL ACCOUNTING (<i>Note 1</i>)	6	5	1		
BCOM-H-1.4-AECC-1-T	ENVIRONMENTAL STUDIES	2				
	Total	20				

B.Com. (Honours)
Semester – I
Course Code: BCOM-H-1.1- CC-1-T
Course Title: FINANCIAL ACCOUNTING 1
Credit - 6
Full Marks - 75

Course Contents

1. Introduction to Accounting

- (i) Meaning and objectives of Financial Accounting, Meaning of different types of accounting
- (ii) Users of accounting information and their information Need
- (iii) Accounting Concepts and Conventions: Entity, Money Measurement, Cost, Realisation, Periodicity, Going Concern, Accrual, Consistency, Conservatism, Materiality, Matching and Full Disclosures.
- (iv) Meaning of Accounting Theory, Relation of Accounting Theory with Practice, Generally Accepted Accounting Principles (GAAP)
- (v) Accounting Standards: Concept, Need, Benefits and Limitations of Accounting Standards, Types (Accounting Standards & Indian Accounting Standards) and names of Accounting Standards in India, Provision relating to mandatory application of Accounting Standards under Companies Act.
- (vi) Basic concept of IFRS.

2. Double entry book keeping system:

- (i) Basic Accounting Equation,
- (ii) Meaning and recognition of Assets, Liabilities, Equity, Income and Expenses (Framework for preparation and presentation of Financial Statements issued by the ICAI)
- (iii) Accounting Cycle - Journal, Ledger, Trial Balance and Financial Statements.

3. Basic Principles of preparing Final Accounts

- (i) Revenue recognition: Meaning of revenue and Revenue Recognition Criteria (AS 9)

- (ii) Inventory: Meaning, Accounting Policy for measurement of Inventory, Ascertainment of cost of inventory, Cost Formula to be used (AS 2),
- (iii) Property, Plant and Equipment: Meaning, Recognition and Derecognition of property, plant and equipment, Accounting treatment for sale or exchange of property, plant and equipment (AS 10).
- (iii) Depreciation: Meaning, Nature and Objective of Depreciation, Methods of computing Depreciation: Straight-line method, Diminishing balance method and Units of production method, Recognition of Depreciation Charge, Change in the method of depreciation, Depreciation in case of revision of Residual Value and Useful Life of asset (AS 10)
- (iv) Provision and Reserves
- (v) Capital and Revenue (Expenditure and Income)
- (vi) Concept of Capital and maintenance of capital, relation between capital and income.
- (vii) Rectification of Errors, Adjusting Entries and Closing Entries.

4. (a) Final Accounts of Profit Seeking Organisation: Manufacturing A/C, Trading A/C, Profit & Loss A/C and Balance Sheet of Sole Proprietorship (Vertical and Horizontal Formats)

(b) Final Accounts of Not-for-Profit Organisation: Receipts and Payment Account, Income and Expenditure Account and Balance Sheet.

5. Accounting from Incomplete Records (including Conversion into Double Entry system)

6. Accounting for special sales transaction:

(a) Consignment: Recording in the books of Consignor – at cost & at invoice price, valuation of unsold stock; ordinary commission, Treatment and valuation of abnormal and normal loss, Special commission, Del Credere Commission (with or without bad debt) Use of consignment debtors a/c. Recording in the books of Consignee.

(b) Joint Venture: Separate set of books and Same set of books.

(c) Accounting for sales on approval.

Suggested Readings:

1. Sukla, Grewal, and Gupta: Advanced Accountancy, S. Chand.
2. Gokul Sinha, Accounting Theory & Management Accounting
3. L.S.Porwal, Accounting Theory, Tata McGraw Hill
4. R. L. Gupta & Radheswamy, Advanced Accountancy, S. Chand.
5. Maheshwari & Maheshwari, Advanced Accountancy, Vikash Publishing House.
6. Sehgal & Sehgal, Advanced Accountancy, Taxman Publication.
7. Hanif & Mukherjee, Financial Accounting, TMH.
8. Frank Wood, Business Accounting, Pearson.
9. Tulsian, Financial Accounting, Pearson.
10. Mukherjee and Mukherjee, Financial Accounting I, Oxford
11. Framework for preparation and presentation of Financial Statements issued by the ICAI.
12. Accounting Standards issued by ICAI.

13. Accounting Standards Rules under Companies Act.

B.Com. (Honours)
Semester – I
Course Code: BCOM-H-1.2- CC-2 -T
Course Title: PRINCIPLES OF MANAGEMENT
Credit - 6
Full Marks - 75

Course Contents

- 1. Introduction:** Concept, Nature, Process and Significance of Management. Is Management a science or an Art or both?
- 2. Evolution of Management Thoughts:** Contribution of Taylor, Fayol, Mayo, Follett, Weber, Neo-classical School, Modern School.
- 3. Planning:** Concept, Importance, Process & Types; Forecasting – Meaning, Importance and Techniques; Decision Making- Concepts and Steps in decision making.
- 4. Organising:** Concept, Nature, Process, Organisation Structure, Delegation of Authority, Span of Management, Line & Staff Authority.
- 5. Motivation:** Concept, Importance of Motivation, Theories- Maslow, Herzberg, McGregor.
- 6. Leadership:** Concept, Leadership Styles –Laissez-Faire, Autocratic, Participative, Transactional & Transformational; Leadership Models– Tannenbaum and Schmidt, Blake and Mouton.
- 7. Communication:** Concept, Nature, Process, Types, Importance and Barriers.
- 8. Control:** Concept, Importance, Features, Process, Tools & Techniques.
- 9. Co-ordination:** Meaning, Importance, Principle & Techniques.

Suggested Reading:

1. Ravichandran, K & Nakkiran, S., Principles of management, Abhijeet Publication.
2. Tripathy, P. C & Reddy, P.N, Principles of Management, McGraw Hill Education India Private Limited.
3. Kaul, Principles and Practice of Management, Vikash
4. Koontz & Weirich, Essentials of Management, TMH.
5. Mitra, J & Somani, N, Principles of Management and Business Communication, Oxford.

B.Com. (Honours)
Semester – I
Course Code: BCOM-H-1.3- GE-1-T
Course Title: FUNDAMENTALS OF FINANCIAL ACCOUNTING
Credit - 6
Full Marks - 75

Course Contents

1. Financial Accounting: Meaning and Objectives, Difference with Cost Accounting and Management Accounting, Users of accounting information, Meaning of assets, liabilities, equity, income and expenses, Basic accounting equation, Meaning of Transactions, Meaning and Types of Account, Rules of Debit and Credit.

2. Basic concepts and conventions:

a. Entity	g. Periodicity
b. Money Measurement	h. Consistency
c. Going Concern	i. Prudence (Conservatism)
d. Cost	j. Materiality
e. Realisation	k. Matching and
f. Accruals	l. Full Disclosures

3. Meaning and Types of Journal, Recording of transaction in Journal.

4. Meaning and Types of Ledger, Posting of transaction to ledger from journal.

5. Meaning of Trial Balance and its Preparation.

6. Depreciation

7. Capital and Revenue Expenditures and Receipts

8. Cash basis, Accrual basis and Mixed basis of accounting

9. Meaning of Financial Statements. Different types of Financial Statements and their preparation.

Suggested Readings:

1. Sukla, Grewal, Gupta: Advanced Accountancy, S. Chand. (Vol. 1).

2. Asish K. Bhattacharyya, Essentials of Financial Accounting, PHI Learning Pvt. Ltd.

B.Com. (Honours)
Semester – I
Course Code: BCOM-H-1.4- AECC-1-T
Course Title: ENVIRONMENTAL STUDIES
Credit - 2
Full Marks - 50

(To be prepared centrally by the University)

Year I: Semester II

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-2.1-CC-3-T	BUSINESS MATHEMATICS	6	5	1		
BCOM-H-2.2-CC-4 -T	HUMAN RESOURCE MANAGEMENT AND MARKETING MANAGEMENT	6	5	1		
BCOM-H-2.3-GE-2-T	FUNDAMENTALS OF INCOME TAX (<i>Note 1</i>)	6	5	1		
BCOM-H-2.4-AECC-2-T	COMMUNICATIVE ENGLISH	2				
	Total	20				

B.Com. (Honours)
Semester – II
Course Code: BCOM-H-2.1- CC-3-T
Course Title: BUSINESS MATHEMATICS
Credit - 6
Full Marks - 75

Course Contents

1. Laws of Indices

2. **Logarithm:** Definition and properties of logarithm and their applications.

3. (i) **A.P. Series:** Definition, Common difference, General term, A.M., Sum of first n terms of an A.P.

(ii) **G.P. Series:** Definition, Common ratio, General term, G.M., Sum of first n terms of a G.P. Sum of Infinite G.P. Series with common ratio less than one.

4. (i) **Permutation** (elementary ideas)- Definition of permutation, Number of permutations of n different things taken r at a time. (i.e. ${}^n P_r$); Permutation of n things taken all together, when things are not all different; Restricted Permutations (formulae and applications only – no deduction): *Permutation of n different things taking r at a time - (i) when m particular things will never occur, (ii) when m particular things will always occur, (iii) when m particular things will always remain in m pre-assigned places, (iv) each thing can be taken once, twice,.....up to r times.*

(ii) **Combination** (elementary ideas): Definition of combination, Combination of n different things taken r at a time (i.e. ${}^n C_r$), ${}^n C_r = {}^n C_{n-r}$; Restricted Combinations (formulae and applications only – no deduction): *Combination of n different things taken r at a time –(i) when p particular things will always occur, (ii) when p particular things would never occur; To find the total number of selections of (p+q) things from (m+n) different things, when p things are to be chosen from the group of m, and q from that of n.*

5. **Compound Interest and Annuities:** Different types of interest rates; Concept of Present value and amount of sum; Types of annuities; Present value and amount of an annuity; including the

case of continuous compounding; Valuation of simple loans and debentures; Problems relating to sinking funds.

6. Calculus (Elementary ideas)

(i) **Functions, Limit and Continuity:** Variables, constants, parameters, functions, idea of rational functions, exponential functions, logarithmic functions, increasing functions, decreasing functions, algebraic functions. Idea of limit, algebra of limits, limit of a function of functions, simple application of some standard limits in evaluating limits; Geometrical idea of continuity of function at a point, various types of discontinuities.

(ii) **Differentiation** (non-trigonometric simple problems only): Definition, Derivative of a constant function, x^n (for real n), Working rule of derivative of x^n , rules of differentiation of sum, product and quotient of two functions.

(iii) **Integration** (non-trigonometric simple problems only): Integration as the inverse of differentiation. Integration of simple functions (polynomials only). Definite integral as a limit of a sum; Definite integrals of x , x^2 , x^3 etc. Fundamental theorem of Integral Calculus (statement only).

Note: *No question should be based on trigonometric application.*

Suggested Readings:

1. Sancheti, D.C. and Kapoor, V. K., *Business Mathematics*, Sultan Chand and Sons.
2. Dey, S. N., *Business Mathematics and Statistics*, Chhaya Prakashani.
3. Chakrabarti, J., *Business Mathematics and Statistics*, Dey Book Concern.
4. Das, N. G. and Das, J. K., *Business mathematics and Statistics*, McGraw Hill Education Ltd.

B.Com. (Honours)
Semester – II
Course Code: BCOM-H-2.2-CC-4 -T
Course Title: HUMAN RESOURCE MANAGEMENT
AND MARKETING MANAGEMENT
Credit - 6
Full Marks - 75
Module I
Human Resource Management

Course Contents

1. Introduction: Concept, Importance, Nature and Scope of Human Resource Management, The changing Environment of HRM, Functions and qualities of a Human Resource Manager;

Personnel Policies – Need, Sources, Process, Types & Contents; A Conceptual Framework of Human Resource Planning and Job-Analysis.

2. Recruitment and Selection: Recruitment – Meaning and Sources; Selection – Process, Recruitment vs. Selection, Types of Interviews, Guidelines for Effective Group Discussion and Interview; Placement & Induction – Conceptual Framework.

3. Training and Development: Training and Development-Meaning and purpose of training Essentials of an Ideal Training Programme. Benefits of Training to organization and employees. Training methods.

4. Performance Appraisal and Compensation Management: Performance Appraisal – Need, Methods and Problems; Job Evaluation – Conceptual Framework; Methods of Remuneration – An Elementary Knowledge of Methods of Wage Payment and Fringe Benefits.

5. Morale & Discipline: Morale – Meaning, Factors Affecting, Methods of Measurement, Suggestions for Improving; Discipline – Need, Causes of Indiscipline, Suggestions for Effective Discipline, Procedure for Disciplinary measures.

Suggested Readings:

1. Aswathapa K. *Human Resource Management*, McGraw-Hill.
2. Gupta, C. B. *Human Resource Management*, Sultan Chand & Sons.
3. Rao, V. S. P. *Human Resource Management: Text and Cases*, Excel Books.
4. Mahajan, Reeta, *Human Resource Management*, Vikash
5. Halдар & Sarkar, *Human Resource Management*, Oxford
6. Sinha, Sekhar & Bala, *Human Resource Management*, Cengage
7. Jyothi & Venkatesh, *Human Resource Management*, Oxford
8. Wilton, N., *An Introduction to Human Resource Management*, Sage

Module II

Marketing Management

Course Contents

1. Introduction: Nature and scope of marketing; Importance of marketing as a business function, and in the economy; Marketing concepts –traditional and modern; Selling vs. marketing; Marketing mix; Marketing environment.

2. Consumer Behaviour and Market Segmentation: Nature, scope and significance of consumer behaviour; Consumer buying process; Market segmentation – concept and importance; Bases for market segmentation.

3. Product: Concept of product, consumer, and industrial goods; Packaging – role and function, Brand name and trade mark; After-sales service; Product life cycle concept.

4. Price and Promotion: Importance of price in the marketing mix; Factors affecting price of a product. Pricing policies and strategies; Methods of promotion; Advertising, Personal selling - concept, merits and demerits; Sales Promotion – concept and types.

5. Distribution and Retailing: Distribution channels – concept and role; Types of distribution channels; Factors affecting choice of a distribution channel; Types of retailing – store based and non-store based retailing, chain stores, specialty stores, supermarkets; Management of retailing operations – an overview; Retailing in India.

Recent developments in marketing: Social Marketing, online marketing, direct marketing, rural marketing.

Suggested Readings:

1. Kotler, Keller, Koshi and Jha, *Marketing Management: A South Asian Perspective*, Pearson Education.
2. Kotler, Armstrong, Agnihotri and Haque, *Principles of Marketing: A South Asian Perspective*, Pearson Education.
3. Ramaswamy and Namakumari, *Marketing Management*, McGraw-Hill.
4. Bhagwati, Pillai, *Marketing Management*, S.Chand.
5. Verma & Duggal, *Marketing Management*, Oxford.
6. Venugopal, P., *Marketing Management*, Sage.
7. Saxena, *Marketing Management*, McGraw Hill.

B.Com. (Honours)

Semester – II

Course Code: BCOM-H-2.3- GE-2-T

Course Title: FUNDAMENTALS OF INCOME TAX

Credit - 6

Full Marks - 75

Course Contents

1. a) Basic Concepts and Definitions under Income Tax Act, 1961: Person, Assessee, Previous year, Assessment year, Income, Sources of income, Heads of income, Gross total income, Total income, Tax evasion, Tax avoidance, Tax planning.
b) Residential Status of an individual and Incidence of Tax
c) Fully Exempted income of an Individual (including agricultural income).
2. Computation of Income under following Heads of Income (Simple Problems):

- (a) Income from Salaries
 - (b) Income from House Property
 - (c) Capital Gain: Meaning and types of Capital Assets, basic concept of Transfer, Computation of Short Term Capital Gain and Long Term Capital Gain, Taxability of Short Term Capital Gain and Long Term Capital Gain.
 - (d) Income from Other Sources (excluding Dividend): Basic concepts.
3. Deductions from Gross Total Income: Deductions u/s 80C, 80D, 80DD, 80E, 80G, 80TTA.
4. Computation of Total Income and Tax Liability of an Individual.

[If any new provisions are enacted in place of the existing provisions, the syllabus will stand modified accordingly with effect from such date as may be prescribed by UNIVERSITY OF KALYANI.]

Suggested Readings

1. Lal & Vashist, *Income Tax and Central Sales Tax*, Pearson.
2. Ahuja & Gupta, *Systematic Approach to Income Tax*, Bharat.
3. Sengupta, C.H., *Income Tax*, Dey Book Concern.
4. Bhadra and Satpati, *Bharoter Kar Babosthapona*, Books and Allied Pvt. Ltd.
5. Mehrotra and Goyal, *Income Tax Law and Accounts*, Sahitya Bhavan Publication
6. Roy, S.K., *Principles and Practice of Direct & Indirect Taxes*, ABS
7. Singhania, V. and Singhania, M., *Students' guide to Income Tax*, Taxmann.
8. Bare Act and Relevant Rules.

B.Com. (Honours)
Semester – II
Course Code: BCOM-H-2.4- AECC-2-T
Course Title: COMMUNICATIVE ENGLISH
Credit - 2
Full Marks - 50

(To be prepared centrally by the University)

Year 2: Semester III

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-3.1-CC-5-T	FINANCIAL ACCOUNTING 2	6	5	1		
BCOM-H-3.2-CC-6 -T	BUSINESS LAWS	6	5	1		
BCOM-H-3.3-CC-7 -T	INCOME TAX LAW	6	5	1		
BCOM-H-3.4-GE-3-T	FUNDAMENTALS OF GOODS AND SERVICE TAX (<i>Note 1</i>)	6	5	1		
BCOM-H-3.5-SEC-1-T+P (A)	<i>Any One of the Following:</i> (A) E-COMMERCE AND COMPUTER APPLICATIONS IN BUSINESS	2				
BCOM-H-3.5-SEC-1-T (B)	Or (B) OFFICE MANAGEMENT AND SECRETARIAL PRACTICE					
	Total	26				

B.Com. (Honours)
Semester – III
Course Code: BCOM-H-3.1- CC-5-T
Course Title: FINANCIAL ACCOUNTING 2
Credit - 6
Full Marks – 75

Course Contents

1. Partnership Accounts:

(a) Profit and Loss Appropriation accounts; Capital & Current A/C; Guarantee – by firm, by partner and both; Correction of appropriation items with retrospective effect.

(b) Changes in constitution of firm – Change in profit sharing ratio, Admission, Retirement, Retirement cum Admission—treatment of Goodwill, revaluation of assets and liabilities, treatment of reserves and adjustment relating to capital; treatment of Joint Life Policy, Death of a Partner.

(c) Dissolution of Firm – including piecemeal distribution.

2. Branch Accounting:

Synthetic Method: Preparation of Branch account, Branch Trading and P/L account (at cost & at Invoice Price) - normal and abnormal losses.

Analytical Method: Preparation of Branch stock adjustment account (at cost & at Invoice Price)- normal and abnormal losses.

Independent branch – concept of wholesale profit

3. Hire purchase and installment payment system:

Recording of Transactions in the books of buyer –Allocation of interest – Use of Interest Suspense Account—Partial and Complete Repossession.

Books of seller – Stock and Debtor Account (with repossession)

Books of Seller – H.P Trading Account (with repossession)

Basic Concept of Operating and Financial lease (AS 19).

4. Departmental Accounts:

Appropriation of common cost, Preparation of Departmental Trading and P/L Account. Consolidated Trading and P/L Account; inter departmental transfer of goods at cost, cost plus and at selling price and elimination of unrealized profit.

5. Introduction to Company Accounts: Meaning of Company and its Classification; Books of Accounts; Maintenance of Books of Accounts; Financial Year; Financial Statements – Meaning, Forms & Contents; Concept of True and Fair View, Authentication of Financial Statements; Filing of Financial Statements.

6. Accounting for Shares and Debentures of Company: Kinds of Share Capital; Issue, Forfeiture, Reissue and Buy-Back of Shares; Right Shares and Bonus Shares; Issue of Debentures, Underwriting of Shares and Debentures, Employees' Stock Option Scheme (ESOS) and Employees' Stock Purchase Scheme (ESPS).

7. Investment Accounts: Preparation of Investment Account for Shares (with Right Shares, Bonus Shares and Sale of Right) and Debentures –treatment of brokerage, cum & ex-interest and cum & ex-dividend, transfer of securities; Valuation of Investment as per Accounting Standard AS 13.

8. Insurance claim for Loss of Stock and Loss of Profit (simple type)

Suggested Readings:

1. Sukla, Grewal, Gupta: Advanced Accountancy, S. Chand.
2. R. L. Gupta & Radheswamy, Advanced Accountancy, S. Chand.
3. Maheshwari & Maheshwari, Advanced Accountancy, Vikash Publishing House.
4. Sehgal & Sehgal, Advanced Accountancy, Taxman Publication.
5. Hanif & Mukherjee, Financial Accounting, TMH.
6. Frank Wood, Business Accounting, Pearson.
7. Tulsian, Financial Accounting, Pearson.
8. Principles and Practices of Accounting, Basu and Das, Rabindra library, Kolkata.
9. Framework for preparation and presentation of Financial Statements issued by the ICAI.
10. Accounting Standards issued by ICAI.
11. Accounting Standards Rules under Companies Act

B.Com. (Honours)
Semester – III
Course Code: BCOM-H-3.2- CC-6 -T
Course Title: BUSINESS LAWS
Credit - 6
Full Marks - 75

Course Contents

1. The Indian Contract Act, 1872

- a) Contract – meaning, characteristics and kinds, Essentials of a valid contract
- b) Offer and acceptance (Definition, Rules, Communication and Revocation of offer and acceptance)
- c) Consideration (Definition, Elements, Types, Rules), “No Consideration No Contract” and its exceptions; Capacity to Parties (Definition and Types)
- d) Consent, Free consent, Coercion, Undue Influence, Fraud, Misrepresentation, Mistake
- e) Legality of objects and Consideration
- f) Void and Voidable agreements – Definition, Types and Distinction
- g) Discharge of a contract – Modes of discharge, Breach and Remedies against breach of contract
- h) Specific Contracts - Contingent contracts, Quasi, Contract of Indemnity, Guarantee, Bailment, Pledges

2. The Sale of Goods Act, 1930

- a) Contract of sale, meaning and difference between sale and agreement to sell
- b) Conditions and warranties
- c) Transfer of ownership in goods including sale by a non-owner
- d) Performance of contract of sale
- d) Unpaid seller – meaning, rights of an unpaid seller against the goods and the buyer

3. The Partnership Act, 1932

- a. Definition – Partner, Partnership
- b) Nature and Characteristics of Partnership
- c) Types of Partners
- d) Registration of a Partnership Firms and consequences of non-registration
- e) Rights and Duties of Partners
- f) Dissolution of firms – meaning and grounds

4. The Limited Liability Partnership Act, 2008

- a) Definition
- b) Salient Features of LLP
- c) Advantages and disadvantages of LLP
- d) Differences between: LLP and Partnership, LLP and Company

e) Incorporation of LLP

5. The Negotiable Instruments Act 1881

a) Definition, Features, Types, Parties of Negotiable Instruments: Promissory Note, bill of exchange, Cheque (Definition and Types)

b) Endorsement: Types of Endorsement

c) Holder and Holder in Due Course, Privileges of Holder in Due Course.

d) Dishonour of Negotiable Instruments: Modes, Consequences, Notice of Dishonour; Noting and Protesting

e) Discharge of Negotiable Instruments: Meaning and Modes

(If any new provisions are enacted in place of the existing provisions, the syllabus will accordingly include such new provisions in place of existing provisions with effect from such date as prescribed by the University of Kalyani. Similarly if any existing provision becomes redundant due to changes, it will be left out of the syllabus)

Suggested Readings

1. M.C. Kuchhal, and Vivek Kuchhal, *Business Law*, Vikas Publishing House, New Delhi.
2. Avtar Singh, *Business Law*, Eastern Book Company, Lucknow.
3. Kumar Ravindra, *Legal Aspects of Business*, Cengage
4. Tulsian & Tulsian, *Business Laws*, S.Chand
5. Kapoor N.D., *Business Laws*, Sultan Chand
6. Das S.K. & Roy P., *Business Regulatory Framework*, OUP
7. Gulsan S.S., *Business Laws*, Excel Books
8. Roychowdhury, Bhattacharjee & Datta, *Business Regulatory Framework*, Elegant Publishers
9. Bhadra, Satpati and Mitra, *Ainer Ruprekha (Bengali Version)*, Dishari

B.Com. (Honours)

Semester – III

Course Code: BCOM-H-3.3- CC-7 -T

Course Title: INCOME TAX LAW

Credit - 6

Full Marks - 75

Course Contents

1. a) Basic Concepts and Definitions under Income Tax Act, 1961: Person, Assessee, Previous year, Assessment year, Income, Sources of income, Heads of income, Gross total income, Total income, Tax evasion, Tax avoidance, Tax planning

b) Residential Status of an individual and Incidence of Tax

c) Fully Exempted income of an Individual

d) Agricultural Income: Definition, determination of agricultural and non-agricultural Income, assessment of tax liability when there are both Agricultural and Non-agricultural income.

2. Heads of Income and Provisions governing Heads of Income:

(a) Income from Salaries

(b) Income from House Property

(c) Profits and Gains from Business or Profession: Special emphasis on section 28, 32, 35, 35D, 35DDA, 36, 37, 40A(2), 40A(3), 43B.

(d) Capital Gain: Meaning and types of Capital Assets, basic concept of Transfer, Cost of Acquisition, Cost of Improvement and Indexation, Computation of Short Term Capital Gain and Long Term Capital Gain, exemptions u/s 54, 54B, 54D, 54EC and 54F, Taxability of Short Term Capital Gain and Long Term Capital Gain.

(e) Income from Other Sources (excluding Dividend): Basic concepts.

3. a) Income of other Persons included in Assessee's Total Income: Section 60 to 65

b) Set off and Carry Forward of Losses: Mode of Set off and Carry Forward, Inter Source and Inter Head Adjustment, Carry forward and set off of losses u/s 71, 72, 73, 74, 74A.

c) Deductions from Gross Total Income: Basic concepts -deductions u/s 80C, 80CCC, 80CCD, 80CCE, 80CCF, 80D, 80DD, 80DDB, 80E, 80G, 80GG, 80GGA, 80GGC, 80QQB, 80RRB, 80TTA, 80U.

4. Computation of Total Income and Tax Liability of an Individual

5. Assessment of Income: Self Assessment u/s 140A, Summary Assessment u/s 143(1), Scrutiny Assessment u/s 143(3), Best Judgment Assessment u/s 144 and Income Escaping Assessment u/s 147.

Suggested Readings

1. Singhanian, V. and Singhanian, M., *Students' guide to Income Tax*, Taxmann.
2. Lal & Vashist, *Income Tax and Central Sales Tax*, Pearson.
3. Ahuja & Gupta, *Systematic Approach to Income Tax*, Bharat.
4. Sengupta, C.H., *Income Tax*, Dey Book Concern.
5. Bhadra and Satpati, *Bharoter Kar Babosthapon*, Books and Allied Pvt. Ltd.
6. Mehrotra and Goyal, *Income Tax Law and Accounts*, Sahitya Bhavan Publication
7. Bare Act and Relevant Rules.
8. Software: Singhanian, V.K., *E-Filing of Income Tax Returns and Computations of Tax*, Taxmann

B.Com. (Honours)
Semester – III
Course Code: BCOM-H-3.4- GE-3-T
Course Title: FUNDAMENTALS OF GOODS AND SERVICE TAX
Credit - 6
Full Marks - 75

Course Contents

1. Introduction- Concept of Direct and Indirect Tax; Types of indirect tax; Right to impose indirect taxes (by Centre and States/Union Territories) before and after 101st Amendment of Indian Constitution; Formation of GST Council;
2. Goods & Services Tax (GST)- Date of effect; Indirect taxes replaced by GST; Goods kept outside the purview of GST; Types of GST- Central GST (governed by The Central Goods & Services Tax Act 2017), State/UT GST (governed by The State Goods & Services Tax Act 2017 of each State/ Union Territory) and Integrated GST (governed by The Integrated Goods & Services Tax Act 2017).
3. Supply- Levy of tax on “Supply”; Definition of supply; Intra-State and Inter-State supply; Composite and Mixed supply; *Nil rated supplies, Zero rated supplies, Exempted supplies & Non-GST supplies*; Concept of reverse charge; Supplies of goods and services liable to reverse charge.
4. Registration-Persons liable to registration; Compulsory registration; Procedure of Registration; Registration for composition levy.
5. Documentation- Tax Invoice; Bill of Supply, Receipt Voucher, Payment Voucher, Refund Voucher, Debit Note, Credit Note. *Harmonized System Nomenclature (HSN) of Goods, and Service Accounting Code (SAC) of Services.*
6. GST Returns - GSTR 1, GSTR 2 and GSTR 3; Time of filing of Returns.

Suggested Readings:

1. V.S. Datey, *Indirect Taxes Laws and Practice*, Taxmann.
2. Anandaday Mishra, *GST Law & Procedure*, Taxman.
3. Relevant Bare Acts and Rules.
4. Publication on GST by the Institute of Chartered Accountants of India (www.icaai.org)
5. Publication on GST by the Central Board of Excise and Customs (www.cbec.org).

B.Com. (Honours)
Semester – III
Course Code: BCOM-H-3.5- SEC-1-T+P (A)
Course Title: E-COMMERCE AND COMPUTER APPLICATIONS IN BUSINESS
Credit - 2
Full Marks - 50
Module I
E-COMMERCE (Theory)

Course Contents

1. Introduction - Limitation of conventional commerce, Origin of E-Commerce, Evolution of E-Commerce, E-Commerce and E-Business, Definition of E-Commerce, Features of E-Commerce, M-Commerce-The concept- How it is done- Purposes of use.

2. Models of E-Commerce- Concepts and examples Business - to - Business (B2B), Business - to - Consumer (B2C), Consumer - to - Consumer (C2C), Consumer - to - Business (C2B), Business - to - Government (B2G), Government - to - Business (G2B), Government - to - Citizen (G2C).

3. E-CRM and SCM

E-CRM-definition, features, goals of E-CRM business framework, phases of E-CRM, types of E-CRM, Functional components of E-CRM, strategies for E-CRM solutions; SCM-definition, features, types of supply chain.

4. Digital Money Transactions

Methods of e-payments [Debit Card, Credit Card, Smart Cards, e-Money], electronic or digital wallet, digital signature (procedures, working and legal provisions), payment gateways[Core Banking Solution or CBS, Mobile Payment, UPI, NCPI, International Payments], Online banking [meaning, concepts, importance, electronic fund transfer, automated clearinghouse, automated ledger posting]; Risks involved in e-payments.

5. E-Commerce in India

Module II
COMPUTER APPLICATIONS IN BUSINESS (Practical)

Course Contents

Accounting and Related Software

1. Tally (Current Version):

a) *Creation of Masters*- Creation of Company, Creation of Ledgers, Creation of Stock Items, Creation of Manufacturing voucher type.

b) *Activation of GST option, Activation of Debit Note / Credit Note*

c) *Passing of Accounting Voucher Entries* (including inventory and GST) in – (i) Receipt, (ii) Payment, (iii) Contra, (iv) Purchase, (v) Sales, (vi) Debit Note, (vii) Credit Note, and (viii) Journal, modes.

d) *Passing of Inventory Voucher Entries*- Manufacturing type

e) *Preparation of Bank Reconciliation Statement*

2. Excel

a) Insertion and deletion of Column/ Row/ Sheet.

b) Change of Column Width

c) Freezing of Column & Row

d) Sorting- Single column and Multi Column (i.e. data base)

e) Linking of one cell with another in the same sheet/ another sheet.

f) Autosum and Formula copy with fill handle

g) Preparation of Chart- Column Chart, Bar Chart, Pie Chart, and Line Chart.

Suggested Readings

1. P. T. Joseph, *E-Commerce: An Indian Perspective*, PHI Learning

2. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, *E-Commerce:*

3. *Fundamentals and Applications*, Wiley.

4. Laudon, *E-Commerce*, Pearson Education India

5. Schneider G., *E-Business*, Cengage

6. Bhaskar, B., *E-Commerce*, McGraw Hill

7. Nadhani, A K, *Mastering Tally ERP 9*, BPB Publications, New Delhi

8. Singh, S & Mehera, N, *Tally ERP: Power of Simplicity*, Amazon Books.

9. Mac Donald, Matthew, *Excel 2007 for Starters: The Missing Manual*, PBC Books, Delhi.

10. Laing, Roger, *Microsoft Excel Basics: Expert Advice, Made Easy*, PBC Books, Delhi.

B.Com. (Honours)

Semester – III

Course Code: BCOM-H-3.5- SEC-1-T (B)

Course Title: OFFICE MANAGEMENT AND SECRETARIAL PRACTICE

Credit - 2

Full Marks – 50

Office Management and Secretarial Practice

Course Contents

1. Office and Office Management: Meaning of office. Functions of office – primary and administrative management functions, importance of office, duties of the office manager, his qualities and essential qualifications.

Filing and Indexing: Filing and Indexing – Its meaning and importance, essentials of good filing, centralized vs. decentralized filing, system of classification, methods of filing and filing equipment, Weeding of old records, meaning and need for indexing, various types of indexing.

2. Mail and Mailing Procedures: Mailing Procedures – meaning and importance of mail, centralization of mail handling work, its advantages, room equipment and accessories, sorting tables and rack, letter opener, time and date stamps, postal franking machine, addressing machine, mailing scales, mailing through post, courier, email, appending files with email. Inward and outward mail – receiving, sorting, opening, recording, making, distributing, folding of letters sent, maintenance of peon book, dispatching, courier services, central receipt and dispatch.

Forms and Stationery: Office Forms – introduction, meaning, importance of forms, advantages of using forms, disadvantages of using forms, type of forms, factors affecting forms design, principles of form design, form control. Stationery – introduction, types of stationery used in offices, importance of managing stationery, selection of stationery, essential requirements for a good system of dealing with stationery, purchasing principles, purchase procedure, standardization of stationery.

3. Modern Office Equipments: Modern Office Equipment – Introduction, meaning and Importance of office automation, objectives of office mechanization, advantages, disadvantages, factors determining office mechanization. Kind of office machines: personal computers, photocopier, fax, telephone, telephone answering machine, dictating machines, Audio Visual Aids.

Budget: Budget - Annual, revised and estimated. Recurring and non-recurring heads of expenditure

Audit: Audit process- Vouching, verification and valuation (in brief). Consumables/ Stock register and Asset register. Procedure for disposal of records and assets.

4. Banking facilities: Types of accounts. Passbook and cheque book. Other forms used in banks. ATM and money transfer.

Abbreviations/Terms used in Offices: Explanation of abbreviations/terms used in offices in day-to-day work.

Modes of Payment: Types of payments handled such as postal orders, Cheque(crossed/uncrossed), post-dated and pre-dated Cheques, stale Cheque, dishonored Cheque.

5. Role of Secretary: Definition; Appointment; Duties and Responsibilities of a Personal Secretary; Qualifications for appointment as Personal Secretary. Modern technology and office communication, email, voice mail, internet, multimedia, scanner, video-conferencing, web-casting. Agenda and Minutes of Meeting. Drafting, fax-messages, email. Maintenance of appointment diary.

Suggested Reading:

1. Bhatia, R.C. *Principles of Office Management*, Lotus Press, New Delhi..
2. Leffingwell and Robbinson: *Text book of Office Management*, Tata McGraw-Hill.
3. Terry, George R: *Office Management and Control*.
4. Ghosh, Evam Aggarwal: *Karyalaya Prabandh*, Sultan Chand & Sons.
5. Duggal, B: *Office Management and Commercial Correspondence*, Kitab Mahal.

Year 2: Semester IV

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-4.1-CC-8-T	COST ACCOUNTING	6	5	1		
BCOM-H-4.2-CC-9 -T	INDIRECT TAX LAWS	6	5	1		
BCOM-H-4.3-CC-10 -T	COMPANY LAW	6	5	1		
BCOM-H-4.4-GE-4-T	FUNDAMENTALS OF COST AND MANAGEMENT ACCOUNTING (Note 1)	6	5	1		
BCOM-H-4.5-SEC-2-T+P (A)	Any One of the Following: (A) TAX RETURNS AND E-FILING OF TAX RETURNS	2				
BCOM-H-4.5-SEC-2-T (B)	Or (B) FUNDAMENTALS OF INVESTMENT					
Total		26				

B.Com. (Honours)**Semester – IV****Course Code: BCOM-H-4.1- CC-8-T****Course Title: COST ACCOUNTING****Credit - 6****Full Marks – 75****Course Contents**

1. **Introduction:** Meaning and Objectives of Cost Accounting, Difference between Cost Accounting, Financial Accounting and Management Accounting, Cost Unit, Cost Centre, Investment Centre & Profit Centre – Cost Accounting System – Installing of Cost Accounting System – Essentials of good Cost Accounting System. Methods and Techniques of Costing.

2. **Costs:** Meaning of cost, Various concepts of costs (Direct cost, Indirect costs, Period cost, Conversion cost, Sunk cost, Opportunity cost, etc.), Cost classification based on Elements, Functions & Behaviour, Preparation of Cost Sheet including Budgeted Cost Sheet.
3. **Material Costs:** Importance of Materials Cost, Constituents of material cost; Centralised & Decentralised Purchase of Materials, Purchase Procedure, Documents; *Storage of Materials:* Storage records; *Material Control:* Stock Levels (Maximum, Minimum, Re-Order & Danger Level), Meaning of Economic Order Quantity and its applications, Periodic Inventory vs. Perpetual Inventory, ABC Analysis, VED Analysis, JIT Inventory; *Different Methods for Pricing the Issue of Material:* FIFO, LIFO, Simple, Weighted & Periodic Average Methods, Preparation of Store Ledger; Accounting for material cost.
4. **Labour Costs:** Accounting and Control of labour cost, Time keeping and time booking, Methods of wage payment (Piece rate, Differential piece rate, Time rate), Incentive schemes for workers (Halsey, Rowan, Halsey-Weir), Measurement of Efficiency of a workers. Concept and treatment of idle time, over time, labour turnover and fringe benefits.
5. **Overhead Costs:** Classification, allocation, apportionment and absorption of overheads; Meaning, Concept & Reasons for Under- absorption and over-absorption of Overhead and treatment in Cost Accounting; Capacity Levels and Costs; Treatments of certain items in costing like interest on capital, packing expenses, bad debts, research and development expenses; Activity based cost allocation.
6. **Contract Costing:** Meaning, Features, Costing Procedure, Fixed Price Contract & Cost Plus Contract, Escalation & De-escalation Clause, Retention Money, Treatment of Profit and Loss on Incomplete Contract, Preparation of Contract Account.
7. **Process Costing:** Meaning, Features, Applicability, Preparation of Process Account, Treatment of Normal Loss, Abnormal Loss & Abnormal Gain, Loss of Income, etc. in Cost Accounting, Inter Process Profit, By-Product & Joint-Product (Meaning and Distinction).
8. **Operating Costing:** Meaning & Concepts, Areas of Application, Different Services and their Composite Units, Computation of Composite Unit Cost.
9. **Cost Control Accounts(non-integrated systems only):** Journal Entries, Ledger Account, Costing Profit & Loss Account; Reasons for Variation between Profit as per Cost Accounts & Profit as per Financial Accounts, Simple Problems on Reconciliation of the Two Profits.

Suggested Readings:

1. B.Banerjee – Cost Accounting (PHI)
2. Horngren, Foster, Datar - Cost Accounting – A Managerial Emphasis, (Pearson)
3. A.K.Bhattacharya, Principles and Practice of Cost Accounting, PHI Learning Pvt. Ltd.
4. Ravi M Kishore - Cost & Management Accounting, (Taxman)
5. M.Y.Khan & P.K.Jain - Management Accounting, (TMH)
6. Colin Drury – Management & Cost Accounting (Chapman & Hall)
7. Charles T. Horngren, Gary L. Sundem, Dave Burgstahler, Jeff O. Schwartzberg: Introduction to Management Accounting – Pearson Education.
8. Dr. S.N. Maheswari and S.N. Mittal: Management Accounting – Shree Mahavir Book Depot., New Delhi

B.Com. (Honours)

Semester – IV

Course Code: BCOM-H-4.2- CC-9 -T

Course Title: INDIRECT TAX LAWS

Credit - 6

Full Marks – 75

Course Contents

1. Introduction: Concept and types of indirect tax. Right to impose indirect taxes (by Centre and States/Union Territories) before and after 101st Amendment of Constitution. Introduction of Goods & Services Tax (GST); Indirect taxes subsumed by GST; Goods kept outside the purview of GST; Formation of GST Council; Date of effect and the non-taxable territory; Types of GST- Central GST (governed by The Central Goods & Services Tax Act 2017), State/UT GST (governed by The State Goods & Services Tax Act 2017 of each State/ Union Territory) and Integrated GST (governed by The Integrated Goods & Services Tax Act 2017).

2. Supply: Levy of tax on “Supply”; Definition of supply; Intra-State and Inter-State supply; Composite and Mixed supply; Supplies of goods and services liable to be reverse charged, Composition levy.

3. (i) Registration: Persons liable to registration; Compulsory registration; Procedure of Registration.

(ii) Documentation: Tax Invoice; Bill of Supply, Receipt Voucher, Payment Voucher, Refund Voucher, Debit Note, Credit Note. *Harmonized System Nomenclature (HSN) of Goods, and Service Accounting Code (SAC) of Services; Nil rated supplies, Zero rated supplies, Exempted supplies & Non-GST supplies.*

4. Input Tax Credit: Eligibility and conditions for taking input tax credit; Apportionment of input credit and blocked credits;

5. (i) GST Returns: GSTR 1, GSTR 2 and GSTR 3, Time and procedure of filing of Returns.

(ii) Payment of Tax: (a) Through Input Tax Credit (b) By cash/bank after generation of online Challan.

Suggested Readings:

1. V.S. Datey, *Indirect Taxes Laws and Practice*, Taxmann.
2. Anandaday Mishra, *GST Law & Procedure*, Taxman.
3. Relevant Bare Acts and Rules.
4. Publication on GST by the Institute of Chartered Accountants of India (www.icaai.org)
5. Publication on GST by the Central Board of Excise and Customs (www.cbec.org).

B.Com. (Honours)
Semester – IV
Course Code: BCOM-H-4.3- CC-10 -T
Course Title: COMPANY LAW
Credit - 6
Full Marks – 75

Course Contents

(i) Introduction: Basic features of Companies Act 2013, Types of companies-Company limited by Guarantee, Company limited by Shares, Unlimited Company, Private company, public company, one person company, small company, dormant company, associate company, government company, Holding Company, Subsidiary Company; Concept of corporate veil, Doctrine of lifting corporate veil.

(ii) Documents: Meaning, contents and alteration of Memorandum of Association, Doctrine of Ultra Vires, Meaning, contents and alteration of Article of Association, Doctrine of Indoor Management; Meaning and contents of Prospectus, abridged prospectus, shelf prospectus, red-herring prospectus, misstatement in a prospectus.

(iii) Formation of Company: Meaning, Legal Position and Functions of Promoter, Steps in formation of a Company, procedure for registration and incorporation, certificate of incorporation and commencement of business.

(iv) Management: Classification of directors, director identification number (DIN), qualification, disqualification, appointment, legal position; number of directorship ; removal, resignation of

director, duties, liabilities, powers of board of directors; Key Managerial Personnel (Definition, Appointment and Qualifications) – Managing Director, Whole time Directors, Companies Secretary, Chief Financial Officer, Resident Director, Independent Director, Women director.

(v) **Company Meetings:** Meetings of shareholders and board of directors; Types of meetings, Convening and conduct of meetings, Requisites of a valid meeting, postal ballot, meeting through videoconferencing, e-voting.

Suggested Readings:

1. GK Kapoor and Sanjay Dhamija, *Company Law*, Bharat Law House, Delhi.
2. Avtar Singh, *Introduction to Company Law*, Eastern Book Company.
3. Kapoor, N.D., *Corporate Law*, S.Chand.
4. Companies Act, 2013 and relevant Rules.

B.Com. (Honours)

Semester – IV

Course Code BCOM-H-4.4- GE-4-T

Course Title: FUNDAMENTALS OF COST AND MANAGEMENT ACCOUNTING

Credit - 6

Full Marks – 75

Course Contents

1. Introduction: Meaning and Objectives of Cost Accounting, Difference between Cost Accounting, Financial Accounting and Management Accounting, Cost Unit, Cost Centre, Investment Centre & Profit Centre, Methods and Techniques of Costing.

2. Costs: Meaning of cost, direct cost, indirect cost, Cost classification based on Elements, Functions & Behaviour, Preparation of Cost Sheet including Budgeted Cost Sheet.

3. Material Costs: Importance of Materials Cost, Constituents of material cost; Purchase Procedure, Storage records; *Different Methods for Pricing the Issue of Material:* FIFO, LIFO, Simple, Weighted Average Methods, Preparation of Store Ledger; Accounting for material cost.

4. Labour Costs: Accounting and Control of labour cost, Time keeping and time booking, Methods of wage payment (Piece rate, Differential piece rate, Time rate), Incentive schemes for workers (Halsey, Rowan, Halsey-Weir), Measurement of Efficiency of a workers.

5. Overhead Costs: Classification, allocation, apportionment and absorption of overheads;

6. Budget and Budgetary Control: Concept of budget and budgetary control. Principal Budget Factors, Budget Committee, Preparation of Functional budgets (Sales, Purchase, Production, etc.), cash budget, fixed and flexible budgets; Concept of Master Budget.

7. Cost Volume Profit Analysis and Marginal Costing: Meaning and assumption of Cost-Volume-Profit Analysis; Break Even Chart- Break Even Point, Margin of Safety, Angle of Incidence; Profit graph. Concepts of Marginal Cost, Marginal Costing & Contribution; Limitations of Marginal Costing, Distinction between Absorption Costing & Marginal Costing, Marginal Cost Equation and Techniques of Marginal Costing.

Suggested Readings:

1. B.Banerjee – Cost Accounting (PHI)
2. Horngren, Foster, Datar - Cost Accounting – A Managerial Emphasis, (Pearson)
3. A.K.Bhattacharya , Principles and Practice of Cost Accounting, PHI Learning Pvt. Ltd.
4. Ravi M Kishore - Cost & Management Accounting, (Taxman)
5. M.Y.Khan & P.K.Jain - Management Accounting, (TMH)
6. Colin Drury – Management & Cost Accounting (Chapman & Hall)
7. Charles T. Horngren, Gary L. Sundem, Dave Burgstahler, Jeff O. Schwartzberg: Introduction to Management Accounting – Pearson Education.
8. Dr. S.N. Maheswari and S.N. Mittal: Management Accounting – Shree Mahavir Book Depot., New Delhi

B.Com. (Honours)

Semester – IV

Course Code: BCOM-H-4.5- SEC-2-T+P (A)

Course Title: TAX RETURNS AND E-FILING OF TAX RETURNS

Credit - 2

Full Marks – 50

Theory

Course Contents

A. Returns under Income Tax

1. PAN and TAN- Procedure for application of PAN/TAN.
2. a) Advance Tax, Refund of Tax and Tax Clearance Certificate.
b) Interest- Interest u/s 234A, 234B, 234C, (simple problems)
c) TDS - TDS from Salary, Lottery, Horse racing, Interest on Securities
3. Filing of Returns- Under-Section 139(1) [within due date]; Section 139(4) [after due date]; Section 139(5) [Revised Return]; Section 139(9) [Defective Return]; Section 142 (1) [Notice to submit Return]. Different types of Returns and Due dates for filing of those Returns.
4. Procedure of filing e-Return- ITR 1 only.

B. Returns under Goods and Services Tax

1. Different types of Taxable Persons and Returns to be submitted by them; Due dates for filing of Returns.
2. Procedure of filing e-Return- GSTR 1 and GSTR 4 only.

Practical

Course Contents

Practical on ITR 1, GSTR 1, and GSTR 4 (downloaded in computer/ hard copy)

Suggested Readings:

1. Singhanian, V. and Singhanian, M., *Students' guide to Income Tax*, Taxmann.
2. Lal & Vashist, *Income Tax and Central Sales Tax*, Pearson.
3. Ahuja & Gupta, *Systematic Approach to Income Tax*, Bharat.
4. Sengupta, C.H., *Income Tax*, Dey Book Concern.
5. Bhadra and Satpati, *Bharoter Kar Babosthapon*, Books and Allied Pvt. Ltd.
6. Mehrotra and Goyal, *Income Tax Law and Accounts*, Sahitya Bhavan Publication
7. Bare Act and Relevant Rules
8. Software: Singhanian, V.K., *E-Filing of Income Tax Returns and Computations of Tax*, Taxmann.

B.Com. (Honours)

Semester – IV

Course Code: BCOM-H-4.5- SEC-2-T (B)

Course Title: FUNDAMENTALS OF INVESTMENT

Credit - 2

Full Marks – 50

Course Contents

1. The Investment Environment

The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.

2. Fixed Income Securities

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

3. Approaches to Equity Analysis

Introductions to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

4. Portfolio Analysis and Financial Derivatives

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India.

5. Investor Protection

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism.

Suggested Readings

1. C.P. Jones, *Investments Analysis and Management*, Wiley, 8th ed.
2. Prasanna Chandra, *Investment Analysis and Portfolio Management*, McGraw Hill Education
3. R.P. Rustogi, *Fundamentals of Investment*, Sultan Chand & Sons, New Delhi.
4. N.D. Vohra and B.R. Bagri, *Futures and Options*, McGraw Hill Education
5. Mayo, *An Introduction to Investment*, Cengage Learning.

Year 3: Semester V

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-5.1-CC-11-T	FINANCIAL MANAGEMENT	6	5	1		
BCOM-H-5.2-CC-12-T	AUDITING	6	5	1		
BCOM-H-5.3-DSE-1-T (A)	<i>Any One of the Following:</i> (A) MANAGEMENT ACCOUNTING OR	6	5	1		
BCOM-H-5.3-DSE-1-T (B)	(B) ADVERTISING					
BCOM-H-5.4-DSE-2-T (A)	<i>Any One of the Following:</i> (A) INDIAN FINANCIAL SYSTEM OR	6	5	1		
BCOM-H-5.4-DSE-2-T (B)	(B) BANKING AND INSURANCE					
Total		24				

B.Com. (Honours)

Semester –V

Course Code: BCOM-H-5.1- CC-11-T

Course Title: FINANCIAL MANAGEMENT

Credit - 6

Full Marks – 75

Course Contents

1. Fundamentals of Financial Management: Definition, Concept, scope, objective, and importance of financial management. Objectives of the firm – profit maximization and wealth maximization. Time value of money.

2. Sources of Finance and Cost of Capital: Different sources of finance - long term and short term sources. *Cost of capital* - concept, relevance of cost of capital, specific costs and weighted average cost, rationale of after tax weighted average cost of capital, marginal cost of capital.

3. Working Capital and Its Management: Meaning, concept, composition, nature, types of working capital, Determining factors of working capital, Working Capital Cycle, Estimation of working capital requirements (excluding problems on extra shift working capital and working capital policy). *Working Capital Management* – Importance of working capital management, Working capital financing – Long-term, medium and short-term.

4. Capital Structure and Leverage: Meaning, concept, importance of capital structure. Determining factors of capital structure. Concept of optimum capital structure. Various capital structure theories (NI, NOI)

Leverage – Concept, types and importance. Financial, operating and combined leverages, Trading on Equity, EBIT-EPS Analysis. Business Risk and Financial Risk.

5. Capital Budgeting – Concept and importance of capital budgeting decisions. Different project evaluation techniques - ARR, Pay Back Period, NPV, IRR, PI.

6. Dividend Decision: Meaning, concept and significance. Determinants of dividend policies. Analytical study of dividend policy theories – Walter’s Model, Gordon’s Model and MM Theory.

7. (a) **Funds Flow Statement:** Concepts of fund – Meaning, nature, importance and limitations of funds flow statement – Various sources and uses of fund – Preparation of funds flow statement.

(b) **Cash Flow Statement:** Meaning, Objectives, Importance and Limitations of cash flow statement – Fund flow statement vs. cash flow statement – Various sources and uses of cash – Preparation of cash flow statement.

Suggested Readings

1. Chandra, P., *Financial Management: Theory and Practice*, Tata-McGraw-Hill Publishing Co., Ltd. New Delhi.
2. Khan, M.Y. and Jain, P.K., *Financial Management: Text, Problems and Cases*, Tata McGraw Hill Publishing Co., Ltd. New Delhi.
3. Pandey, I.M., *Financial Management*, Vikas Publishing House Pvt. Ltd., New Delhi.
4. V.C. Van Horne., *Financial Management & Policy*, PHI, New Delhi.
5. B. Banerjee., *Financial Management*, PHI, New Delhi
6. Kuchhal, S.C.: *Financial Management*
7. Sharma & Gupta: *Financial Management*

8. Arvind Kumar & Pusphendra Misra: Financial Management, New Royal Book Co.
9. L.M. Bhole., *Financial Institutions and Markets*, TMH
10. Gordon & Natarajan., *Financial Services*, HPH
11. S.G. Guruswamy., *Financial Services & Systems*, Thomson Learning
12. M.Y. Khan., *Financial Services*, Tata McGraw Hill

B.Com. (Honours)
Semester –V
Course Code: BCOM-H-5.2- CC-12-T
Course Title: AUDITING
Credit - 6
Full Marks – 75

Course Contents

- 1. Introduction:** Definition of Audit, Difference between audit and assurance, concept and objectives of independent financial audit, Types of audit- Internal audit, Independent financial audit, Cost audit, Tax audit, Management audit, Secretarial audit. Types of tests- Substantive test and Compliance test, Concept of ‘true & fair’ and ‘materiality’.
- 2. Internal Control:** Concept of- Internal check, Internal control, and Internal financial control. Importance of Internal check & Internal control for the purpose of audit. Questionnaire for verification of Internal control. Provision of the Companies Act 2013 in relation to Internal financial controls- (i) Explanation- Section 134(5)(e); (ii) Reporting requirement- 143(3)(i).
- 3. Vouching & Verification** (Substantive Test): Vouching- Meaning, Objectives-Vouching of different items (Receipts and Payments related). Verification- Concept& Objectives; Verification of Share Capital, Loans (secured and unsecured), Fixed assets (Building, Plant and Machinery), Loans and Advances, Investment, Goodwill, Copy Right, Patent Right, Inventories, Debtors, Creditors.
- 4. Audit of Limited Companies:** Appointment (section 139), removal & resignation of auditors (section 140), Eligibility, Qualifications and disqualifications of auditors (section 141), Remuneration of auditors (section 142), Mandatory compliance of Auditing Standards [Section 143 (9) & (10)].
- 5. Auditors’ Report:** Definition; Distinction between Report and Certificate; Types of Opinion- (i) Unmodified or Clean, (ii) Qualified, (iii) Negative (iv) Disclaimer; Format of audit report (SA 700, SA 705 & SA 706).

Suggested Readings

1. Gupta, Kamal. *Contemporary Auditing*, Tata McGraw Hill.

2. Tandon, B.N., *Principles of Auditing*, S. Chand & Co.
3. Sharma, T.R., *Auditing Principles & Problems*, Sahitya Bhavan, Agra.
4. Basu, Sanjib Kumar, *Fundamentals of Auditing*, Pearson.
5. Auditing Assurance Standards and Guidelines issued by ICAI.
6. Companies Act, 2013.

B.Com. (Honours)
Semester –V
Course Code: BCOM-H-5.3- DSE-1-T (A)
Course Title: MANAGEMENT ACCOUNTING
Credit - 6
Full Marks – 75

Course Contents

1. **Introduction:** Meaning, Objectives, Nature Scope of management accounting, Cost Accounting, Financial Accounting and Management Accounting, Concept of cost control, cost reduction and cost management.
2. **Budget and Budgetary Control:** Concept of budget and budgetary control. Principal Budget Factors, Budget Committee, Budget Manual; Preparation of Functional budgets (Sales, Purchase, Production, etc.), cash budget, fixed and flexible budgets; Concept of Master Budget and Zero base budgeting.
3. **Standard Costing:** Meaning of standard cost and standard costing. Steps involved in standard costing, Advantages and Limitations of Standard Costing. Types and Meaning of different cost variances, Determination of material and labour cost variances.
4. **Cost Volume Profit Analysis and Marginal Costing:** Meaning and assumption of Cost-Volume-Profit Analysis; Break Even Chart- Break Even Point, Margin of Safety, Angle of Incidence; Profit graph.

Concepts of Marginal Cost, Marginal Costing & Contribution; Limitations of Marginal Costing, Distinction between Absorption Costing & Marginal Costing, Marginal Cost Equation and Techniques of Marginal Costing.
5. (a) **Ratio Analysis:** Accounting Ratios – Meaning, objectives, uses, advantages and limitations; Classification and determination of accounting ratios—liquidity, solvency, activity, profitability, capital structure, managerial efficiency; Preparation of financial statement and statement of proprietor’s fund from relevant ratios.

(b) Common Size Statements: Meaning, Objectives and Preparation of Common Size Statements.

Suggested Readings:

1. B.Banerjee – Cost Accounting (PHI)
2. Horngren, Foster, Datar - Cost Accounting – A Managerial Emphasis, (Pearson)
3. A.K.Bhattacharya, Principles and Practice of Cost Accounting, PHI Learning Pvt. Ltd.
4. Ravi M Kishore - Cost & Management Accounting, (Taxman)
5. M.Y.Khan & P.K.Jain - Management Accounting, (TMH)
6. Colin Drury – Management & Cost Accounting (Chapman & Hall)
7. Charles T. Horngren, Gary L. Sundem, Dave Burgstahler, Jeff O. Schwartzberg: Introduction to Management Accounting – Pearson Education.
8. Dr. S.N. Maheswari and S.N. Mittal: Management Accounting – Shree Mahavir Book Depot., New Delhi

B.Com. (Honours)
Semester –V
Course Code: BCOM-H-5.3: DSE-1-T (B)
Course Title: ADVERTISING
Credit - 6
Full Marks – 75

Course Contents

1. Introduction:

Communication Process; Advertising as a tool of communication; Meaning, nature and importance of advertising; Types of advertising; Advertising objectives. Audience analysis; Setting of advertising budget: Determinants and major methods.

2. Media Decisions:

Major media types - their characteristics, internet as an advertising media, merits and demerits; Factors influencing media choice; media selection, media scheduling, Advertising through the Internet-media devices.

3. Message Development:

Advertising appeals, Advertising copy and elements, Preparing ads for different media.

4. Measuring Advertising Effectiveness:

Evaluating communication and sales effects; Pre-testing and Post-testing techniques.

5. (a) Advertising Agency: Role, types and selection of advertising agency.

(b) Social, ethical and legal aspects of advertising in India.

Suggested Readings:

1. George E Belch, Michael A Belch, Keyoor Purani, *Advertising and Promotion: An Integrated Marketing Communications Perspective (SIE)*, McGraw Hill Education.
2. S. Watson Dunn, and Arnold M. Barban. *Advertising: Its Role in Marketing*. Dryden Press
3. Burnett, Wells, and Moriarty. *Advertising: Principles and Practice*. 5th ed. Prentice Hall of India, New Delhi.
4. Batra, Myers and Aaker. *Advertising Management*. PHI Learning.
5. Terence A. Shimp. *Advertising and Promotion: An IMC Approach*. Cengage Learning.
6. Sharma, Kavita. *Advertising: Planning and Decision Making*, Taxmann Publications.
7. Jaishree Jethwaney and Shruti Jain, *Advertising Management*, Oxford University Press, 2012.
8. Chunawala and Sethia, *Advertising*, Himalaya Publishing House.
9. Ruchi Gupta, *Advertising*, S. Chand & Co.
10. O'Guinn, *Advertising and Promotion: An Integrated Brand Approach*, Cengage Learning.

B.Com. (Honours)

Semester –V

Course Code: BCOM-H-5.4- DSE-2-T (A

Course Title: INDIAN FINANCIAL SYSTEM

Credit - 6

Full Marks – 75

Module-I

Indian Financial System

Course Contents

1. Financial System- Meaning, Significance & Components; Structure of Indian Financial System
2. Reserve Bank of India-
 - a) Organisation, Management, Functions- Credit Creation and Control
 - b) Monetary Policy- Objective, Different ways of RBI, Impediments to the effectiveness of monetary policy.
3. Development Banks- Concepts, Objectives & Functions of National & State Level Development Banks (IFCI, IDBI, ICICI, NABARD, SIDCs)
4. Insurance Sector- LIC & GIC- Objectives and Functions.
5. Financial Regulatory Bodies-

a) Fundamental ideas about various regulatory bodies.(SEBI, Company Law Board, RBI, Insurance Regulatory Body, Insurance Regulatory Development Authority (IRDA), Ministry of Finance.

b) SEBI- Structure, Role in Investors' protection

Module-II Market Operation

Course Contents

1. Introduction- An Overview of Financial Market in India- New Financial Instrument: Commercial Paper, Treasury Bill, Certificate of Deposit- Concepts, features and advantages.
2. Money Market- Concept, Structure of Indian Money Market, Basic idea of its different components
3. Capital Market- Primary Market and Secondary Market- Concept & Interrelation, Function and role of Stock Exchange (Including the basic ideas of types of stock market, Operation and Trading Mechanism of Stock Market) Credit Rating: Meaning, Rating Methodology, Rating symbols by different Rating Agencies.
4. Depository Services –Role and Function of Depository Services, Advantages, NSDL and CDSL
5. Recent Trends in Capital Market: Concept and Types of Mutual Fund, Concept of NAV, NAV calculation, Regulatory Regime of Mutual Fund, Systematic Investment Plan (SIP)-Concepts, importance and relevance.

Suggested Readings:

1. Indian Financial System and Financial Market operation: Sushil Mukherjee
2. Indian Financial System: Theory and Practice: MY Khan
3. Indian Financial System; 4th Edition: H R Machiraju
4. Indian Financial System & Financial Market Operations: For Universities of West Bengal: Anupam Karmakar
5. Bhartiya Aarthik Byabasthya ebong Aarthik Bajarer Karjabali: Sushil Mukherjee
6. Bhartiya Aarthik Byabasthya ebong Aarthik Bajarer Karjabali: Nayak, Sana
7. Subhamoy Das, Perspectives on Financial Services, Allied Publishers.
8. Siddhartha Saha, Indian Financial Systems and Markets, McGraw Hill

B.Com. (Honours)
Semester –V
Course Code: BCOM-H-5.4- DSE-2-T (B)
Course Title: BANKING AND INSURANCE
Credit - 6
Full Marks – 75

Course Contents

1. Introduction

Origin of banking: definition, banker and customer relationship, General and special types of customers, Types of deposits, Origin and growth of commercial banks in India. Financial Services offered by banks, changing role of commercial banks, types of banks.

2. Cheques and Paying Banker

Crossing and endorsement - meaning, definitions, types and rules of crossing. Duties, Statutory protection in due course, collecting bankers: duties, statutory protection for holder in due course, Concept of negligence.

3. Banking Lending

Principles of sound lending, Secured vs. unsecured advances, Types of advances, Advances against various securities.

4. Internet Banking

Meaning, Benefits, Home banking, Mobile banking, Virtual banking, E-payments, ATM Card/Biometric card, Debit/Credit card, Smart card, NEFT, RTGS, ECS (credit/debit), E-money, Electronic purse, Digital cash.

5. Insurance

Basic concept of risk, Types of business risk, Assessment and transfer, Basic principles of utmost good faith, Indemnity, Economic function, Proximate cause, Subrogation and contribution, Types of insurance: Life and Non-life, Re-insurance, Risk and return relationship, Need for coordination. Power, functions and Role of IRDA, Online Insurance

Suggested readings:

1. Agarwal, O.P., *Banking and Insurance*, Himalaya Publishing House.
2. Satyadevi, C., *Financial Services Banking and Insurance*, S. Chand.
3. Suneja, H.R., *Practical and Law of Banking*, Himalaya Publishing House.
4. Chabra, T.N., *Elements of Banking Law*, Dhanpat Rai and Sons.
5. Arthur, C. and C. William Jr., *Risk Management and Insurance*, McGraw Hill.
6. Saxena, G.S; *Legal Aspects of Banking Operations*, Sultan Chand and Sons.
7. Varshney, P.N., *Banking Law and Practice*, Sultan Chand and Sons.
8. Jyotsna Sethi and Nishwan Bhatia, *Elements of Banking and Insurance*, PHI Learning.

Year 3: Semester VI

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-H-6.1-CC-13-T	CORPORATE ACCOUNTING	6	5	1		
BCOM-H-6.2-CC-14-T+ P	PROJECT WORK	6				
BCOM-H-6.3-DSE-3-T (A)	<i>Any One of the Following:</i> (A) BUSINESS COMMUNICATION AND ENTREPRENEURSHIP DEVELOPMENT OR	6	5	1		
BCOM-H-6.3-DSE-3-T (B)	(B) CORPORATE GOVERNANCE AND SOCIAL RESPONSIBILITY OF BUSINESS					
BCOM-H-6.4-DSE-4-T (A)	<i>Any One of the Following:</i> (A) ACCOUNTING FOR LOCAL BODIES OR	6	5	1		
BCOM-H-6.4-DSE-4-T (B)	(B) INTERNATIONAL BUSINESS					
	Total	24				

B.Com. (Honours)
Semester –VI
Course Code: BCOM-H-6.1- CC-13-T
Course Title: CORPORATE ACCOUNTING
Credit - 6
Full Marks – 75

Course Contents

- 1. Final Accounts of Companies:** Preparation of Statement of Profit & Loss and Balance Sheet as per Schedule III to the Companies Act, 2013.
- 2. Redemption of Preference Shares and Debentures.**
- 3. Accounting of Limited Liability Partnership**
- 4. Business Acquisition and Conversion of Partnership Firm into Limited Company:** Amalgamation of Partnership Firms - accounting in the books of transferor and transferee firm; Conversion of Partnership into Limited Company –with the same or different set of books; Profit or Loss Prior to Incorporation - Accounting for Acquisition of Business.
- 5. Reconstruction of Companies:** Meaning of Internal and External Reconstruction of companies, Concept of and accounting for Amalgamation as per Accounting Standard - 14 (issued by ICAI, excluding inter-company holdings); Accounting for Internal Reconstruction (excluding

preparation of scheme of reconstruction).

6. Valuation: Valuation of Goodwill and Shares.

7. Holding Company: Preparation of Consolidated Balance Sheet as per Accounting Standard - 21 issued by ICAI (excluding problems on chain and cross holding).

Suggested Readings:

1. Gupta, R.L. and M. Radhaswamy, “*Advanced Accountancy*”, Vol-II, Sultan Chand and Sons, New Delhi.
2. Maheshwari, S.N. and S. K. Maheshwari, “*Corporate Accounting*”, Vikas Publishing House, New Delhi.
3. Jain, S.P. and K.L. Narang, “*Corporate Accounting*”, Kalyani Publishers, New Delhi.
4. Shukla, M.C., T.S. Grewal, and S.C. Gupta, “*Advanced Accounts*”, Vol-II, S. Chand & Co., New Delhi.
5. Monga, J.R., “*Fundamentals of Corporate Accounting*”, Mayur Paper Backs, New Delhi.
6. “*Compendium of Statements and Standards of Accounting*”, The Institute of Chartered Accountants of India, New Delhi.
7. “*Financial Statements Presentation under Companies Act, 2013: Practitioner’s Perspective*”, The Institute of Chartered Accountants of India, New Delhi.

B.Com. (Honours)
Semester –VI
Course Code: BCOM-H-6.2- CC-14-T+ P
Course Title: PROJECT WORK
Credit - 6
Full Marks – 75

Course Contents

For Project Work: The student will write a project report under the supervision of a faculty member assigned by the college/institution (**Details to be notified later**).

Examples of a few broad areas of Project (List is indicative, not exhaustive)

- Accounting and Finance of Local Bodies
- Any topic concerning local economic /entrepreneurial issues / new business proposal
- Agro based industry / cottage industry
- Commercial Crops including Horticulture & Sericulture
- Micro-finance/ Financial Inclusion
- Micro-insurance
- Small Savings
- Rural and Agricultural Banking
- Preservation & Storage of Agricultural Products
- Eco-tourism
- Hotels, Restaurants, Eateries

- Digital Service Providers- Photocopy, Mobile, Internet, Cable etc.
- Medical Service Providers
- Educational Service Providers
- Construction industry
- Small Traders/ Street Vendors/ Hawkers including Railway Hawkers
- Rural and Agricultural workers
- Role of Micro Small and Medium Enterprises
- Accounting Standards for Local Bodies.
- IFRS for SMEs
- Indian Accounting Standards(Rule of 2006, as amended in 2016)
- Schedule III of Companies Act, 2013
- Auditing Standards
- E-Commerce & M-commerce
- Credit Rating / Risk Management
- Frauds/ White Collar Frauds
- Subprime Meltdown and its after effect with case study from Indian Industry.
- Carbon Credit
- Value Added Tax (VAT) / Goods and Service Tax (GST)
- Public Sector Undertakings and Indian Economic Development
- Corporate Social Responsibilities
- Corporate Governance
- Financial Sector Reforms
- On-line Banking
- NPA Management
- Business Process Outsourcing
- Capital Market
- Environmental Accounting/ Environmental Management
- Financial Statement Analysis / Performance Analysis
- Working Capital Management
- Mergers & Acquisitions
- Study on Aviation Sector in India.
- Venture Capital
- Equity Linked Savings Scheme
- Insurance Industry in India
- Analysis of Mutual Funds
- Commercialization of Sports in India.
- Marketing Strategy of products
- Marketing and Promotional Strategies
- Market Research
- Brand Repositioning
- Customer Relationship Management
- Sales & Distribution Management
- Customer Awareness
- Industrial Marketing Vs. Consumer

- Study of Consumer Behaviour
- Packaging of Products
- After Sales Service and Customer Satisfaction
- Effectiveness of Advertising
- Direct Marketing & Networking

B.Com. (Honours)
Semester –VI
Course Code: BCOM-H-6.3- DSE-3-T (A)
Course Title: BUSINESS COMMUNICATION AND ENTREPRENEURSHIP
DEVELOPMENT
Credit - 6
Full Marks – 75

Module I
BUSINESS COMMUNICATION

Course Contents

1. Business Communication: Introduction, Definition, Objectives, Importance, Elements, Types of Communication – Formal and informal, Level of Analysis of Business Communication, Principles of Effective Communication.
2. Significance of Communication, Business Productivity, Inter Group and Intra-Group Conflict, Conflict Resolution and Group Cohesiveness.
3. Management Information System (MIS): Definition, Elements, Need, Function, Use of IT in MIS (Conceptual), Role of MIS in Decision Making, Decision Support System (DSS).
4. Tools of Communication: Emergence of Communication Technology, Modern forms of Communication, Fax, E-Mail, and Video Conferencing.
5. Practice in Effective Communication: Drafting Notice, Circular, Minute, Resolution, Report, CV writing, Business Letter Writing, Office Letter, Status Enquiry, Quotation Order Confirmation, Execution, Refusal and Cancellation of Order, Recommendation, Credit Collection, Claim, Bank Loan.

Module II
ENTREPRENEURSHIP DEVELOPMENT

Course Contents

1. Introduction: Meaning and Concept of Entrepreneurship, Elements, Determinants and Importance of Entrepreneurship, Role and Creativity, Characteristics, Function and Qualities of Entrepreneur.
2. Entrepreneurship Roles in Different Business Environment: Small, Micro & Medium Business Enterprises, Family Venture, Corporate Entrepreneurship, Role of Government as Entrepreneur.
3. Entrepreneur and Law: Legal protection of innovations-Patents, Trademarks and Copyrights-Intellectual Property Right.
4. Financing of New Ventures: Methods of Financing Equity Financing, Venture Capital Debt Financing and Governmental Grants.
5. Project Planning and Feasibility Studies: Methods of preparation of Project Plans and conducting Feasibility Studies.

Suggested Readings:

1. Drucker, P.F., Management: Tasks, Responsibilities & Practices.
2. Holt, D.H., Entrepreneurship: New Venture Creation.
3. Koontz and O'Donnell, Essentials of Management.
4. Irwin, R.D., Principles of Management.
5. Madhukar, R.K. , Business Communication.
6. Chopra, R.K. , Business Correspondence.

B.Com. (Honours)
Semester –VI
Course Code: BCOM-H-6.3- DSE-3-T (B)
Course Title: CORPORATE GOVERNANCE AND SOCIAL RESPONSIBILITY OF
BUSINESS
Credit - 6
Full Marks – 75

Course Contents

- 1. Conceptual Framework of Corporate Governance:** Meaning; theories and models of corporate governance.
- 2. Corporate Governance Framework in India:** Corporate boards and its powers, responsibilities, disqualifications; board committees and their functions- remuneration

committee, nomination committee, compliance committee, shareholders grievance committee, investors relation committee, investment committee, risk management committee, and audit committee; regulatory framework of corporate governance in India; SEBI guidelines and clause 49; reforms in the Companies Act, 2013.

3. Major Corporate Scandals in India and Abroad: Common Governance Problems Noticed in various Corporate Failures.

4. Whistle-blowing and Corporate Governance: The Concept of whistle-blowing; types of whistleblowers; whistle-blower policy; the whistle-blower legislation across countries; developments in India.

5. Corporate Social Responsibility (CSR)

Concept of CSR, Corporate Philanthropy, Strategic Planning and Corporate Social Responsibility; Relationship of CSR with Corporate Sustainability; CSR and Business Ethics, CSR and Corporate Governance; CSR provisions under the Companies Act 2013; CSR Committee; CSR Models, Codes, and Standards on CSR.

Suggested Readings:

1. Anil Kumar, *Corporate Governance: Theory and Practice*, Indian Book House, New Delhi.
2. MC Kuchhal, *Modern Indian Company Law*, Shri Mahaveer Book Depot (Publishers). (Relevant Chapters)
3. K.V. Bhanumurthy and Usha Krishna, *Politics, Ethics and Social Responsibility of Business*, Pearson Education.
4. Erik Banks, *Corporate Governance: Financial Responsibility, Controls and Ethics*, Palgrave Macmillan.
5. N Balasubramanian, *A Casebook on Corporate Governance and Stewardship*, McGraw Hill Education.
6. B.N. Ghosh, *Business Ethics and Corporate Governance*, McGraw Hill Education.
7. S K Mandal, *Ethics in Business and Corporate Governance*, McGraw Hill Education.
8. Bob Tricker, *Corporate Governance-Principles, Policies, and Practice* (Indian Edition), Oxford University Press.
9. Christine Mallin, *Corporate Governance (Indian Edition)*, Oxford University Press
10. Sharma, J.P., *Corporate Governance, Business Ethics, and CSR*, Ane Books Pvt Ltd, New Delhi.
11. Blowfield, Michael, and Alan Murray, *Corporate Responsibility*, Oxford University Press.
12. Francesco Perrini, Stefano, and Antonio Tencati, *Developing Corporate Social Responsibility-A European Perspective*, Edward Elgar.
13. Sharma, J.P., *Corporate Governance and Social Responsibility of Business*, Ane Books Pvt. Ltd, New Delhi.

B.Com. (Honours)
Semester –VI
Course Code: BCOM-H-6.4-DSE-4-T (A)
Course Title: ACCOUNTING FOR LOCAL BODIES
Credit - 6
Full Marks – 75

Course Contents

1. Introduction: Concept of local bodies; Salient features of 73rd Amendment of the Constitution in 1992, Article 243J- Audit of Accounts.
2. Provisions related to Accounts in the West Bengal Panchayat Act, 1973: Some important provisions of – (a) West Bengal Panchayat (Zilla Parishad and Panchayat Samiti) Accounts and Finance Rules 2003, (b) West Bengal Panchayat (Gram Panchayat Accounts, Audit and Budget) Rules 2007.
3. Financial Statements of Municipalities: Balance Sheet, Income & Expenditure Account, Statement of Cash Flows, Receipts and Payments Account, and Notes to Accounts (Refer National Municipal Accounts Manual, 2004);
Important contents of the Accounting Manual for Urban Local Bodies, 2006, of the Govt. of West Bengal: **Part 1: Introduction to Double Entry Accrual- based Accounting** Para 4- New Accounting System (i.e. double entry accrual system of accounting); Para 6- Accounting Documents; Para 7- Financial Statements; Para 9- Fundamental Accounting Assumptions. **Part 5: Forms and Formats.**
4. Accounting Standards: Overview of *Accounting Standards for Local Bodies* issued by the Institute of Chartered Accountants of India.
5. Financial Statements of PRIs (Panchayat Raj Institutions) and Municipalities: problem solutions; Software for Preparation of Financial Statements.

Note- Evaluation of Answer Scripts is to be made by internal teachers of concerned college.

Suggested Readings:

1. Constitution of India
2. West Bengal Panchayat Act, 1973
3. West Bengal Panchayat (Zilla Parishad and Panchayat Samiti) Accounts and Finance Rules 2003
4. West Bengal Panchayat (Gram Panchayat Accounts, Audit and Budget) Rules 2007
5. National Municipal Accounts Manual, 2004
6. Accounting Manual for Urban Local Bodies, 2006, of the Govt. of West Bengal
7. *Accounting Standards for Local Bodies* issued by the Institute of Chartered Accountants of India.

B.Com. (Honours)
Semester –VI
Course Code: BCOM-H-6.4- DSE-4-T (B)
Course Title: INTERNATIONAL BUSINESS
Credit - 6
Full Marks – 75

Course Contents

1. a) *Introduction to International Business*: Globalisation and its importance in world economy; Impact of globalization; International business vs. domestic business: Complexities of international business; Modes of entry into international business.

b) *International Business Environment*: National and foreign environments and their components - economic, cultural and political-legal environments.

2. a) *Theories of International Trade*: an overview (Classical Theories, Product Life Cycle theory, Theory of National Competitive Advantage); Commercial Policy Instruments - tariff and non-tariff measures – difference in Impact on trade, types of tariff and non-tariff barriers (Subsidy, Quota and Embargo in detail) ; Balance of payment account and its components.

b) *International Organizations and Arrangements*: WTO – Its objectives, principles, organizational structure and functioning; An overview of other organizations – UNCTAD,; Commodity and other trading agreements (OPEC).

3. a) *Regional Economic Co-operation: Forms of regional groupings*: Integration efforts among countries in Europe, North America and Asia (NAFTA, EU , ASEAN and SAARC).

b) *International Financial Environment: International financial system and institutions* (IMF and World Bank: Objectives and Functions); Foreign exchange markets and risk management; Foreign investments - types and flows; Foreign investment in Indian perspective.

4. a) *Organisational structure for international business operations*: International business negotiations.

b) *Developments and Issues in International Business*: Outsourcing and its potentials for India; Role of IT in international business; International business and ecological considerations.

5. a) *Foreign Trade Promotion Measures and Organizations in India*: Special economic zones (SEZs) and export oriented units (EOUs), ; Measures for promoting foreign investments into and from India; Indian joint ventures and acquisitions abroad.

b) *Financing of foreign trade and payment terms*: Sources of trade finance (Banks, factoring, forfaiting, Banker’s Acceptance and Corporate Guarantee) and forms of payment (Cash in advance, Letter of Credit, Documentary Collection, Open Account).

Suggested Readings:

1. Charles W.L. Hill and Arun Kumar Jain, *International Business*. New Delhi: McGraw Hill Education
2. Daniels John, D. Lee H. Radenbaugh and David P. Sullivan. *International Business*. Pearson Education
3. Debra Johnson and Colin Turner. *International Business - Themes & Issues in the Modern Global Economy*. London: Roultedge.
4. Sumati Varma, *International Business*, Pearson Education.
5. Cherunilam, Francis. *International Business: Text and Cases*. PHI Learning
6. Michael R. Czinkota. et al. *International Business*. Fortforth: The Dryden Press.
7. Bennett, Roger. *International Business*. Pearson Education.
8. Peng and Srivastav, *Global Business*, Cengage Learning

Detailed Syllabus

B.Com. (General)

Year I: Semester I

Course Code*	Course Title	Credit	No. of Classes per Week**		No. of Classes per Week**	
			L	T	L	P
BCOM-G-1.1-CC-1-T	FINANCIAL ACCOUNTING 1	6	5	1		
BCOM-G-1.2-CC-2 -T	PRINCIPLES OF MANAGEMENT	6	5	1		
BCOM-G-1.3-CC-3-T	LANGUAGE L ₁ - 1	6	5	1		
BCOM-G-1.4-AECC-1-T	ENVIRONMENTAL STUDIES	2				
	Total	20				

B.Com. (General)

Semester – I

Course Code: BCOM-G-1.1- CC-1-T

Course Title: FINANCIAL ACCOUNTING 1

Credit - 6

Full Marks - 75

Course Contents

1. Introduction to Accounting

- (i) Meaning and objectives of Financial Accounting, Meaning of different types of accounting
- (ii) Users of accounting information and their information Need
- (iii) Accounting Concepts and Conventions: Entity, Money Measurement, Cost, Realisation, Periodicity, Going Concern, Accrual, Consistency, Conservatism, Materiality, Matching and Full Disclosures.
- (iv) Meaning of Accounting Theory, Relation of Accounting Theory with Practice, Generally Accepted Accounting Principles (GAAP)
- (v) Accounting Standards: Concept, Need, Benefits and Limitations of Accounting Standards, Types (Accounting Standards & Indian Accounting Standards) and names of Accounting Standards in India.
- (vi) Basic concept of IFRS.

2. Double entry book keeping system:

- (i) Basic Accounting Equation,
- (ii) Meaning and recognition of Assets, Liabilities, Equity, Income and Expenses (Framework for preparation and presentation of Financial Statements issued by the ICAI)
- (iii) Accounting Cycle - Journal, Ledger, Trial Balance and Financial Statements.

3. Basic Principles of preparing Final Accounts

- (i) Revenue recognition: Meaning of revenue and Revenue Recognition Criteria (AS 9)
- (ii) Inventory: Meaning, Accounting Policy for measurement of Inventory, Ascertainment of cost of inventory, Cost Formula to be used (AS 2),

- (iii) Property, Plant and Equipment: Meaning, Recognition and Derecognition of property, plant and equipment, Accounting treatment for sale or exchange of property, plant and equipment (AS 10).
- (iii) Depreciation: Meaning, Nature and Objective of Depreciation, Methods of computing Depreciation: Straight-line method, Diminishing balance method and Units of production method, Recognition of Depreciation Charge, Change in the method of depreciation, Depreciation in case of revision of Residual Value and Useful Life of asset.
- (iv) Provision and Reserves
- (v) Capital and Revenue (Expenditure and Income)
- (vi) Concept of Capital and maintenance of capital, relation between capital and income.
- (vii) Rectification of Errors, Adjusting Entries and Closing Entries.

4. (a) Final Accounts of Profit Seeking Organisations: Manufacturing A/C, Trading A/C, Profit & Loss A/C and Balance Sheet of Sole Proprietorship (Vertical and Horizontal Formats)

(b) Final Accounts of Not-for-Profit Organisations: Receipts and Payment Account, Income and Expenditure Account and Balance Sheet.

5. Accounting from Incomplete Records (excluding Conversion into Double Entry system)

6. Accounting for special sales transaction:

- (a) Consignment: Recording in the books of Consignor – at cost & at invoice price, valuation of unsold stock; ordinary commission, Treatment and valuation of abnormal and normal loss, Special commission, Del Credere Commission (with or without bad debt) Use of consignment debtors a/c. Recording in the books of Consignee.
- (b) Joint Venture: Separate set of books and Same set of books.
- (c) Accounting for sales on approval.

Suggested Readings:

1. Sukla, Grewal, Gupta: Advanced Accountancy, S. Chand.
2. Gokul Sinha, Accounting Theory & Management Accounting
3. L.S.Porwal, Accounting Theory, Tata McGraw Hill
4. R. L. Gupta & Radheswamy, Advanced Accountancy, S. Chand.
5. Maheshwari & Maheshwari, Advanced Accountancy, Vikash Publishing House.
6. Sehgal & Sehgal, Advanced Accountancy, Taxman Publication.
7. Hanif& Mukherjee, Financial Accounting, TMH.
8. Frank Wood, Business Accounting, Pearson.
9. Tulsian, Financial Accounting, Pearson.
10. Mukherjee and Mukherjee, Financial Accounting I, Oxford
11. Framework for preparation and presentation of Financial Statements issued by the ICAI.
12. Accounting Standards issued by ICAI.
13. Accounting Standards Rules under Companies Act.

B.Com. (General)
Semester – I
Course Code: BCOM-G-1.2- CC-2 -T
Course Title: PRINCIPLES OF MANAGEMENT
Credit - 6
Full Marks – 75

Course Contents

- 1. Introduction:** Concept, Nature, Process and Significance of Management. Is Management a science or an Art or both?
- 2. Evolution of Management Thoughts:** Contribution of Taylor, Fayol, Mayo, Follett, Weber, Neo-classical School, Modern School.
- 3. Planning:** Concept, Importance, Process & Types; Forecasting – Meaning, Importance and Techniques; Decision Making- Concepts and Steps in decision making.
- 4. Organising:** Concept, Nature, Process, Organisation Structure, Delegation of Authority, Span of Management, Line & Staff Authority.
- 5. Motivation:** Concept, Importance of Motivation, Theories- Maslow, Herzberg, McGregor.
- 6. Leadership:** Concept, Leadership Styles –Laissez-Faire, Autocratic, Participative, Transactional &Transformational; Leadership Models– Tannenbaum and Schmidt, Blake and Mouton.
- 7. Communication:** Concept, Nature, Process, Types, Importance and Barriers.
- 8. Control:** Concept, Importance, Features, Process, Tools & Techniques.
- 9. Co-ordination:** Meaning, Importance, Principle & Techniques.

Suggested Reading:

1. Ravichandran, K &Nakkiran, S., Principles of management, Abhijeet Publication.
2. Tripathy, P. C & Reddy, P.N, Principles of Management, McGraw Hill Education India Private Limited.
3. Kaul, Principles and Practice of Management, Vikash
4. Koontz &Weirich, Essentials of Management, TMH.
5. Mitra, J. & Somani, N., Principles of Management and Business Communication, Oxford.

B.Com. (General)
Semester – I
Course Code: BCOM-G-1.3- CC-3-T
Course Title: LANGUAGE (L1- 1)
Credit - 6
Full Marks - 75

(To be prepared centrally by the University)

B.Com. (General)
Semester – I
Course Code: BCOM-G-1.4- AECC-1-T
Course Title: ENVIRONMENTAL STUDIES
Credit - 2
Full Marks - 50

(To be prepared centrally by the University)

Year I: Semester II

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-2.1-CC-4-T	HUMAN RESOURCE MANAGEMENT AND MARKETING MANAGEMENT	6	5	1		
BCOM-G-2.2-CC-5-T	BUSINESS LAWS	6	5	1		
BCOM-G-2.3-CC-6-T	LANGUAGE L ₂ - 1	6	5	1		
BCOM-G-2.4-AECC-2-T	COMMUNICATIVE ENGLISH	2				
	Total	20				

B.Com. (General)

Semester – II

Course Code: BCOM-G-2.1- CC-4-T

Course Title: HUMAN RESOURCE MANAGEMENT AND MARKETING MANAGEMENT

Credit - 6

Full Marks - 75

Module I

HUMAN RESOURCE MANAGEMENT

Course Contents

- 1. Nature and Scope:** Concept and meaning of Human Resource Management, Understanding the Nature and Scope of HRM, Functions and importance
- 2. Human Resource Planning:** Definition, Need and Features of Human Resource Planning, factor affecting Human Resource Planning.
- 3. Recruitment and Selection:** Definition of Recruitment, Sources, need and importance of Recruitment, Recruitment Policy – Process, sources of Recruitment. Definition of Selection, Steps of selection.
- 4. Training and Development:** Training and Development-Meaning and purpose of training, Benefits of Training to organization and employees. Training methods.
- 5. Job Evaluation and Performance Appraisal:** Job Evaluation – objective, scope, methods, Job analysis, Job description, Job Specification- basic concepts and significance. Performance Appraisal- Concept.

Suggested Readings:

1. Aswathapa K. *Human Resource Management*, McGraw-Hill.
2. Gupta, C. B. *Human Resource Management*, Sultan Chand & Sons.
3. Rao, V. S. P. *Human Resource Management: Text and Cases*, Excel Books.
4. Mahajan, Reeta, *Human Resource Management*, Vikash
5. Halдар & Sarkar, *Human Resource Management*, Oxford

Module II**MARKETING MANAGEMENT****Course Contents**

- 1. Introduction:** Nature and scope of marketing; Evolution of Marketing concepts; Selling vs. marketing; Marketing mix; Marketing environment.
- 2. Consumer Behaviour and Market Segmentation:** Nature, scope and significance of consumer behaviour; Market segmentation – concept and importance; Bases for market segmentation.
- 3. Product:** Concept of product, consumer, and industrial goods; Packaging and labeling; function, Product life cycle concept.
- 4. Price and Promotion:** Importance of price in the marketing mix; Factors affecting price of a product. Pricing policies and strategies; Methods of promotion; Advertising, Personal selling ; Sales Promotion.
- 5. Distribution and Retailing:** Distribution channels – concept and role; Types of distribution channels; Types of retailing – store based and non-store based retailing, chain stores, specialty stores, supermarkets; Retailing in India.

Suggested Readings:

1. Kotler, Keller, Koshi and Jha, *Marketing Management: A South Asian Perspective*, Pearson Education.
2. Kotler, Armstrong, Agnihotri and Haque, *Principles of Marketing: A South Asian Perspective*, Pearson Education.
3. Ramaswamy and Namakumari, *Marketing Management*, McGraw-Hill.
4. Bhagwati, Pillai, *Marketing Management*, S.Chand.
5. Verma & Duggal, *Marketing Management*, Oxford.

B.Com. (General)
Semester – II
Course Code: BCOM-G-2.2- CC-5 -T
Course Title: BUSINESS LAWS
Credit - 6
Full Marks - 75

Course Contents

1. The Indian Contract Act, 1872

- a) Contract – meaning, characteristics and kinds, Essentials of a valid contract
- b) Offer and acceptance (Definition, Rules, Communication and Revocation of offer and acceptance)
- c) Consideration (Definition, Elements, Types, Rules), “No Consideration No Contract” and its exceptions; Capacity to Parties (Definition and Types)
- d) Consent, Free consent, Coercion, Undue Influence, Fraud, Misrepresentation, Mistake
- e) Legality of objects and Consideration
- f) Void and Voidable agreements – Definition, Types and Distinction
- g) Discharge of a contract – Modes of discharge, Breach and Remedies against breach of contract
- h) Specific Contracts - Contingent contracts, Quasi, Contract of Indemnity, Guarantee, Bailment, Pledges

2. The Sale of Goods Act, 1930

- a) Contract of sale, meaning and difference between sale and agreement to sell
- b) Conditions and warranties
- c) Transfer of ownership in goods including sale by a non-owner
- d) Performance of contract of sale
- d) Unpaid seller – meaning, rights of an unpaid seller against the goods and the buyer

3. The Partnership Act, 1932

- a) Definition – Partner, Partnership
- b) Nature and Characteristics of Partnership
- c) Types of Partners
- d) Registration of a Partnership Firms and consequences of non-registration
- e) Rights and Duties of Partners
- f) Dissolution of firms – meaning and grounds

4. The Limited Liability Partnership Act, 2008

- a) Definition
- b) Salient Features of LLP.
- c) Advantages and disadvantages of LLP.
- d) Differences between: LLP and Partnership, LLP and Company.
- e) Incorporation of LLP.

5. The Negotiable Instruments Act 1881

- a) Definition, Features, Types, Parties of Negotiable Instruments: Promissory Note, bill of exchange, Cheque (Definition and Types)
- b) Endorsement: Types of Endorsement
- c) Holder and Holder in Due Course, Privileges of Holder in Due Course.
- d) Dishonour of Negotiable Instruments: Modes, Consequences, Notice of Dishonour; Noting and Protesting
- e) Discharge of Negotiable Instruments: Meaning and Modes

(If any new provisions are enacted in place of the existing provisions, the syllabus will accordingly include such new provisions in place of existing provisions with effect from such date as prescribed by University of Kalyani. Similarly if any existing provision becomes redundant due to changes, it will be left out of the syllabus)

Suggested Readings

1. M.C. Kuchhal, and Vivek Kuchhal, *Business Law*, Vikas Publishing House, New Delhi.
2. Avtar Singh, *Business Law*, Eastern Book Company, Lucknow.
3. Kumar Ravindra, *Legal Aspects of Business*, Cengage
4. Tulsian & Tulsian, *Business Laws*, S.Chand
5. Kapoor N.D., *Business Laws*, Sultan Chand
6. Das S.K. & Roy P., *Business Regulatory Framework*, OUP
7. Gulsan S.S., *Business Laws*, Excel Books
8. Roychowdhury, Bhattacharjee & Datta, *Business Regulatory Framework*, Elegant Publishers
9. Bhadra, Satpati and Mitra, *Ainer Ruprekha (Bengali Version)*, Dishari

B.Com. (General)

Semester – II

Course Code: BCOM-G-2.3- CC-6-T

Course Title: LANGUAGE (L₂ - 1)

Credit - 6

Full Marks - 75

(To be prepared centrally by the University)

B.Com. (General)
Semester – II
Course Code: BCOM-G-2.4- AECC-2-T
Course Title: COMMUNICATIVE ENGLISH
Credit - 2
Full Marks - 50

(To be prepared centrally by the University)

Year 2: Semester III

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-3.1-CC-7-T	FINANCIAL ACCOUNTING 2	6	5	1		
BCOM-G-3.2-CC-8 -T	INCOME TAX LAW	6	5	1		
BCOM-G-3.3-CC-9-T	LANGUAGE L ₁ - 2	6	5	1		
BCOM-G-3.4-SEC-1-T+P (A)	<i>Any one of the following:</i> {A} E-COMMERCE AND COMPUTER APPLICATIONS IN BUSINESS OR	2				
BCOM-G-3.4-SEC-1-T (B)	{B} PERSONAL SELLING AND SALESMANSHIP					
	Total	20				

B.Com. (General)
Semester – III
Course Code: BCOM-G-3.1- CC-7-T
Course Title: FINANCIAL ACCOUNTING 2
Credit - 6
Full Marks - 75

Course Contents

1. **Insurance Claim for Loss of Stock** (simple problem).

2. **Partnership Accounts:**

(a) Profit and Loss Appropriation accounts; Capital & Current A/C; Guarantee – by firm, by partner and both; Correction of appropriation items with retrospective effect.

(b) Changes in constitution of firm – Change in profit sharing ratio, Admission, Retirement, Retirement cum Admission—treatment of Goodwill, revaluation of assets and liabilities,

treatment of reserves and adjustment relating to capital; treatment of Joint Life Policy, Death of a Partner.

(c) Dissolution of Firm – excluding piecemeal distribution.

3. Branch Accounting:

Synthetic Method: Preparation of Branch account, Branch Trading and P/L account (at cost & at Invoice Price)- normal and abnormal losses.

Analytical Method: Preparation of Branch stock adjustment account (at cost & at Invoice Price)- normal and abnormal losses.

4. Hire purchase and installment payment system:

Recording of Transactions in the books of buyer –Allocation of interest – Use of Interest Suspense Account—Partial and Complete Repossession.

Books of seller – Stock and Debtor Account (with repossession)

5. Departmental Accounts:

Appropriation of common cost; preparation of Departmental Trading and P/L Account. Consolidated Trading and P/L Account; inter departmental transfer of goods at cost, cost plus and at selling price and elimination of unrealized profit.

6. **Investment Accounts:** Preparation of Investment Account for Shares (with Right Shares, Bonus Shares and Sale of Right) and Debentures –treatment of brokerage, cum & ex-interest and cum & ex-dividend, transfer of securities. (Simple Problems).

Suggested Readings:

1. Sukla, Grewal, Gupta: Advanced Accountancy, S. Chand.
2. R. L. Gupta & Radheswamy Advanced Accountancy, S. Chand.
3. Maheshwari & Maheshwari, Advanced Accountancy, Vikash Publishing House.
4. Sehgal & Sehgal, Advanced Accountancy, Taxman Publication.
5. Hanif & Mukherjee, Financial Accounting, TMH.
6. Frank Wood, Business Accounting, Pearson.
7. Tulsian, Financial Accounting, Pearson.
8. Principles and Practices of Accounting, Basu and Das, Rabindra library, Kolkata.
9. Framework for preparation and presentation of Financial Statements issued by the ICAI.
10. Accounting Standards issued by ICAI.
11. Accounting Standards Rules under Companies Act

B.Com. (General)
Semester – III
Course Code: BCOM-G-3.2- CC-8 -T
Course Title: INCOME TAX LAW
Credit - 6
Full Marks - 75

Course Contents

- 1. a) Basic Concepts and Definitions under Income Tax Act, 1961:** Person, Assessee, Previous year, Assessment year, Income, Sources of income, Heads of income, Gross total income, Total income, Tax evasion, Tax avoidance, Tax planning.
- b) Residential Status of an individual and Incidence of Tax**
- c) Fully Exempted income of an Individual**
- d) Agricultural Income:** Definition, determination of agricultural and non-agricultural Income, assessment of tax liability when there are both Agricultural and Non-agricultural income.
- 2. Heads of Income and Provisions governing Heads of Income:**
 - (a) Income from Salaries**
 - (b) Income from House Property**
 - (c) Profits and Gains from Business or Profession:** Special emphasis on section 28, 32, 35, 35D, 35DDA, 36, 37, 40A(2), 40A(3), 43B.
 - (d) Capital Gain:** Meaning and types of Capital Assets, basic concept of Transfer, Cost of Acquisition, Cost of Improvement and Indexation, Computation of Short Term Capital Gain and Long Term Capital Gain, Taxability of Short Term Capital Gain and Long Term Capital Gain.
 - (e) Income from Other Sources (excluding Dividend):** Basic concepts.
- 3. Deductions from Gross Total Income:** Basic concepts - deductions u/s 80C, 80CCC, 80CCD, 80CCE, 80CCF, 80D, 80DD, 80DDB, 80E, 80G, 80GG, 80TTA, 80U.
- 4. Computation of Total Income and Tax Liability of an Individual.**
- 5. Assessment of Income:** Self Assessment u/s 140A, Summary Assessment u/s 143(1), Scrutiny Assessment u/s 143(3), Best Judgment Assessment u/s 144 and Income Escaping Assessment u/s 147.

If any new provisions are enacted in place of the existing provisions, the syllabus will stand modified accordingly with effect from such date as may be prescribed by UNIVERSITY OF KALYANI.

Suggested Readings

1. Singhanian, V. and Singhanian, M., *Students' guide to Income Tax*, Taxmann.
2. Lal & Vashist, *Income Tax and Central Sales Tax*, Pearson.
3. Ahuja & Gupta, *Systematic Approach to Income Tax*, Bharat.
4. Sengupta, C.H., *Income Tax*, Dey Book Concern.
5. Bhadra and Satpati, *Bharoter Kar Babosthapon*, Books and Allied Pvt.Ltd.
6. Mehrotra and Goyal, *Income Tax Law and Accounts*, Sahitya Bhavan Publication
6. Roy, S.K, *Principles and Practice of Direct & Indirect Taxes*, ABS
7. Bare Act and Relevant Rules

B.Com. (General)
Semester – III
Course Code: BCOM-G-3.3-CC-9-T
Course Title: LANGUAGE (L1- 2)
Credit - 6
Full Marks - 75

(to be prepared centrally by the University)

B.Com. (General)
Semester – III
Course Code: BCOM-G-3.4- SEC-1-T+P (A)
Course Title: E-COMMERCE AND COMPUTER APPLICATIONS IN BUSINESS
Credit - 2
Full Marks - 50
Module I
E-COMMERCE (Theory)

Course Contents

1. Introduction - Limitation of conventional commerce, Origin of E-Commerce, Evolution of E-Commerce, E-Commerce and E-Business, Definition of E-Commerce, Features of E-Commerce, M-Commerce-The concept- How it is done- Purposes of use.

2. Models of E-Commerce- Concepts and examples Business - to - Business (B2B), Business - to - Consumer (B2C), Consumer - to - Consumer (C2C), Consumer - to - Business (C2B), Business - to - Government (B2G), Government - to - Business (G2B), Government - to - Citizen (G2C).

3. E-CRM and SCM

E-CRM-definition, features, goals of E-CRM business framework, phases of E-CRM, types of E-CRM, Functional components of E-CRM, strategies for E-CRM solutions;
SCM-definition, features, types of supply chain.

4. Digital Money Transactions

Methods of e-payments [Debit Card, Credit Card, Smart Cards, e-Money], electronic or digital wallet, digital signature (procedures, working and legal provisions), payment gateways[Core Banking Solution or CBS, Mobile Payment, UPI, NCPI, International Payments], Online banking [meaning, concepts, importance, electronic fund transfer, automated clearinghouse, automated ledger posting]; Risks involved in e-payments.

5. E-Commerce in India

Module II

COMPUTER APPLICATIONS IN BUSINESS (Practical)

Course Contents

Accounting and Related Software

1. Tally (Current Version):

- a) *Creation of Masters-* Creation of Company, Creation of Ledgers, Creation of Stock Items, Creation of Manufacturing voucher type.
- b) *Activation of GST option, Activation of Debit Note / Credit Note*
- c) *Passing of Accounting Voucher Entries* (including inventory and GST) in – (i) Receipt, (ii) Payment, (iii) Contra, (iv) Purchase, (v) Sales, (vi) Debit Note, (vii) Credit Note, and (viii) Journal, modes.
- d) *Passing of Inventory Voucher Entries-* Manufacturing type
- e) *Preparation of Bank Reconciliation Statement*

2. Excel

- a) Insertion and deletion of Column/ Row/ Sheet.
- b) Change of Column Width
- c) Freezing of Column & Row
- d) Sorting- Single column and Multi Column (i.e. data base)
- e) Linking of one cell with another in the same sheet/ another sheet.
- f) Autosum and Formula copy with fill handle
- g) Preparation of Chart- Column Chart, Bar Chart, Pie Chart, and Line Chart.

Suggested Readings

1. P. T. Joseph, *E-Commerce: An Indian Perspective*, PHI Learning
2. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, *E-Commerce:*
3. *Fundamentals and Applications*, Wiley.
4. Laudon, *E-Commerce*, Pearson Education India
5. Schneider G., *E-Business*, Cengage
6. Bhaskar, B., *E-Commerce*, McGraw Hill

7. Nadhani, A K, *Mastering Tally ERP 9*, BPB Publications, New Delhi
8. Singh, S & Mehera, N, *Tally ERP: Power of Simplicity*, Amazon Books.
9. MacDonald, Matthew, *Excel 2007 for Starters: The Missing Manual*, PBC Books, Delhi.
10. Laing, Roger, *Microsoft Excel Basics: Expert Advice, Made Easy*, PBC Books, Delhi.

B.Com. (General)
Semester – III
Course Code: BCOM-G-3.4-SEC-1-T (B)
Course Title: PERSONAL SELLING AND SALESMANSHIP
Credit - 2
Full Marks - 50

Course Contents

- 1. Introduction to Personal Selling:** Introductions and Overview of Personal Selling, Importance of personal selling, myths of selling, Difference between Personal Selling, Salesmanship and Sales Management, Characteristics of a good salesman, types of selling situations, types of salespersons, Career opportunities in selling, Measures for making selling an attractive career.
- 2. Buying Motives:** Concept of motivation, Maslow's theory of need hierarchy; Dynamic nature of motivation; Buying motives and their uses in personal selling
- 3. Preliminary Stages of Personal Selling Process:** Prospecting - Meaning, Importance, Characteristics for qualifying as a prospects and methods of prospecting, Pre-approach - Meaning, Importance and sources of information.
- 4. Advance Stages of Personal Selling Process:** Demonstration & Presentation - Concepts & Essential features of Good Presentation and Demonstration, Objection Handling - Understanding Objections, Procedure for Handling Objections, Closing Sale - Features and methods of Closing Sale, After sale Services - Concepts and importance of after Sale Service.
- 5. Sales Reports:** reports and documents; sales manual, Order Book, Cash Memo; Tour Diary, Daily and Periodical Reports; Ethical aspects of Selling

Suggested Readings:

1. *Spiro, Stanton, and Rich, Management of the Sales force*, McGraw Hill.
2. Rusell, F. A. Beach and Richard H. Buskirk, *Selling: Principles and Practices*, McGraw Hill
3. Futrell, Charles, *Sales Management: Behaviour, Practices and Cases*, The Dryden Press.
4. Still, Richard R., Edward W. Cundiff and Norman A. P. Govoni, *Sales Management: Decision Strategies and Cases*, Prentice Hall of India Ltd., New Delhi,
5. Johnson, Kurtz and Schueing, *Sales Management*, McGraw Hill
6. Pedesson, Charles A. Wright, Milburn d. And Weitz, Barton A., *Selling: Principles and Methods*, Richard, Irvin
7. Kapoor Neeru, *Advertising and personal Selling*, Pinnacle, New Delhi.

Year 2: Semester IV

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-4.1-CC-10-T	COST ACCOUNTING	6	5	1		
BCOM-G-4.2-CC-11 -T	INDIRECT TAX LAWS	6	5	1		
BCOM-G-4.3-CC-12-T	LANGUAGE L ₂ - 2	6	5	1		
BCOM-G-4.4-SEC-2-T+P (A)	<i>Any one of the following:</i> (A) TAX RETURNS AND E-FILING OF TAX RETURNS	2				
BCOM-G-4.4-SEC-2-T (B)	OR (B) ADVERTISING					
	Total	20				

B.Com. (General)

Semester – IV

Course Code: BCOM-G-4.1- CC-10-T

Course Title: COST ACCOUNTING

Credit - 6

Full Marks - 75

Course Contents

1. Introduction: Meaning and Objectives of Cost Accounting, Difference between Cost Accounting, Financial Accounting and Management Accounting, Cost Unit, Cost Centre, Investment Centre & Profit Centre – Cost Accounting System – Installing of Cost Accounting System – Essentials of good Cost Accounting System. Methods and Techniques of Costing.

2. Costs: Meaning of cost, Various concepts of costs (Direct cost, Indirect costs, Period cost, Conversion cost, Sunk cost, Opportunity cost, etc.), Cost classification based on Elements, Functions & Behaviour, Preparation of Cost Sheet including Budgeted Cost Sheet.

3. Material Costs: Importance of Materials Cost, Constituents of material cost; Centralised & Decentralised Purchase of Materials, Purchase Procedure, Documents; *Storage of Materials:* Storage records; *Material Control:* Stock Levels (Maximum, Minimum, Re-Order & Danger Level), Meaning of Economic Order Quantity and its applications, Periodic Inventory vs. Perpetual Inventory, ABC Analysis, VED Analysis, JIT Inventory; *Different Methods for Pricing the Issue of Material:* FIFO, LIFO, Simple, Weighted & Periodic Average Methods, Preparation of Store Ledger; Accounting for material cost.

4. Labour Costs: Accounting and Control of labour cost, Time keeping and time booking, Methods of wage payment (Piece rate, Differential piece rate, Time rate), Incentive schemes for workers (Halsey, Rowan, Halsey-Weir), Measurement of Efficiency of a workers.

5. Overhead Costs: Classification, allocation, apportionment and absorption of overheads; Meaning, Concept & Reasons for Under- absorption and over-absorption of Overhead and treatment in Cost Accounting; Capacity Levels and Costs.

6. Contract Costing: Meaning, Features, Costing Procedure, Fixed Price Contract & Cost Plus Contract, Escalation & De-escalation Clause, Retention Money, Preparation of Contract Account.

7. Process Costing: Meaning, Features, Applicability, Preparation of Process Account, Treatment of Normal Loss, Abnormal Loss & Abnormal Gain, Loss of Income, etc. in Cost Accounting,

8. Operating Costing: Meaning & Concepts, Areas of Application, Different Services and their Composite Units, Computation of Composite Unit Cost.

Suggested Readings:

1. B.Banerjee – Cost Accounting (PHI)
2. Horngren, Foster, Datar - Cost Accounting – A Managerial Emphasis, (Pearson)
3. A.K.Bhattacharya, Principles and Practice of Cost Accounting, PHI Learning Pvt. Ltd.
4. Ravi M Kishore - Cost & Management Accounting, (Taxman)
5. M.Y. Khan & P.K.Jain - Management Accounting, (TMH)
6. Colin Drury – Management & Cost Accounting (Chapman & Hall)
7. Charles T. Horngren, Gary L. Sundem, Dave Burgstahler, Jeff O. Schwartzberg: Introduction to Management Accounting – Pearson Education.
8. Dr. S.N. Maheswari and S.N. Mittal: Management Accounting – Shree Mahavir Book Depot., New Delhi

B.Com. (General)
Semester – IV
Course Code: BCOM-G-4.2- CC-11 -T
Course Title: INDIRECT TAX LAWS
Credit - 6
Full Marks - 75

Course Contents

1. Introduction: Concept and types of indirect tax. Right to impose indirect taxes (by Centre and States/Union Territories) before and after 101st Amendment of Constitution. Introduction of Goods & Services Tax (GST); Indirect taxes subsumed by GST; Goods kept outside the purview of GST; Formation of GST Council; Date of effect and the non-taxable territory; Types of GST- Central GST (governed by The Central Goods & Services Tax Act 2017), State/UT GST (governed by The State Goods & Services Tax Act 2017 of each State/ Union Territory) and Integrated GST (governed by The Integrated Goods & Services Tax Act 2017).

2. Supply: Levy of tax on “Supply”; Definition of supply; Intra-State and Inter-State supply; Composite and Mixed supply; Supplies of goods and services liable to be reverse charged, Composition levy.

3. (i) Registration: Persons liable to registration; Compulsory registration; Procedure of Registration.

(ii) Documentation: Tax Invoice; Bill of Supply, Receipt Voucher, Payment Voucher, Refund Voucher, Debit Note, Credit Note. *Harmonized System Nomenclature (HSN) of Goods, and Service Accounting Code (SAC) of Services; Nil rated supplies, Zero rated supplies, Exempted supplies & Non-GST supplies.*

4. Input Tax Credit: Eligibility and conditions for taking input tax credit; Apportionment of input credit and blocked credits;

5. (i) GST Returns: GSTR 1, GSTR 2 and GSTR 3, Time and procedure of filing of Returns.

(ii) Payment of Tax: (a) Through Input Tax Credit (b) By cash/bank after generation of online Challan.

Suggested Readings:

1. V.S. Datey, *Indirect Taxes Laws and Practice*, Taxmann.
2. Anandaday Mishra, *GST Law & Procedure*, Taxman.
3. Relevant Bare Acts and Rules.
4. Publication on GST by the Institute of Chartered Accountants of India (www.icaai.org)
5. Publication on GST by the Central Board of Excise and Customs (www.cbec.org).

B.Com. (General)
Semester – IV
Course Code: BCOM-G-4.3- CC-12-T
Course Title: LANGUAGE (L₂ – 2)
Credit - 6
Full Marks - 75

(to be prepared centrally by the University)

B.Com. (General)
Semester – IV
Course Code: BCOM-G-4.4- SEC-2-T+P (A)
Course Title: TAX RETURNS AND E-FILING OF TAX RETURNS
Credit - 2
Full Marks - 50

Theory

Course Contents

Returns under Income Tax

1. PAN and TAN- Procedure for application of PAN/TAN.
2. a) Advance Tax, Refund of Tax and Tax Clearance Certificate.
b) Interest- Interest u/s 234A, 234B, 234C, (simple problems)
c) TDS - TDS from Salary, Lottery, Horse racing, Interest on Securities
3. Filing of Returns- Under-Section 139(1) [within due date]; Section 139(4) [after due date]; Section 139(5) [Revised Return]; Section 139(9) [Defective Return]; Section 142 (1) [Notice to submit Return]. Different types of Returns and Due dates for filing of those Returns.
4. Procedure of filing e-Return- ITR 1 only.

Returns under Goods and Services Tax

1. Different types of Taxable Persons and Returns to be submitted by them; Due dates for filing of Returns.
2. Procedure of filing e-Return- GSTR 1 and GSTR 4 only.

Practical

Course Contents

Practical on ITR 1, GSTR 1, and GSTR 4(downloaded in computer/ hardcopy)

Suggested Readings:

1. Singhania, V. and Singhania, M., *Students' guide to Income Tax*, Taxmann.
2. Lal & Vashist, *Income Tax and Central Sales Tax*, Pearson.
3. Ahuja & Gupta, *Systematic Approach to Income Tax*, Bharat.
4. Sengupta, C.H., *Income Tax*, Dey Book Concern.
5. Bhadra and Satpati, *Bharoter Kar Babosthapon*, Books and Allied Pvt. Ltd.
6. Mehrotra and Goyal, *Income Tax Law and Accounts*, Sahitya Bhavan Publication
7. Bare Act and Relevant Rules
8. Software: Singhania, V.K., *E-Filing of Income Tax Returns and Computations of Tax*, Taxmann.

B.Com. (General)

Semester – IV

Course Code: BCOM-G-4.4- SEC-2-T (B)

Course Title: ADVERTISING

Credit - 2

Full Marks - 50

Course Contents

1. Introduction:

Communication Process; Advertising as a tool of communication; Meaning, nature and importance of advertising; Types of advertising; Advertising objectives. Audience analysis; Setting of advertising budget: Determinants and major methods.

2. Media Decisions:

Major media types - their characteristics, internet as an advertising media, merits and demerits; Factors influencing media choice; media selection, media scheduling, Advertising through the Internet-media devices.

3. Message Development:

Advertising appeals, Advertising copy and elements, Preparing ads for different media.

4. Measuring Advertising Effectiveness:

Evaluating communication and sales effects; Pre-testing and Post-testing techniques.

5. (a) Advertising Agency: Role, types and selection of advertising agency.

b) Social, ethical and legal aspects of advertising in India.

Suggested Readings:

1. George E Belch, Michael A Belch, Keyoor Purani, *Advertising and Promotion: An Integrated Marketing Communications Perspective (SIE)*, McGraw Hill Education.
2. S. Watson Dunn, and Arnold M. Barban. *Advertising: Its Role in Marketing*. Dryden Press
3. Burnett, Wells, and Moriatty. *Advertising: Principles and Practice*. 5th ed. Prentice Hall of India, New Delhi.
4. Batra, Myers and Aaker. *Advertising Management*. PHI Learning.
5. Terence A. Shimp. *Advertising and Promotion: An IMC Approach*. Cengage Learning.
6. Sharma, Kavita. *Advertising: Planning and Decision Making*, Taxmann Publications.
7. Jaishree Jethwaney and Shruti Jain, *Advertising Management*, Oxford University Press, 2012.
8. Chunawala and Sethia, *Advertising*, Himalaya Publishing House.
9. Ruchi Gupta, *Advertising*, S. Chand & Co.
10. O'Guinn, *Advertising and Promotion: An Integrated Brand Approach*, Cengage Learning.

Year 3: Semester V

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-5.1-DSE-1-T (A)	<i>Any one of the following:</i> (A) CORPORATE ACCOUNTING OR	6	5	1		
BCOM-G-5.1-DSE-1-T (B)	(B) BANKING AND INSURANCE					
BCOM-G-5.2-DSE-2-T (A)	<i>Any one of the following:</i> (A) MANAGEMENT ACCOUNTING OR	6	5	1		
BCOM-G-5.2-DSE-2-T (B)	(B) INDIAN FINANCIAL SYSTEM					
BCOM-G-5.3-GE-1-T	BASIC FINANCIAL ACCOUNTING (<i>Note 2</i>)	6	5	1		
BCOM-G-5.4-SEC-3-T (A)	<i>Any one of the following:</i> (A) BUSINESS COMMUNICATION AND ENTREPRENEURSHIP DEVELOPMENT OR	2				
BCOM-G-5.4-SEC-3-T (B)	(B) AUDITING					
	Total	20				

B.Com. (General)
Semester –V
Course Code: BCOM-G-5.1- DSE-1-T (A)
Course Title: CORPORATE ACCOUNTING
Credit - 6
Full Marks - 75

Course Contents

- 1. Final Accounts of Companies:** Preparation of Statement of Profit & Loss and Balance Sheet as per Schedule III to the Companies Act, 2013.
- 2. Introduction to Company Accounts:** Meaning of Company and its Classification; Books of Accounts; Maintenance of Books of Accounts; Financial Year; Financial Statements – Meaning, Forms & Contents; Concept of True and Fair View, Authentication of Financial Statements; Filing of Financial Statements.
- 3. Accounting for Shares and Debentures of Company:** Kinds of Share Capital; Issue, Forfeiture, Reissue of Shares; Right Shares and Bonus Shares; Issue of Debentures, Underwriting of Shares and Debentures; Redemption of Preference Shares.
- 4. Business Acquisition and Conversion of Partnership Firm into Limited Company:** Amalgamation of Partnership Firms - accounting in the books of transferor and transferee firm; Conversion of Partnership into Limited Company –with the same or different set of books; Profit or Loss Prior to Incorporation - Accounting for Acquisition of Business.
- 5. Reconstruction of Companies:** Meaning of Internal and External Reconstruction of companies, Concept of and accounting for Amalgamation as per Accounting Standard - 14 (issued by ICAI, excluding inter-company holdings); Accounting for Internal Reconstruction (excluding preparation of scheme of reconstruction).
- 6. Valuation:** Valuation of Goodwill and Shares (Simple Problem).

Suggested Readings:

1. Gupta, R.L. and M. Radhaswamy, “*Advanced Accountancy*”, Vol-II, Sultan Chand and Sons, New Delhi.
2. Maheshwari, S.N. and S. K. Maheshwari, “*Corporate Accounting*”, Vikas Publishing House, New Delhi.
3. Jain, S.P. and K.L. Narang, “*Corporate Accounting*”, Kalyani Publishers, New Delhi.
4. Shukla, M.C., T.S. Grewal, and S.C. Gupta, “*Advanced Accounts*”, Vol-II, S. Chand & Co., New Delhi.
5. Monga, J.R., “*Fundamentals of Corporate Accounting*”, Mayur Paper Backs, New Delhi.
6. “*Compendium of Statements and Standards of Accounting*”, The Institute of Chartered Accountants of India, New Delhi.

7. “*Financial Statements Presentation under Companies Act, 2013: Practitioner’s Perspective*”, The Institute of Chartered Accountants of India, New Delhi.

B.Com. (General)
Semester –V
Course Code: BCOM-G-5.1- DSE-1-T (B)
Course Title: BANKING AND INSURANCE
Credit - 6
Full Marks - 75

Course Contents

1. Introduction

Origin of banking: definition, banker and customer relationship, General and special types of customers, Types of deposits, Origin and growth of commercial banks in India. Financial Services offered by banks, changing role of commercial banks, types of banks.

2. Cheques and Paying Banker

Crossing and endorsement - meaning, definitions, types and rules of crossing. Duties, Statutory protection in due course, collecting bankers: duties, statutory protection for holder in due course, Concept of negligence.

3. Banking Lending

Principles of sound lending, Secured vs. unsecured advances, Types of advances, Advances against various securities.

4. Internet Banking

Meaning, Benefits, Home banking, Mobile banking, Virtual banking, E-payments, ATM Card/Biometric card, Debit/Credit card, Smart card, NEFT, RTGS, ECS (credit/debit), E-money, Electronic purse, Digital cash.

5. Insurance

Basic concept of risk, Types of business risk, Assessment and transfer, Basic principles of utmost good faith, Indemnity, Economic function, Proximate cause, Subrogation and contribution, Types of insurance: Life and Non-life, Re-insurance, Risk and return relationship, Need for coordination. Power, functions and Role of IRDA, Online Insurance

Suggested readings:

1. Agarwal, O.P., *Banking and Insurance*, Himalaya Publishing House.
2. Satyadevi, C., *Financial Services Banking and Insurance*, S.Chand.
3. Suneja, H.R., *Practical and Law of Banking*, Himalaya Publishing House.
4. Chabra, T.N., *Elements of Banking Law*, Dhanpat Rai and Sons.
5. Arthur, C. and C. William Jr., *Risk Management and Insurance*, McGraw Hill.
6. Saxena, G.S; *Legal Aspects of Banking Operations*, Sultan Chand and Sons.
7. Varshney, P.N., *Banking Law and Practice*, Sultan Chand and Sons.
8. Jyotsna Sethi and Nishwan Bhatia, *Elements of Banking and Insurance*, PHI Learning.

B.Com. (General)
Semester –V
Course Code: BCOM-G-5.2- DSE-2-T (A)
Course Title: MANAGEMENT ACCOUNTING
Credit - 6
Full Marks - 75

Course Contents

1. **Introduction:** Meaning, Objectives, Nature Scope of management accounting, Cost Accounting, Financial Accounting and Management Accounting, Concept of cost control, cost reduction and cost management.

2. **Budget and Budgetary Control:** Concept of budget and budgetary control. Principal Budget Factors, Budget Committee, Budget Manual; Preparation of Functional budgets (Sales, Purchase, Production, etc.), cash budget, fixed and flexible budgets; Concept of Master Budget and Zero base budgeting.

3. **Standard Costing:** Meaning of standard cost and standard costing. Steps involved in standard costing, Advantages and Limitations of Standard Costing. Types and Meaning of different cost variances, Determination of material variances.

4. **Cost Volume Profit Analysis and Marginal Costing:** Meaning and assumption of Cost-Volume-Profit Analysis; Break Even Chart- Break Even Point, Margin of Safety, Angle of Incidence; Profit graph.

Concepts of Marginal Cost, Marginal Costing & Contribution; Limitations of Marginal Costing, Distinction between Absorption Costing & Marginal Costing, Marginal Cost Equation and Techniques of Marginal Costing.

5. **Ratio Analysis:** Accounting Ratios – Meaning, objectives, uses, advantages and limitations; Classification and determination of accounting ratios–liquidity, solvency, activity, profitability, capital structure, managerial efficiency; Preparation of financial statement and statement of proprietor’s fund from relevant ratios.

Suggested Readings:

1. B.Banerjee – Cost Accounting (PHI)
2. Horngren, Foster, Datar - Cost Accounting – A Managerial Emphasis, (Pearson)
3. A.K.Bhattacharya, Principles and Practice of Cost Accounting, PHI Learning Pvt. Ltd.
4. Ravi M Kishore - Cost & Management Accounting, (Taxman)
5. M.Y.Khan & P.K.Jain - Management Accounting, (TMH)
6. Colin Drury – Management & Cost Accounting (Chapman & Hall)

7. Charles T. Horngren, Gary L. Sundem, Dave Burgstahler, Jeff O. Schwartzberg: Introduction to Management Accounting – Pearson Education.
8. Dr. S.N. Maheswari and S.N. Mittal: Management Accounting – Shree Mahavir Book Depot., New Delhi

B.Com. (General)
Semester –V
Course Code: BCOM-G-5.2- DSE-2-T (B)
Course Title: INDIAN FINANCIAL SYSTEM
Credit - 6
Full Marks - 75
Module-I
Indian Financial System

Course Contents

1. Financial System- Meaning, Significance & Components; Structure of Indian Financial System
2. Reserve Bank of India-
 - a) Organisation, Management, Functions- Credit Creation and Control
 - b) Monetary Policy- Objective, Different ways of RBI, Impediments to the effectiveness of monetary policy.
3. Development Banks- Concepts, Objectives & Functions of National & State Level Development Banks(IFCI, IDBI, ICICI, NABARD, SIDCs)
4. Insurance Sector- LIC & GIC- Objectives and Functions.
5. Financial Regulatory Bodies-
 - a) Fundamental ideas about various regulatory bodies.(SEBI, Company Law Board, RBI, Insurance Regulatory Body, Insurance Regulatory Development Authority (IRDA), Ministry of Finance.
 - b) SEBI- Structure, Role in Investors' protection

Module-II
Market Operation

Course Contents

1. Introduction- An Overview of Financial Market in India- New Financial Instrument: Commercial Paper, Treasury Bill, Certificate of Deposit- Concepts, features and advantages.
2. Money Market- Concept, Structure of Indian Money Market, Basic idea of its different components
3. Capital Market- Primary Market and Secondary Market- Concept & Interrelation, Function and role of Stock Exchange (Including the basic ideas of types of stock market, Operation and

Trading Mechanism of Stock Market) Credit Rating: Meaning, Rating Methodology, Rating symbols by different Rating Agencies.

4. Depository Services –Role and Function of Depository Services, Advantages, NSDL and CDSL

5. Recent Trends in Capital Market: Concept and Types of Mutual Fund, Concept of NAV, NAV calculation, Regulatory Regime of Mutual Fund, Systematic Investment Plan (SIP)-Concepts, importance and relevance.

Suggested Reading:

1. Indian Financial System and Financial Market operation: Sushil Mukherjee
2. Indian Financial System: Theory and Practice: MY Khan
3. Indian Financial System; 4th Edition: H R Machiraju
4. Indian Financial System & Financial Market Operations: For Universities of West Bengal: Anupam Karmakar
5. Bhartiya Aarthik Byabasthya ebong Aarthik Bajarer Karjabali: Sushil Mukherjee
6. Bhartiya Aarthik Byabasthya ebong Aarthik Bajarer Karjabali: Nayak, Sana
7. Subhamoy Das, Perspectives on Financial Services, Allied Publishers.
8. Siddhartha Saha, Indian Financial Systems and Markets, McGraw Hill

B.Com. (General)
Semester – V
Course Code: BCOM-G-5.3: GE-1-T
Course Title: BASIC FINANCIAL ACCOUNTING
Credit - 6
Full Marks - 75

Course Contents

1. Financial Accounting: Meaning and Objectives, Difference with Cost Accounting and Management Accounting, Users of accounting information, Meaning of assets, liabilities, equity, income and expenses, Basic accounting equation, Meaning of Transactions, Meaning and Types of Account, Rules of Debit and Credit.

2. Basic concepts and conventions:

a. Entity	g. Periodicity
b. Money Measurement	h. Consistency
c. Going Concern	i. Prudence (Conservatism)
d. Cost	j. Materiality

e. Realisation	k. Matching and
f. Accruals	l. Full Disclosures

3. Meaning and Types of Journal, Recording of transaction in Journal.
4. Meaning and Types of Ledger, Posting of transaction to ledger from journal.
5. Meaning of Trial Balance and its Preparation.
6. Depreciation
7. Capital and Revenue Expenditures and Receipts
8. Cash basis, Accrual basis and Mixed basis of accounting
9. Meaning of Financial Statements. Different types of Financial Statements and their preparation.

Suggested Readings

1. Sukla, Grewal, Gupta: Advanced Accountancy, S. Chand. (Vol. 1).
2. Asish K. Bhattacharyya, Essentials of Financial Accounting, PHI Learning Pvt. Ltd.

B.Com. (General)
Semester –V
Course Code: BCOM-G-5.4- SEC-3-T (A)
Course Title: BUSINESS COMMUNICATION AND ENTREPRENEURSHIP
DEVELOPMENT
Credit - 2
Full Marks - 50

Module I
BUSINESS COMMUNICATION

Course Contents

1. Business Communication: Introduction, Definition, Objectives, Importance, Elements, Types of Communication – Formal and informal, Level of Analysis of Business Communication, Principles of Effective Communication.
2. Significance of Communication, Business Productivity, Inter Group and Intra-Group Conflict, Conflict Resolution and Group Cohesiveness.
3. Management Information System (MIS): Definition, Elements, Need, Function, Use of IT in MIS (Conceptual), Role of MIS in Decision Making, Decision Support System (DSS).

4. Tools of Communication: Emergence of Communication Technology, Modern forms of Communication, Fax, E-Mail, and Video Conferencing.

5. Practice in Effective Communication: Drafting Notice, Circular, Minute, Resolution, Report, CV writing, Business Letter Writing, Office Letter, Status Enquiry, Quotation Order Confirmation, Execution, Refusal and Cancellation of Order, Recommendation, Credit Collection, Claim, Bank Loan.

Module II

ENTREPRENEURSHIP DEVELOPMENT

Course Contents

1. Introduction: Meaning and Concept of Entrepreneurship, Elements, Determinants and Importance of Entrepreneurship, Role and Creativity, Characteristics, Function and Qualities of Entrepreneur.

2. Entrepreneurship Roles in Different Business Environment: Small, Micro & Medium Business Enterprises, Family Venture, Corporate Entrepreneurship, Role of Government as Entrepreneur.

3. Entrepreneur and Law: Legal protection of innovations-Patents, Trademarks and Copyrights-Intellectual Property Right.

4. Financing of New Ventures: Methods of Financing Equity Financing, Venture Capital Debt Financing and Governmental Grants.

5. Project Planning and Feasibility Studies: Methods of preparation of Project Plans and conducting Feasibility Studies.

Suggested Readings

1. Drucker, P.F., Management: Tasks, Responsibilities & Practices.

2. Holt, D.H., Entrepreneurship: New Venture Creation.

3. Koontz and O'Donnell, Essentials of Management.

4. Irwin, R.D., Principles of Management.

5. Madhukar, R.K. , Business Communication.

6. Chopra, R.K., Business Correspondence.

B.Com. (General)
Semester –V
Course Code: BCOM-G-5.4- SEC-3-T (B)
Course Title: AUDITING
Credit - 2
Full Marks - 50

Course Contents

1.Introduction: Definition of Auditing, Standards on Auditing (Preliminary idea only), Objectives of Audit, Basic Principles Governing an Audit, Scope of Audit, Inherent limitations of Audit, Different types of Audit, Auditing and Investigation. Basic Concepts in Auditing - Auditor's Independence, Advantages of an independent Audit, Audit Evidence, Concept of Materiality, Concept of True and Fair.

2.Preparation for an Audit: Auditor's Engagement, Audit Process, Audit Techniques, Audit Planning, Audit Programme, Continuous and Final Audit, Audit Planning and Materiality, Audit Working Papers, Quality Control for Audit Work, Elements of Statistical Sampling, Audit Risk, Surprise Checks, Obtaining Certificate from Management.

3.Internal Control, Internal Check and Internal Audit: Concept of Internal Control, Internal Control and Management, Internal Control and the Auditor, Testing of Internal Control, Examination in Depth, Internal Check, Internal check and Auditor, Internal Audit, Relationship between the Statutory and the Internal Auditors, Internal Financial Control.

4. Vouching: Concept of Vouching; Vouching of- Cash Transactions, Payments, Receipts, Trading Transactions, Purchases, Sales; Verification of Bank Balance and Cash-in-Hand.

5. Audit of Sole Proprietorship Concern and Partnership Firm.

Suggested Readings:

1. Gupta, K. *Contemporary Auditing*, Tata McGraw Hill.
2. Ghatalia, S. V., *Spicer and Pegler's Practical Auditing* (by Bigg, Walter W.), 5th Indian Edition, Allied Publishers Pvt. Ltd.
3. Basu, S. K., *Nirikshar Tattwa-o- Koushal* (Bengali), Pearson.
4. Bhattacharya, K. and Sheel, K. L., *Nireekshashastrer Tatwa O Prayog*, Rabindra Library.
5. Tandon, B.N., *Principles of Auditing*, S. Chand &Co.
6. Tandon, B.N., Sudharsanam, S. and Sundharabahu, S., *A Handbook of Practical Auditing*, S. Chand & Company.
7. Kundu, J. L., *Nirikshashastra*, ABS Publishers.
8. Majumder, P., *Nirikhasastra*, Dove Publishing House.

Year 3: Semester VI

Course Code	Course Title	Credit	No. of Classes per Week		No. of Classes per Week	
			L	T	L	P
BCOM-G-6.1-DSE-3-T (A)	Any one of the following: (A) FINANCIAL MANAGEMENT OR (B) CORPORATE GOVERNANCE AND SOCIAL RESPONSIBILITY OF BUSINESS	6	5	1		
BCOM-G-6.1-DSE-3-T (B)						
BCOM-G-6.2-DSE-4-T (A)	Any one of the following: (A) ACCOUNTING FOR LOCAL BODIES OR (B) FUNDAMENTALS OF INVESTMENT	6	5	1		
BCOM-G-6.2-DSE-4-T (B)						
BCOM-G-6.3-GE-2-T	BASIC INCOME TAX (<i>Note 2</i>)	6	5	1		
BCOM-G-6.4-SEC-4-T+P	PROJECT WORK	2				
Total		20				

In Course Code, 'H' stands for Honours, 'G' stands for General, 'T' stands for Theory and 'P' stands for Practical.

B.Com. (General)

Semester –VI

Course Code: BCOM-G-6.1- DSE-3-T (A)

Course Title: FINANCIAL MANAGEMENT

Credit - 6

Full Marks – 75

Course Contents

1. Fundamentals of Financial Management: Definition, Concept, scope, objective, and importance of financial management. Objectives of the firm – profit maximization and wealth maximization. Time value of money.

2. Sources of Finance and Cost of Capital: Different sources of finance - long term and short term sources. *Cost of capital* - concept, relevance of cost of capital, specific costs and weighted average cost, rationale of after tax weighted average cost of capital, marginal cost of capital.

3. Working Capital and Its Management: Meaning, concept, composition, nature, types of working capital, Determining factors of working capital, Working Capital Cycle, Estimation of

working capital requirements (excluding problems on extra shift working capital and working capital policy). **Working Capital Management** – Importance of working capital management, Working capital financing – Long-term, medium and short-term.

4. Capital Structure and Leverage: Meaning, concept, importance of capital structure. Determining factors of capital structure. Concept of optimum capital structure. Various capital structure theories (NI, NOI)

Leverage – Concept, types and importance. Financial, operating and combined leverages, Trading on Equity, EBIT-EPS Analysis. Business Risk and Financial Risk.

7. (a) **Funds Flow Statement:** Concepts of fund – Meaning, nature, importance and limitations of funds flow statement – Various sources and uses of fund – Preparation of funds flow statement.

(b) **Cash Flow Statement:** Meaning, Objectives, Importance and Limitations of cash flow statement – Fund flow statement vs. cash flow statement – Various sources and uses of cash – Preparation of cash flow statement.

Suggested Readings:

1. Chandra, P., *Financial Management: Theory and Practice*, Tata-McGraw-Hill Publishing Co., Ltd. New Delhi.
2. Khan, M.Y. and Jain, P.K., *Financial Management: Text, Problems and Cases*, Tata McGraw Hill Publishing Co., Ltd. New Delhi.
3. Pandey, I.M., *Financial Management*, Vikas Publishing House Pvt. Ltd., New Delhi.
4. V.C. Van Horne., *Financial Management & Policy*, PHI, New Delhi.
5. B. Banerjee., *Financial Management*, PHI, New Delhi
6. Kuchhal, S.C.: *Financial Management*
7. Sharma & Gupta: *Financial Management*
8. Arvind Kumar & Pusphendra Misra: *Financial Management*, New Royal Book Co.
9. L.M. Bhole., *Financial Institutions and Markets*, TMH
10. Gordon & Natarajan., *Financial Services*, HPH
11. S.G. Guruswamy., *Financial Services & Systems*, Thomson Learning
12. M.Y. Khan., *Financial Services*, Tata McGraw Hill

B.Com. (General)
Semester –VI
Course Code: BCOM-G-6.1- DSE-3-T (B)
Course Title: CORPORATE GOVERNANCE AND SOCIAL RESPONSIBILITY OF
BUSINESS
Credit - 6
Full Marks – 75

Course Contents

I. Conceptual Framework of Corporate Governance: Meaning; theories and models of corporate governance.

2. Corporate Governance Framework in India: Corporate boards and its powers, responsibilities, disqualifications; board committees and their functions- remuneration committee, nomination committee, compliance committee, shareholders grievance committee, investors relation committee, investment committee, risk management committee, and audit committee; regulatory framework of corporate governance in India; SEBI guidelines and clause 49; reforms in the Companies Act, 2013.

3. Major Corporate Scandals in India and Abroad: Common Governance Problems Noticed in various Corporate Failures.

4. Whistle-blowing and Corporate Governance: The Concept of whistle-blowing; types of whistleblowers; whistle-blower policy; the whistle-blower legislation across countries; developments in India.

5. Corporate Social Responsibility (CSR)

Concept of CSR, Corporate Philanthropy, Strategic Planning and Corporate Social Responsibility; Relationship of CSR with Corporate Sustainability; CSR and Business Ethics, CSR and Corporate Governance; CSR provisions under the Companies Act 2013; CSR Committee; CSR Models, Codes, and Standards on CSR.

Suggested Readings:

1. Anil Kumar, *Corporate Governance: Theory and Practice*, Indian Book House, New Delhi.
2. MC Kuchhal, *Modern Indian Company Law*, Shri Mahaveer Book Depot (Publishers). (Relevant Chapters)
3. KV Bhanumurthy and Usha Krishna, *Politics, Ethics and Social Responsibility of Business*, Pearson Education.
4. Erik Banks, *Corporate Governance: Financial Responsibility, Controls and Ethics*, Palgrave Macmillan.
5. N Balasubramanian, *A Casebook on Corporate Governance and Stewardship*, McGraw Hill Education.

6. B.N. Ghosh, Business Ethics and Corporate Governance, McGraw Hill Education.
7. S K Mandal, *Ethics in Business and Corporate Governance*, McGraw Hill Education.
8. Bob Tricker, *Corporate Governance-Principles, Policies, and Practice* (Indian Edition), Oxford University Press.
9. Christine Mallin, *Corporate Governance (Indian Edition)*, Oxford University Press
10. Sharma, J.P., *Corporate Governance, Business Ethics, and CSR*, Ane Books Pvt Ltd, New Delhi.
11. Blowfield, Michael, and Alan Murray, Corporate Responsibility, Oxford University Press.
12. Francesco Perrini, Stefano, and Antonio Tencati, *Developing Corporate Social Responsibility-A European Perspective*, Edward Elgar.
13. Sharma, J.P., *Corporate Governance and Social Responsibility of Business*, Ane Books Pvt. Ltd, New Delhi.

B.Com. (General)

Semester –VI

Course Code: BCOM-G-6.2- DSE-4-T (A)

Course Title: ACCOUNTING FOR LOCAL BODIES

Credit - 6

Full Marks – 75

Course Contents

1. Introduction: Concept of local bodies; Salient features of 73rd Amendment of the Constitution in 1992, Article 243J- Audit of Accounts.
2. Provisions related to Accounts in the West Bengal Panchayat Act, 1973: Some important provisions of – (a) West Bengal Panchayat (Zilla Parishad and Panchayat Samiti) Accounts and Finance Rules 2003, (b) West Bengal Panchayat (Gram Panchayat Accounts, Audit and Budget) Rules 2007.
3. Financial Statements of Municipalities: Balance Sheet, Income & Expenditure Account, Statement of Cash Flows, Receipts and Payments Account, and Notes to Accounts (Refer National Municipal Accounts Manual, 2004);
Important contents of the Accounting Manual for Urban Local Bodies, 2006, of the Govt. of West Bengal: **Part 1: Introduction to Double Entry Accrual- based Accounting** Para 4- New Accounting System (i.e. double entry accrual system of accounting); Para 6- Accounting Documents; Para 7- Financial Statements; Para 9- Fundamental Accounting Assumptions. **Part 5: Forms and Formats.**
4. Accounting Standards: Overview of *Accounting Standards for Local Bodies* issued by the Institute of Chartered Accountants of India.

5. Financial Statements of PRIs (Panchayat Raj Institutions) and Municipalities: problem solutions; Software for Preparation of Financial Statements.

Note- Evaluation of Answer Scripts is to be made by internal teachers of concerned college.

Suggested Readings:

1. Constitution of India
2. West Bengal Panchayat Act, 1973
3. West Bengal Panchayat (Zilla Parishad and Panchayat Samiti) Accounts and Finance Rules 2003
4. West Bengal Panchayat (Gram Panchayat Accounts, Audit and Budget) Rules 2007
5. National Municipal Accounts Manual, 2004
6. Accounting Manual for Urban Local Bodies, 2006, of the Govt. of West Bengal
7. *Accounting Standards for Local Bodies* issued by the Institute of Chartered Accountants of India.

B.Com. (General)

Semester –VI

Course Code: BCOM-G-6.2- DSE-4-T (B)

Course Title: FUNDAMENTALS OF INVESTMENT

Credit - 6

Full Marks - 75

Course Contents

1. The Investment Environment

The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.

2. Fixed Income Securities

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

3. Approaches to Equity Analysis

Introductions to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

4. Portfolio Analysis and Financial Derivatives

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India.

5. Investor Protection

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism.

Suggested Readings

1. C.P. Jones, *Investments Analysis and Management*, Wiley, 8th ed.
2. Prasanna Chandra, *Investment Analysis and Portfolio Management*, McGraw Hill Education
3. R.P. Rustogi, *Fundamentals of Investment*, Sultan Chand & Sons, New Delhi.
4. N.D. Vohra and B.R. Bagri, *Futures and Options*, McGraw Hill Education
5. Mayo, *An Introduction to Investment*, Cengage Learning.

B.Com. (General)

Semester –VI

Course Code: BCOM-G-6.3- GE-2-T

Course Title: BASIC INCOME TAX

Credit - 6

Full Marks – 75

Course Contents

1. a) Basic Concepts and Definitions under Income Tax Act, 1961: Person, Assessee, Previous year, Assessment year, Income, Sources of income, Heads of income, Gross total income, Total income, Tax evasion, Tax avoidance, Tax planning.
b) Residential Status of an individual and Incidence of Tax
c) Fully Exempted income of an Individual (including agricultural income).
2. Computation of Income under following Heads of Income (Simple Problems):
(a) Income from Salaries
(b) Income from House Property
(c) Capital Gain: Meaning and types of Capital Assets, basic concept of Transfer, Computation of Short Term Capital Gain and Long Term Capital Gain, Taxability of Short Term Capital Gain and Long Term Capital Gain.
(d) Income from Other Sources (excluding Dividend): Basic concepts.
3. Deductions from Gross Total Income: Deductions u/s 80C, 80D, 80DD, 80E, 80G, 80TTA.
4. Computation of Total Income and Tax Liability of an Individual.

[If any new provisions are enacted in place of the existing provisions, the syllabus will stand modified accordingly with effect from such date as may be prescribed by UNIVERSITY OF KALYANI.]

Suggested Readings

1. Lal & Vashist, *Income Tax and Central Sales Tax*, Pearson.
2. Ahuja & Gupta, *Systematic Approach to Income Tax*, Bharat.
3. Sengupta, C.H., *Income Tax*, Dey Book Concern.

4. Bhadra and Satpati, *Bharoter Kar Babosthapona*, Books and Allied Pvt. Ltd.
5. Mehrotra and Goyal, *Income Tax Law and Accounts*, Sahitya Bhavan Publication
6. Roy, S.K, *Principles and Practice of Direct & Indirect Taxes*, ABS
7. Singhanian, V. and Singhanian, M., *Students' guide to Income Tax*, Taxmann.
8. Bare Act and Relevant Rules.

B.Com. (General)
Semester –VI
Course Code: BCOM-G-6.4- SEC-4-T+P
Course Title: PROJECT WORK
Credit - 2
Full Marks – 50

Course Contents

For Project Work: The student will write a project report under the supervision of a faculty member assigned by the college/institution (**Details to be notified later**).

Examples of a few broad areas of Project (List is indicative, not exhaustive)

- Accounting and Finance of Local Bodies
- Any topic concerning local economic /entrepreneurial issues / new business proposal
- Agro based industry / cottage industry
- Commercial Crops including Horticulture & Sericulture
- Micro-finance/ Financial Inclusion
- Micro-insurance
- Small Savings
- Rural and Agricultural Banking
- Preservation & Storage of Agricultural Products
- Eco-tourism
- Hotels, Restaurants, Eateries
- Digital Service Providers- Photocopy, Mobile, Internet, Cable etc.
- Medical Service Providers
- Educational Service Providers
- Construction industry
- Small Traders/ Street Vendors/ Hawkers including Railway Hawkers
- Rural and Agricultural workers
- Role of Micro Small and Medium Enterprises
- Accounting Standards for Local Bodies.
- IFRS for SMEs
- Indian Accounting Standards(Rule of 2006, as amended in 2016)
- Schedule III of Companies Act, 2013
- Auditing Standards
- E-Commerce & M-commerce
- Credit Rating / Risk Management

- Frauds/ White Collar Frauds
- Subprime Meltdown and its after effect with case study from Indian Industry.
- Carbon Credit
- Value Added Tax (VAT) / Goods and Service Tax (GST)
- Public Sector Undertakings and Indian Economic Development
- Corporate Social Responsibilities
- Corporate Governance
- Financial Sector Reforms
- On-line Banking
- NPA Management
- Business Process Outsourcing
- Capital Market
- Environmental Accounting/ Environmental Management
- Financial Statement Analysis / Performance Analysis
- Working Capital Management
- Mergers & Acquisitions
- Study on Aviation Sector in India.
- Venture Capital
- Equity Linked Savings Scheme
- Insurance Industry in India
- Analysis of Mutual Funds
- Commercialization of Sports in India.
- Marketing Strategy of products
- Marketing and Promotional Strategies
- Market Research
- Brand Repositioning
- Customer Relationship Management
- Sales & Distribution Management
- Customer Awareness
- Industrial Marketing Vs. Consumer
- Study of Consumer Behaviour
- Packaging of Products
- After Sales Service and Customer Satisfaction
- Effectiveness of Advertising
- Direct Marketing & Networking

Appendix A

The following four GE Papers are offered to the students (Honours) of any department other than students of commerce department.

- i) Fundamentals of Financial Accounting (GE 1)
- ii) Fundamentals of Income Tax (GE 2)
- iii) Fundamentals of Goods and Service Tax (GE 3)
- iv) Fundamentals of Cost and Management Accounting (GE 4)

If GE papers under B.Com. (Honours) Syllabus are allowed by the University Authority to be opted by students of commerce departments as well as students of any other department, then above four GE Papers are to be substituted by the following four GE Papers:

- i) Micro Economics (GE 1)
- ii) Business Statistics (GE 2)
- iii) Macro Economics (GE 3)
- iv) Indian Economics (GE 4)]

MICRO ECONOMICS (GE 1)

Course Contents

1. Demand and Supply

Concept of demand, Demand function, Law of Demand and its exceptions, Derivation of individual and market demand curves, Elasticity of demand– price elasticity – relation between slope of demand and elasticity of demand– concepts of income and cross price elasticity of demand. Supply function and equilibrium.

2. Consumer Behaviour

Concepts of cardinal and ordinal utility, Indifference curve analysis, Consumer equilibrium using indifference curve and budget constraint –graphical approach.

3. Production and Cost

Production Function – Short run and long run –Law of variable proportions, Concepts of total productivity, average productivity and marginal productivity, Producer equilibrium through isoquants and isocosts – economics and diseconomies of large scale of production and Returns to scale.

Cost Analysis– Fixed and variable cost, Explicit and Implicit costs, Marginal and average costs, Short–run and Long–run cost curves.

4. Perfect Competition

Perfect Competition-Features; Marginal and Average Revenue under Perfect competition; Profit maximization, Equilibrium of firm and industries, Short run and long run supply curves.

5. Imperfect Competition

Monopoly-Features; Marginal and Average Revenue under Imperfect competition; Price and output determination under monopoly, Price discrimination– Degrees of price discrimination; Social cost of Monopoly- concepts only.

Monopolistic competition-Features and examples; Oligopoly – Concepts of collusive and non-collusive oligopoly, Non-collusive Oligopoly- Price competition and Sweezy model, Collusive Oligopoly – Cartel.

Suggested Readings:

1. Pindyke and Rubinfeld, Micro Economics.
2. Principles of Microeconomics, Mankiw.
3. Microeconomics, Theory and Applications, Maddala Miller.
4. Gould & Ferguson, Micro Economic Theory.
5. Banerjee & Majumdar, Fundamentals of Business Economics.
6. Banerjee & Majumdar, Banijjik Arthaniti –o- Banijjik Paribesh (Bengali).
7. Ratan Khasnabish & Ranesh Roy, Banijjik Arthaniti –o- Bharoter Arthanaitik Paribesh (Bengali).

BUSINESS STATISTICS (GE 2)

Course Contents

1. (A) **Introductory ideas:** Data and different types of data; Summarization of statistical data – different types frequency distributions, their construction and their properties.
(B) **Diagrammatic representation:** Histogram, Frequency Polygon, Ogive Bar and Line Diagram.
2. (A) **Different Measures of Central Tendency:** Common measures of central tendency – mean, median and mode; Partition values – quartiles, deciles, percentiles(concepts only).
(B) **Different Measures of Dispersion:** Absolute measures of dispersion – range, quartile deviation, mean deviation and standard deviation; Relative measures of dispersion.
(C) **Moments, Skewness and Kurtosis:** Different types of moments and their relationships; Meaning of skewness and kurtosis; Different measures of Skewness and Kurtosis.
3. **Correlation Analysis:** Scatter diagram; Pearson’s co-efficient of correlation: calculation and properties (proofs not required). Probable and standard errors; Rank Correlation; Meaning of Simple, multiple and Partial Correlation.
4. **Regression Analysis:** Principle of least squares and regression lines. Regression equations and estimation; Standard Error of Estimates.

5. **Index Numbers:** Meaning and uses of index numbers; Construction of index numbers: fixed and chain base, univariate and composite; Aggregative and average of relatives – simple and weighted; Tests of adequacy; Base shifting, splicing, deflating; Construction of Consumer price index.

6. (A) **Set Theory:** Definition of Set; Presentation of Sets; Different types of Sets- Null Set, Finite & Infinite Sets, Universal Set, Subset, Power Set etc.; Set operations; Laws of algebra of Sets.

(B) **Theory of Probability:** Theory of Probability; Approaches to the calculation of probability; Calculation of event probabilities; Addition and multiplication laws of probability; Conditional probability; Expectation and variance of a random variable.

Suggested Readings

1. Das, N. G., Statistical Methods, McGraw-Hill Education India Ltd.
2. Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House.
3. Gupta, S.P., Statistical Methods, Sultan Chand & Sons,
4. Vohra N. D., Business Statistics, McGraw Hill.
5. Gupta, S.P., and Archana Gupta. Statistical Methods. Sultan Chand & Sons, New Delhi.
6. Dey, S. N., *Business Mathematics and Statistics*, Chhaya Prakashani.
7. Goon, Gupta and Dasgupta, *Fundamentals of Statistics*, The World Press.
8. Spiegel M.D., *Theory and Problems of Statistics*, Schaum's Outlines Series, McGraw Hill Publishing Co

MACRO ECONOMICS (GE 3)

Course Contents

1. Introduction

Macroeconomics- Concept, Difference with microeconomics, Concept of basic variables of macroeconomics.

2. National Income Accounting

Concepts and measurement of National Income, Circular flow of income, Real and nominal GDP, GDP deflator, Alternative approaches of measuring national income – Income method, Expenditure method, Value-added method; Difficulties in Measurement of NI

3. Determination of Equilibrium Level of Income

Simple Keynesian Model, Consumption, Savings and Investment Function, Concept of multiplier – Government expenditure multiplier and Tax multiplier, Investment multiplier and Balanced budget multiplier

4. Commodity Market and Money Market Equilibrium

Concept of commodity market and money market equilibrium, Demand and supply of money – Transaction demand of money and speculative demand of money, Derivation of IS and LM curves, Shifts of IS & LM curves, Monetary and Fiscal policy in ISLM.

5. Money and Inflation

Measures of money supply; Quantity Theory of Money; Concept of inflation, Demand-pull and cost-push inflation, Inflationary gap; Effects of Inflation; Monetary and fiscal policies to control inflation

Suggested Readings:

1. Macroeconomics, Mankiw
2. W. H. Branson, Macroeconomic Theory and Policy
3. Richard T. Froyen, Macroeconomics Theory and Policies
4. Joydeb Sarkhel, Macro Economic Theory
5. Dornbusch, Fischer and Startz, Macroeconomics

INDIAN ECONOMICS (GE 4)]

Course Contents

1. Basic Issues of Economic Development: Concept and Measures of Development and Underdevelopment; Human Development Index; Human Capital-Meaning and Importance;

2. Basic Issues of Indian Economy: Features of Indian Economy; Sectoral distribution of National Income; Structural Change in Indian Economy; Problem of Poverty, Poverty alleviation measures; Problem of Unemployment and the policy measures; Population Growth and Economic Development

3. Agricultural Sector: Problems of Indian agriculture; Land Reforms; Green Revolution and its impact; Problems of Rural Credit and Marketing; Co-operative Farming

4. Industrial Sector: Industrial Labour; Industrial Sickness; Small Scale and Cottage Industry; Industrial Policy-Role of Public Sector; Its performance and issue of Disinvestment-Privatisation

5. External Sector: Foreign Capital: Components; Need of Foreign Capital; Policy towards Foreign Capital; Foreign Investment since 1991; Globalisation- Meaning and Impact; International Institutions-WTO, World Bank, IMF

Suggested Readings:

1. A N Agrawal, Indian Economy
2. Dutt & Sundaram, Indian Economy
3. Mishra & Puri, Indian Economy
4. Uma Kapila, Indian Economy
5. Ajay Kumar Nandi, Adhunik Bharatiya Arthanitir Ruprekha(Bengali)
6. Swapan Kumar Ray & Joydeb Sarkhel, Bharater Arthaniti(Bengali)

7. Jaydeb Sarkhel, Sekh Selim & Anindyo Bhukto, Economic Development- Institutions, Theory and Application.
8. Jaydeb Sarkhel, Sekh Selim & Anindyo Bhukto, Arthanoitik Unnoyan- Pratisthan, Tattwo O Prayog(Bengali).

Annexure B

The following two GE Papers are offered to the students (General) of any department other than students of commerce department.

- i) Basic Financial Accounting (GE 1)
- ii) Basic Income Tax (GE 2)

[If GE papers under B.Com. (General) Syllabus are allowed by the University Authority to be opted by students of commerce departments as well as students of any other department, then above two GE Papers are to be substituted by the following two GE Papers:

- i) Business Economics (GE 1)
- ii) Business Mathematics and Statistics (GE 2)]

BUSINESS ECONOMICS (GE 1)

MODULE I

MICROECONOMICS AND MACROECONOMICS

Course Contents

1. Basics of Demand - Supply and Consumer Behaviour

Concept of demand, Demand function, Law of Demand and its exceptions, Derivation of individual and market demand curves; Elasticity of demand– relation between slope of demand and elasticity of demand; Supply function, Market demand and supply curve, Determination of equilibrium price.

2. Production and Cost

Production Function – Concept of short run and long run, Graphical representation of TP, AP, MP; Concept of fixed and variable cost, Economic and accounting costs, Marginal and average costs, Short–run and Long–run cost curves.

3. Market Structure

Definition of market, Revenue concept under various market conditions, TR AR and MR, Perfect competition-Features, Equilibrium analysis; Monopoly market-Price and output determination.

4. National Income Accounting

Concepts and measurement of GDP, GNP, NNP, NI, and Disposable Personal Income (DPI); Difficulties in Measurement of NI.

5. Consumption and Inflation

Meaning and concepts of Consumption, Investment and Savings. Features of Keynesian Consumption Function; Determination of Equilibrium Level of Income; Concept of demand-pull and cost-push inflation; Inflationary gap.

Suggested Readings:

1. Pindyke and Rubinfeld, Micro Economics.
2. Principles of Microeconomics, Mankiw.
3. Macroeconomics, Mankiw.
4. Joydeb Sarkhel, Macro Economic Theory.

MODULE II INDIAN ECONOMICS

Course Contents

1. Basic Issues of Economic Development: Concept and Measures of Development and Underdevelopment; Human Capital-Meaning and Importance.

2. Basic Issues of Indian Economy: Features of Indian Economy, Sectoral Change in Indian Economy; Problem of Poverty, Poverty alleviation measures; Problem of Unemployment and the policy measures.

3. Agricultural Sector: Problems of Indian agriculture; Land Reforms; Green Revolution and its impact.

4. Industrial Sector: Small Scale and Cottage Industry; Industrial Policy-Role of Public Sector: Its performance and issue of Disinvestment-Privatisation.

5. External Sector: Globalisation- Meaning and Impact; International Institutions-WTO, World Bank, IMF.

Suggested Readings:

1. A N Agrawal, Indian Economy
2. Dutt & Sundaram, Indian Economy
3. Mishra & Puri, Indian Economy
4. Uma Kapila, Indian Economy
5. Ajay Kumar Nandi, Adhunik Bharatiya Arthanitir Ruprekha
6. Swapan Kumar Ray & Joydeb Sarkhel, Bharater Arthaniti (Bengali)
7. Jaydeb Sarkhel, Sekh Selim & Anindyo Bhukto, Economic Development- Institutions, Theory and Application

8. Jaydeb Sarkhel, Sekh Selim & Anindyo Bhukto, Arthanoitik Unnoyan- Pratisthan, Tattwo O Prayog (Bengali)

BUSINESS MATHEMATICS AND STATISTICS (GE 2)

Module I

BUSINESS MATHEMATICS

Course Contents

1. (A) **Logarithm:** Meaning of Logarithm, General properties of Logarithm, Common Problems
- (B) **Laws of Indices**
2. (A) **A.P. Series:** Definition, Common difference, General term, A.M., Sum of first n terms of an A.P., Sum of an infinite A.P. Series.
- (B) **G.P. Series:** Definition, Common ratio, General term, G.M., Sum of first n terms of a G.P., Sum of an infinite G.P. Series.
3. **Compound Interest & Annuities:** Different types of interest rates; Concept of Present Value and amount of sum; Types of annuities; Present value and amount of an annuity; including the case of continuous compounding; Valuation of simple loans and debentures; Problems relating to sinking funds.

Module II

STATISTICS

Course Contents

1. **Statistical Data and Descriptive Statistics**
 - (A) **Statistical Data:** Data and different types of data; Summarization of statistical data – different types frequency distributions, their construction and their different properties.
 - (B) **Diagrammatic representation:** Histogram, Frequency Polygon, Ogive, Pie chart, Line and Bar diagram..
 - (C) **Different Measures of Central Tendency:** Arithmetic Mean, Geometric Mean and Harmonic Mean, Median, Mode and Quartiles.
 - (D) **Different Measures of Dispersion:** Common measures of dispersion – range, quartile deviation, mean deviation and standard deviation; Measures of relative dispersion.
2. **Simple Correlation and Regression Analysis**
 - (A) **Correlation Analysis:** Scatter diagram; Pearson's co-efficient of correlation; Rank Correlation;
 - (B) **Regression Analysis:** Regression equations and estimation [Elementary level].
3. **Index Numbers:** Meaning and uses of index numbers; Construction of index numbers: fixed and chain base, Problems relating to construction of index numbers, Construction of consumer price indices.

Suggested Readings:

1. Dey, S. N., *Business Mathematics and Statistics*, Chhaya Prakashani.
2. Chakrabarti, J. *Business Mathematics and Statistics*, Dey Book Concern.
3. Francis, A., *Business Mathematics and Statistics*, Thomson Learning.
4. Das, N. G., *Business mathematics and Statistics*, McGraw-Hill Education Ltd.
5. Ghosh, R. K. and Saha, S., *Business mathematics and Statistics*, New Central Book Agency (P) Ltd.

UNIVERSITY OF KALYANI



**CBCS CURRICULUM FOR THREE YEARS UNDER-GRADUATE COURSE
IN
POLITICAL SCIENCE (HONOURS)**

**WITH EFFECT FROM THE ACADEMIC SESSION
2018-19**

INTRODUCTION:

The University Grants Commission (UGC) has taken various measures by means of formulating regulations and guidelines and updating them, in order to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions in India. The various steps that the UGC has initiated are all targeted towards bringing equity, efficiency and excellence in the Higher Education System of country. These steps include introduction of innovation and improvements in curriculum structure and content, the teaching-learning process, the examination and evaluation systems, along with governance and other matters. The introduction of Choice Based Credit System is one such attempt towards improvement and bringing in uniformity of system with diversity of courses across all higher education institutes in the country. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising of core, elective, skill enhancement or ability enhancement courses. The courses shall be evaluated following the grading system, is considered to be better than conventional marks system. This will make it possible for the students to move across institutions within India to begin with and across countries for studying courses of their choice. The uniform grading system shall also prove to be helpful in assessment of the performance of the candidates in the context of employment.

Outline of the Choice Based Credit System being introduced:

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. Ability Enhancement Courses/ Skill Enhancement Courses:

3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

A. TOTAL Number of courses in UG-CBCS (B.A. Hons.):

Types of course	Core course (CC)	Elective course		Ability enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

TABLE-1: DETAILS OF COURSES & CREDIT OF B.A.(HONOURS) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory + Tutorial
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (14 papers)	14x4 = 56	14x5 = 70
1.B.	Core Course (Practical/Tutorial)* (14 papers)	14x2 = 28	14x1 = 14
2.	Elective Courses: (8 papers)		
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x4 = 16	4x5 = 20
2.B.	DSE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
2C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x4 = 16	4x5 = 20
2.D.	GE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
Total Credit:		140	140

TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.A.(HONOURS)

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1			--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

❖ **COURSE CODE & COURSE TITLE:**

A. Core courses (CC)

1. POL-H-CC-T-1: Political Theory (Liberal Tradition)
2. POL-H-CC-T-2: Political Theory: Marxist Tradition
3. POL-H-CC-T-3: Politics in India
4. POL-H-CC-T-4: Indian Constitution
5. POL-H-CC-T-5: Indian Political Thought (Ancient and Medieval)
6. POL-H-CC-T-6: Indian Political Thought (Modern)
7. POL-H-CC-T-7: Understanding International Relations: Theories and Concepts.
8. POL-H-CC-T-8: Public Administration (Theories & Concepts)
9. POL-H-CC-T-9: Dynamics of Indian Administration
10. POL-H-CC-T-10: India's Foreign Policy in a Globalizing World
11. POL-H-CC-T-11: Western Political Thought (Ancient & Medieval)
12. POL-H-CC-T-12: Western Political Thought (Modern)
13. POL-H-CC-T-13: Introducing Political Sociology
14. POL-H-CC-T-14: Comparative Government and Politics

B. Discipline specific elective courses (DSE)

1. POL-H-DSE-T-1/2(A): Human Rights: Theory and Practice
2. POL-H-DSE-T-1/2(B): Environment Politics in India
3. POL-H-DSE-T-1/2(C): Public Policy in India
4. POL-H-DSE-T-1/2(D): Understanding Gender Politics
5. POL-H-DSE-T-1/2(E): Development Administration in India: Policies and Prospects.
6. POL-H-DSE-T-3/4(A): Local Government in West Bengal
7. POL-H-DSE-T-3/4(B): Politics in West Bengal.

8. POL-H-DSE-T-3/4(C): Social Movements in Contemporary India
9. POL-H-DSE-T-3/4(D): Citizenship in a Globalizing World
10. POL-H-DSE-3/4(E): Dissertation

C. Generic elective courses (GE):

1. POL-H-GE-T-1(A): Political Theory
2. POL-H-GE-T-1(B): Comparative Politics
3. POL-H-GE-T-2(A): Colonialism & National Movement
4. POL-H-GE-T-2(B): Governance in India: Issues and Challenges
5. POL-H-GE-T-3(A): Issues in World Politics
6. POL-H-GE-T-3(B): South Asian Politics
7. POL-H-GE-T-4(A): India and Her Neighbours
8. POL-H-GE-T-4(B): Research Methodology

D. Ability enhancement compulsory courses (AECC)

1. AECC-1: Environmental Education
2. AECC-2: English Communication

E. Skill enhancement courses (SEC)

1. POL-H-SEC-T-1(A): Democratic Awareness with Legal Literacy
2. POL-H-SEC-T-1(B): Public Opinion and Survey Research
3. POL-H-SEC-T-2(A): Legislative Practices and Procedures
4. POL-H-SEC-T-2(B): Peace and Conflict Resolution

**Table-3: Semester & Course wise credit distribution in B.A. (Hons.) Political Science
(6 Credit=75 Marks & 2 Credit=50 Marks)**

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-H-CC-T-1	Political Theory (Liberal Tradition)	Core (75L+15T)	6(5L+1T)
POL-H-CC-T-2	Political Theory: Marxist Tradition	Core (75L+15T)	6(5L+1T)
POL-H-GE-T-1 (any one)	A. Political Theory	Generic Elective (75L+15T)	6(5L+1T)
	B. Comparative Politics		
AECC-1	Environmental Education	Ability enhancement compulsory (30L)	2 (2L)
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-H-CC-T-3	Politics in India	Core (75L+15T)	6(5L+1T)
POL-H-CC-T-4	Indian Constitution	Core (75L+15T)	6(5L+1T)
POL-H-GE-T-2 (any one)	A. Colonialism & National Movement.	Generic Elective (75L+15T)	6(5L+1T)
	B. Governance in India: Issues and Challenges		
AECC-2	English communication	Ability enhancement compulsory (30L)	2 (2L)
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-H-CC-T-5	Indian Political Thought (Ancient and Medieval)	Core (75L+15T)	6(5L+1T)
POL-H-CC-T-6	Indian Political Thought (Modern)	Core (75L+15T)	6(5L+1T)
POL-H-CC-T-7	Understanding International Relations: Theories and Concepts.	Core (75L+15T)	6(5L+1T)
POL-H-GE-T-3	A: Issues in World Politics	Generic Elective (75L+15T)	6(5L+1T)
	B: South Asian Politics		
POL-H-SEC-T-1	A. Democratic Awareness with Legal Literacy	Skill enhancement	2 (2L)

	B. Public Opinion and Survey Research	(30L)	
Total	5 courses	Total	26
SEMESTER-IV			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-H-CC-T-8	Public Administration(Theories & Concepts)	Core (75L+15T)	6(5L+1T)
POL-H-CC-T-9	Dynamics of Indian Administration	Core (75L+15T)	6(5L+1T)
POL-H-CC-T-10	India's Foreign Policy in a Globalizing World	Core (75L+15T)	6(5L+1T)
POL-H-GE-T-4	A: India and Her Neighbours	Generic Elective (75L+15T)	6(5L+1T)
	B: Research Methodology		
POL-H-SEC-T-2	A. Legislative Practices and Procedures	Skill enhancement (30L)	2 (2L)
	B. Peace and Conflict Resolution		
Total	5 courses	Total	26
SEMESTER-V			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-H-CC-T-11	Western Political Thought (Ancient & Medieval)	Core (75L+15T)	6(5L+1T)
POL-H-CC-T-12	Western Political Thought (Modern)	Core (75L+15T)	6(5L+1T)
POL-H-DSE-T-1 POL-H-DSE-T-2 (any two)	A: Human Rights: Theory and Practice	Discipline specific (75L+15L)	2x6 (2x5L+2x1L)
	B: Environment Politics in India		
	C: Public Policy in India		
	D: Understanding Gender Politics		
	E: Development Administration in India: Policies and Prospects.		
Total	4 courses	Total	24
SEMESTER-VI			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-H-CC-T-13	Introducing Political Sociology	Core (75L+15T)	6(5L+1T)
POL-H-CC-T-14	Comparative Government and Politics	Core (75L+15T)	6(5L+1T)
POL-H-DSE-T-3 POL-H-DSE-T-4	A: Local Government in West Bengal	Discipline specific (75L+15L)	2x6 (2x5L+2x1L)

(any two)	B: Politics in West Bengal.		
	C: Social Movements in Contemporary India		
	D: Citizenship in a Globalizing World		
	E: Dissertation		
Total	4 courses	Total	24
Total (All semesters)	26 courses	Total	140

CBCS CURRICULUM OF B.A. IN POLITICAL SCIENCE (HONOURS)

B.A. Political Science (Honours)

SEMESTER-I

POL-H-CC-T-1: Political Theory (Liberal Tradition)

Core Course; Credit-6; Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Understand certain key aspects of conceptual analysis in political theory
- Develop the skills required to engage in debates surrounding the application of these concepts.

Unit 1: What is Politics? Political Theory and its relevance.

Unit 2: Concepts and their Interrelationships: Liberty, Equality, Justice, Rights.

Unit 3: Approaches to the study of Politics: Normative, Behavioral & Post-behavioral.

Unit 4: Nature of State: Idealist, Liberal and Neo-liberal theories

Unit 1: Marx: Concepts of Dialectical Materialism, Historical Materialism, Class and Class Struggle.

Unit 2: Marxian Theory of Party: Lenin's Contribution, Lenin –Rosa Luxemburg Debate on Party.

Unit 3: Gramsci: State and Civil Society, Hegemony.

Unit 4: Freedom and Democracy: Socialist Perspective.

Unit 5: Theories of Revolution: Marx, Lenin and Mao.

Suggested Readings:

1. Bottomore, Tom, *A Dictionary of Marxist Thought*; UK, Wiley Publishers, 1992.
2. McLellan, David, *Marxism after Marx*, UK, Palgrave Macmillan, 2007.
3. Kolakowski, Leszek, *Main Currents of Marxism; Founders : The Founders, the Golden Age, the Breakdown*, New York, W.W. Norton Publishers, 1978.
4. Avineri, Shlomo, *The Social & Political Thought of Karl Marx*; Cambridge, Cambridge University Press, 1968.
5. Worsley, Peter, *Marx and Marxism*, London, Routledge, 2002.

B.A. Political Science (Honours)

SEMESTER-I

POL-H-GE-T-1(A): Political Theory

Generic Elective Course: Credit-6. Full Marks-75

Course Objective:

After completion of the course the learners will be able to:

- Understand the Nature and Significance of Political Theory
- Develop ideas about concepts like State, Justice and Democracy.

Unit 1: Nature and Significance of Political Theory- Its main concern, decline and resurgence since 1970s-

Politics as a Process: Different views- Liberal, Marxist and Communitarian.

Unit 2: Concept of State – Rise and Growth of the modern Nation- state – Nationalism vs Internationalism- State and Civil Society – Current Crisis of the Nation-State.

Unit 3: Concept of Democracy- Problems of Representation – Theories of Democracy – Elitist, Pluralist, Marxist and Radical.

Unit 4: Issues of political obligation and civil disobedience – Theories of Unlimited Obligation, Theories of Limited obligation – Theories against Political Obligation – Gandhian Perspectives.

Unit 5: Concept of Justice – Dimensions of Justice- Distinction between procedural Justice and Substantive Justice – Liberal Perspective (Rawl’s Theory of Justice) – Libertarian Perspective (Nozick’s Theory of Justice) – Democratic –Socialist Perspective on Justice -Marxist Perspective on Justice.

Suggested readings:

1. Mckinnon, Catriona (ed.) *Issues in Political Theory*, New York, Oxford University Press, 2008.
2. Knowles, Dudley. *Political Philosophy*, London: Routledge, 2001.
3. Swift, Adam, *Political Philosophy: A Beginners’ Guide for Students and Politicians*, Cambridge: Polity Press, 2006.
4. Bhargava, R and Acharya, A. (eds.), *Political Theory: An Introduction.*, Delhi: Pearson Longman, 2008.
5. Bellamy, R. (ed.) *Theories and Concepts of Politics*. New York: Manchester University Press, 1993.
6. Bellamy, R. and Mason, A. (eds.) *Political Concepts*, Manchester and New York: Manchester University Press, 2003.
7. Knowles, Dudley, *Political Obligation: A Critical Introduction*, New York, Routledge, 2010.
8. Farrelly Colin (edt.), *Contemporary Political Theory: A Reader*, London, Sage Publications Ltd, 2004.

B.A. Political Science (Honours)

SEMESTER-I

POL-H-GE-T-1(B): Comparative Politics

Core Course; Credit-6 Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Identify the different traditional and modern approaches to the study of Comparative Politics.
- Understand the scope, purpose and methods of comparison in Comparative politics.
- Understand the different approaches to the study of Comparative politics.

Unit1: Evolution of Comparative Politics as a Discipline – Its Nature and Scope.

Unit 2: Approaches to the study of Comparative Politics: *Traditional Approaches* – Historical, Institutional & Legal- *Modern Approaches* – Economic, Sociological, and Marxian.

Unit 3: Systems Analysis in Political Science - David Easton

Unit 4: Structural-Functional Analysis in Political Science – Gabriel A. Almond.

Unit 5: Theories of Political Modernization and Political Development: Pye and Huntington.

Suggested Readings:

1. Almond, G and others, eds. *Comparative Politics Today: A World View*, 8th Edition, Pearson Education, 2004.

2. Chatterjee, Rakhahari, *Introduction to Comparative Political analysis*, Kolkata, Sarat, 2014.

3. Verma, S.P., *Modern Political Theory*, New Delhi, Vikash Publishers, 1975.

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5. Peters B. Guy, *Comparative politics: theory and methods*, Delhi, Macmillan, 1998.

6. Johari, J.C., *Comparative Politics*, New Delhi, Sterling Publishers Pvt. Ltd., 2008.

B.A. Political Science (Honours)

SEMESTER-I

AECC-1: Environmental Education

Ability Enhancement Compulsory Course; Credit-2. Full Marks-50

COMMON SYLLABUS

B.A. Political Science (Honours)

SEMESTER-II

POL-H-CC-T-3: Politics in India

Core Course; Credit-6; Full Marks-75

Course Objectives:

After completion the course the learners will be able to:

- Develop a basic understanding about the Indian party system and electoral politics.
- Identify the major challenges to the process of Nation-building in India.
- It also familiarizes students with the working of the Indian state, paying attention to the contradictory dynamics of modern state power.

Unit 1. Approaches to the Study of Indian Politics – Marxist and Liberal- Indian Political Culture- Various Interpretations.

Unit2. The Indian Party System – Main Features- Major National Political Parties – Major Regional Political Parties- From the Congress System to Multi-Party Coalitions.

Unit 3. Identity Politics and Social Cleavages in India- Role of Caste, Class and Religion in politics.

Unit 4. Electoral Politics in India: The Election Commission- Electoral Reforms in India – Voting Behaviour in India- Defection Politics in India – Crime and Politics in India.

Unit 5. Nation Building in India – Major Challenges - Regionalism in India- Main Components- Regionalism versus Nationalism Debate- Major Regional movements in India – Gorkhaland and Bodoland movement.

Suggested Readings:

1. Z. Hasan (ed.) *Parties and Party Politics in India*, Delhi, Oxford University Press, 2002.
2. E. Sridharan, *Coalition Politics and Democratic Consolidation in Asia*, Delhi, Oxford University Press, 2013.

3. Frankel F., Hasan, Z., and R. Bhargava (eds.) *Transforming India: Social and Political Dynamics in Democracy*, Delhi, Oxford University Press, 2002.
4. Baruah, S. ed., *Ethnonationalism in India: A Reader*, Delhi: Oxford University Press, 2012.
5. Brass, P., *The Politics of India Since Independence*, Delhi: Cambridge University Press and Foundation Books, 1990.
6. Vora, R. and Palshikar, S. (eds.) *Indian Democracy: Meanings and Practices*, New Delhi, Sage, 2004.
7. Menon, Nivedita & Nigam Aditya, *Power and Contestation: India since 1989*, London: Fernwood Publishing, Halifax and Zed Books, 2007.
8. Mehta, P. and Jayal N. (eds.) *The Oxford Companion to Politics in India*, Delhi: Oxford University Press, 2010.
9. R. Kothari, *Caste in Indian Politics*, Delhi: Orient Longman, 1970.
10. Kohli Atul (ed.), *The Success of India's Democracy*, New Delhi, Cambridge University Press, 2001.

B.A. Political Science (Honours)
SEMESTER-II
POL-H-CC-T-4: Indian Constitution
Core Course; Credit-6; Full Marks-7

Course Objectives:

After completion the course the learners will be able to:

- Develop a basic understanding about the structure of the Indian Constitution.
- Understand the nature of federalism in India.
- Get an idea about the Fundamental rights of the Indian citizens' and the role that the Indian judiciary play in protecting and upholding these rights.

Unit 1: Framing of the Indian Constitution: Role of the Constituent Assembly, the Preamble.

Unit 2: Fundamental Rights and Duties, Directive Principles of State Policy.

Unit 3: Nature of Indian Federalism: Union-State Relations – Nature and Evolving Trends of Federalism in India.

Unit 4: Union Executive: President and Vice President. Prime Minister and Council of Ministers, Relationship between President and Prime Minister

Unit 5: Union Legislature: Rajya Sabha and Lok Sabha: Composition and Functions, Speaker.

Unit 6: The Judiciary: Supreme Court and High Courts – Composition and Functions, Judicial Activism & Public Interest Litigation (PIL).

Suggested Readings:

1. Basu, D.D., Manohar, V.R., Banerjee B.P., Khan S. A., *Introduction to the Constitution of India*, Nagpur , Lexis Nexis Butterworths Wadhwa, 2008.
2. Kashyap, S.C., *Our Constitution: An Introduction to India's Constitution and Constitutional Law*, New Delhi, National Book Trust, 1994.
3. Chakrabarty, Bidyut & Pandey, Rajendra Kumar, *Indian Government and Politics*, New Delhi, Sage, 2008.
4. Kochanek, Stanley A. & Hardgrave Robert L.(Jr), *India: Government and Politics in a Developing Nation*, USA, Thomson Wadsworth, 2008.
5. Johari J.C., *Indian Government and Politics: Basic Framework and State Structure*, New Delhi, Vikash Publication, 1974.

**B.A. Political Science (Honours)
SEMESTER-II**

POL-H-GE-T-2(A):- Colonialism & National Movement

Generic Elective Course: Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to-

- Understand historically the advent of colonialism in India and the emergence of the discourse on nationalism as a response to it.
- Engage with theoretical explanations of colonialism and nationalism in India at the same time study the social, political and institutional practices that unfolded in that period, gradually paving way towards independence and democracy in India.

Unit 1: Colonialism and Nationalism: a. Main perspectives on colonialism: Liberalism, Marxism. b. Approaches to the study of nationalism in India: Nationalist, Imperialist, Marxist, and Subaltern interpretations

Unit 2: Colonial Rule in India and its impact: On agriculture, land relations, industry and administration system.

Unit 3: Reform and Resistance: a. The Revolt of 1857 b. Major social and religious movements c. Education and the rise of the new middle class in India.

Unit 4: Nationalist Politics and Expansion of its Social Base: a. Phases of the Nationalist Movement: Birth of INC & Liberal constitutionalist phase , Swadeshi and the Radicals, Formation of the Muslim League b. Gandhi and mass mobilization: Non-cooperation, Civil Disobedience, and Quit India Movements c. Socialist alternatives: Congress socialists, Communists d. Communalism in Indian Politics - Muslim League and Hindu Mahasabha e. The two-nation theory, Negotiations over partition and the Partition of India.

Unit 5: Social Movements - The Women's Question: participation in the national movement and its impact - The Caste Question: anti-Brahmanical Politics - Peasant, Tribal, and Workers movements in Colonial India.

Suggested Readings:

1. Chandra, B., *Essays on Colonialism*, Hyderabad, Orient Blackswan, 1999.
2. Chandra, B., Mukherjee, M., Mukherjee, A., Panikkar, K.N. & Mahajan S., *India's Struggle for Independence (1857-1947)*, New Delhi, Penguin, 2016.
3. Young, R., *Postcolonialism : A Very Short Introduction*. Oxford: Oxford University Press, 2003.
5. Bandopadhyay, S., *From Plassey to Partition and After: A History of Modern India*, New Delhi: Orient Longman, 2015. (revised edition)
6. Sarkar, S., *Modern India (1885-1847)*, New Delhi: Macmillan, 1983.
8. Desai, A.R., *Social Background of Indian Nationalism*, Bombay, Popular, 1987.

B.A. Political Science (Honours)
SEMESTER-II

POL-H-GE-T-2(B):- Governance in India: Issues and Challenges
Generic Elective Course: Credit-6. Full Marks-75

After completion of the course the learners will be able to:

- Identify the institutional aspects of Indian democracy.
- Identify the Structure and process of Governance in India
- Understand the Ideas, Interests and Institutions in Public Policy in India
- Understand the functioning of major Regulatory Institutions in India

Unit 1: Structure and Process of Governance: Indian Model of Democracy, Parliament, Party Politics and Electoral behaviour, Federalism, The Supreme Court and Judicial Activism, Units of Local Governance (Grassroots Democracy) Political Communication -Nature, Forms and Importance.

Unit 2: Ideas, Interests and Institutions in Public Policy: Contextual Orientation of Policy Design, Institutions of Policy Making, Regulatory Institutions – SEBI, TRAI, Competition Commission Of India, Corporate Affairs, Lobbying Institutions: Chambers of Commerce and Industries, Trade Unions, Farmers Associations.

Unit 3: Contemporary Political Economy of Development in India: Policy Debates over Models of Development in India, Recent trends of Liberalisation of Indian Economy in different sectors.

Unit 4: Dynamics of Civil Society: New Social Movements and Various interests, Role of NGO's in Governance, Understanding the political significance of Media and Popular Culture.

Unit 5: Good Governance - Meaning and concept, Difference between Government and Governance, Good Governance initiatives in India, E-governance in India- Case Studies.

Suggested Readings:

1. Kohli, Atul (ed.), *The Success of India's Democracy*, Delhi, Cambridge University Press, 2001.

2. Corbridge, Stuart and John Harris, *Reinventing India: Liberalisation, Hindu Nationalism and Popular Democracy*, Delhi, OUP, 2000.
3. Dreze, J. and Sen, A., *India: Economic Development and Social Opportunity*, Oxford, Clarendon Press, 1999.
4. Saeed, S., *Screening the Public Sphere: Media and Democracy in India*, Taylor & Francis Group, 2016.
5. Fuller, C.J. (ed.), *Caste Today*, Delhi, Oxford University Press, 1997
6. Singh, Himat, *Green Revolution Reconsidered: The Rural World of Punjab*, Delhi, OUP, 2001.
7. Bhagwati, Jagdish, *India in Transition: Freeing The Economy*, Oxford, Clarendon Press, 1993.
8. Stiglitz, Joseph E., *Globalisation and its Discontents*, WW Norton, 2003.
9. Patel, I.G., *Glimpses of Indian Economic Policy: An Insider View*, Delhi, OUP, 2002.
10. Sinha, R.P., *E-Governance in India: Initiatives and Issues*, Delhi, Concept Publishing, 2006.
11. Bhatnagar, Subhash, *E-Government: From Vision to Implementation - A Practical Guide With Case Studies*, Delhi, Sage Publication, 2004.
12. Mishra Panda, S., *Engendering Governance Institutions: State, Market And Civil Society*, Delhi, Sage Publications, 2008.
13. Chandhoke, Neera, *State And Civil Society Explorations In Political Theory*, New Delhi, Sage Publishers, 1995.
14. Smith, B. C., *Good Governance and Development*, New York, Palgrave Macmillan, 2007.
15. Bardhan, P.K., *The Political Economy of Development in India*, Delhi, Oxford University Press, 2005.
16. Guha, Ramachandra, *Environmentalism: A Global History*, New Delhi, Longman Publishers, 1999.
17. Evans, J.P., *Environmental Governance*, New York, Routledge, 2012.
18. Bardhan P.K. and Mookherjee, D., *Decentralization And Local Governance In Developing Countries: A Comparative Perspective*, MIT Press, 2006.
19. Sachdeva, Pardeep, *Local Government In India*, Delhi, Pearson Publishers, 2011.
20. Kumar, K. Vijaya, *Right to Education Act 2009: Its Implementation as to Social Development in India*, Delhi, Akansha Publishers, 2012.

B.A. Education (Honours)
SEMESTER-II
AECC-2: English Communication
Ability Enhancement Compulsory Course; Credit-2. Full Marks-50

COMMON SYLLABUS

B.A. Political Science (Honours)
SEMESTER-III

POL-H-CC-T-5: Indian Political Thought (Ancient and Medieval)

Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Understand the key concepts of ancient Indian political thought.
- Identify the key concerns of medieval Indian political thinkers

Unit 1: Nature and growth of ancient Indian political thought- Some Key Concepts- *Dharma and Danda, Dandaniti.*

Unit 2: Buddhist political thought and the relations between politics and Ethics.

Unit 3: Kautilya's Political Thought: *Saptanga Theory of State – Mandala Theory and Diplomacy.*

Unit4: Medieval Political Thought in India: A broad outline- Zia Barani: Good Sultan and Ideal Polity

Unit5: Abul Fazl: Governance and Administration

Suggested Readings:

1. Altekar A. S., *The state and government in ancient India*, Delhi, Motiram Banarasidas, 1973.
2. Bhandarkar D. R., *Some aspects of ancient Indian polity*. Banaras, Banaras Hindu University, 1963.
3. Drekeimer C. *Kingship and Community in early India*, Berkeley, University of California, 1962.
4. Ghoshal U. N., *A history of Indian Political Ideas*, Mumbai, Oxford University Press, 1966.

5. Jayaswal K. P., *Hindu Polity*, Calcutta, Butterworth Publishers, 1924.
6. Kangle R. D., *The Arthashastra of Kautilya*, 3 Vols., Mumbai, University of Mumbai, 1975.
7. Krishna Rao M. V.; *Studies in Kautilya*, Delhi, Munshiram Manoharlal, 1979.
8. Saletore B. A., *Ancient Indian Political thought and Institutions*, Bombay, University of Bombay, 1963.
11. Sharma J. P.; *Republics in ancient India*, London, E. J. Brill Publishers, 1968.
12. Singh, Mahendra Prasad & Roy, Himanshu eds., *Indian Political Thought: Themes and Thinkers*, New Delhi, Pearson, 2011.
13. Mehta, V.R. & Mehta Vrajendra Raj, *Foundations of Indian Political Thought: An Interpretation: from Manu to the Present Day*, New Delhi, Manohar Publishers, 1996.

B.A. Political Science (Honours)
SEMESTER-III
POL-H-CC-T-6: Indian Political Thought (Modern)

Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Understand the key concerns of major thinkers of modern India.

Unit 1: Rammohan Roy– Views on rule of law, freedom of thought and social justice.

Unit 2: Vivekananda: Views on Cultural nationalism and Education.

Unit3: Rabindranath Tagore: Views on State, Nationalism and Internationalism.

Unit 4: M.N.Roy : Views on National and Colonial Questions and Radical Humanism.

Unit 5: B.R. Ambedkar : Views on social justice and Constitutionalism.

Suggested Readings:

1. Verma, V.P., *Modern Indian Political Thought*, Agra, Lakshmi Narain Agarwal Educational Publishers, 1974.

2. Pantham, T. and Deutsch, K. eds., *Political Thought in Modern India*, New Delhi, Sage publications, 1986.
3. Appadorai, A., *Documents on political thought in Modern India*, 02 Vols. Bombay, Oxford University Press, 1970.
4. Chakrabarty, B. & Pandey, R.K., *Modern Indian Political Thought : Text and Context*, New Delhi, Sage Publication, 2009.
5. K.N. Kakan (ed) *Dr. B.R. Ambedkar*, New Delhi, Sage Publication, 1992.
6. Pramanik Nimai (ed), *Adhunik Bharater Samajik o Rajnitik Bhabna*, Kolkata, Chaya Prakasani, Vol.1, 2009.
7. Jayapalan, N., *Indian Political Thinkers: Modern Indian Political Thought*, New Delhi, Atlantic Publishers, 2003.

**B.A. Political Science (Honours)
SEMESTER-III**

POL-H-CC-T-7: Understanding International Relations: Theories and Concepts.

Core Course; Credit-6. Full Marks-75

Course Objectives-

After completion the course the learners will be able to:

- Understand the major approaches to the study of International Relations
- Comprehend the main theories in International Relations
- Develop an idea about some major concepts of International Relations.

Unit 1: International Relations: outline of its evolution as academic discipline – What is International Relations Theory?

Unit 2: The Great Debates in the discipline of International Relations: First, Second and Third.

Unit 3: Mainstream International Relations Theories: (a) Classical Realism and Neo-Realism (b) Liberalism and Neo-Liberalism (c) Marxian - Dependency & World Systems theory.

Unit 4: National Power- Definition, Elements and Limitation – Balance of Power- Devices of maintaining Balance of Power- Collective Security.

Unit 5: Foreign Policy- Objectives – Instruments of foreign policy- Diplomacy, Propaganda and Foreign Aid.

Suggested Readings

1. Griffiths, Martin , *International Relations Theory for the Twenty-First Century: An Introduction*, NewYork, Routledge, 2007.
2. Jackson R & Sorensen G., *Introduction to International Relations: Theories and Approaches*, Oxford, Oxford University Press, 2010.
3. Daddow, Oliver, *International Relations Theory*, Sage Publications, 2017.
4. Roach, Steven C., Griffiths, M & O'Callaghan, T., *International Relations: The Key Concepts*, Routledge, 2008.
5. Chatterjee A., *International Relations Today: Concepts and Applications*, New Delhi, Pearson, 2010.

B.A. Political Science (Honours)
SEMESTER-III
POL-H-GE-T-3(A): Issues in World Politics

Generic Elective Course; Credit-6. Full Marks-75

Course objectives:

After completing of the course, the student will be able to

- Understand the major issues influencing International politics
- Identify the major regional organizations and their policies

Unit 1: Wars, Arms Race and Disarmament: Nature, causes and types of Wars, Arms race, arms control and Disarmament Policy: PTBT, NPT and CTBT.

Unit 2: Political Economy of International Relations: New International Economic Order- North-South Dialogue- South-South Cooperation- WTO- Global trade & Finance- Neo-Colonialism and Dependency.

Unit 3: Terrorism & International System: Conceptual Framework - Variance of International Terrorism –Challenges to Global Security - Counter Terrorist Strategies and War on Terror.

Unit 4: Human Rights: The politics of human rights promotion – UN and Human Rights- Non-governmental organizations and human rights- Humanitarian intervention in World Politics- Peacekeeping and Peace-building.

Unit 5: Regionalism and Regional Integration: EU, ASEAN, OPEC, BRICS.

Suggested Readings:

1. Baylis John & Smith Steve, *The Globalization of World Politics: An introduction to International Relations*, New Delhi, Oxford University Press, 2005.
2. Salmon, Trevor C. & Imber Mark F. eds., *Issues in International Relations*, New York, Routledge, 2000.
3. Larche, Rene A. ed., *Global Terrorism Issues and Developments*, New York, Nova Science Publishers, 2008.
4. Forsythe, David P. ,*Human Rights in International Relations*, Cambridge , Cambridge University Press, 2012.
5. Grugel, Jean & Hout Wil , Eds. *Regionalism across the North/South Divide: State Strategies and Globalization*, New York, Routledge, 1999.
6. Footer, Mary E., *An Institutional and Normative Analysis of the World Trade Organization*, Leiden, Martinus Nijhoff Publishers, 2006.

B.A. Political Science (Honours) SEMESTER-III

POI-H-GE-T-3(B): South Asian Politics Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Understand the Geo-politics of South Asia as a region.
- Understand the nature of state system in various countries of South Asia.
- Understand the process of regional integration in South Asia.

- Identify the major environmental issues in South Asia.

Unit 1: South Asia as a region -Geopolitical dimensions.

Unit 2: State system in South Asia: Nepal, Pakistan, Bangladesh and Srilanka.

Unit 3: Military Intervention in South Asian politics: Pakistan and Bangladesh.

Unit 4: Regional integration in South Asia: SAARC &. BIMSTEC

Unit 5: Environmental Issues in South Asia: Policies, Movements and Trends.

Suggested Readings:

1. B.H.Farmer, *An Introduction to South Asia*, London, Rutledge, 1993.
2. Baxter et al (ed.), *Government and Politics in South Asia*, Boulder, West view, 1987.
3. Robert W. Stern, *Democracy and Dictatorship in South Asia*, New Delhi, India Research Press, 2001.
4. Urmila Phadnis and RajatGanguly, *Ethnicity and Nation Building in South Asia*, Delhi, Sage, 2001.
5. Hamza Alavi and John Harriss (ed.), *The Sociology of Developing States: South Asia*, New Delhi, Houndmill: Macmillan, 1987.

B.A. Political Science (Honours)

SEMESTER-III

**POL-H-SEC-T-1(A): Democratic Awareness with Legal Literacy
Skill Enhancement Course; Credit-2. Full Marks-50**

Course Objectives:

After completion of the course the learners will be able to:

After completion of the course the learners will be able to:

- Understand the structure and manner of functioning of the legal system in India.

- Develop an understanding of the formal and Alternate Dispute Redressal (ADR) mechanisms that exist in India, public interest litigation.

Unit 1: Constitution – fundamental rights, fundamental duties, other constitutional rights.

Unit 2: Laws relating to dowry, sexual harassment and violence against women – laws relating to consumer rights.

Unit 3: Anti-terrorist laws: Implication for security and human rights. Laws relating to cyber crimes.

Unit 4: System of courts/ tribunals and their jurisdiction in India – criminal and civil courts, writ jurisdiction, specialized courts such as juvenile courts, Mahila courts and tribunals.

Unit 5: Alternate dispute such as Lokadalats, non-formal mechanisms.

Unit 6 : Human Rights - emerging trends; Role of legal aid agencies, Human Rights Commissions, NGOs and Civil liberties groups.

Suggested Readings:

1. Basu, D. D et.al. , *Introduction to the Constitution of India*, Nagpur: Lexis Nexis Butterworths, 2008.
2. Kashyap, S, *Our Constitution: An Introduction to India's Constitution and Constitutional Laws*, New Delhi, National Book Trust, 1994.
3. Gender Study Group, *Sexual Harassment in Delhi University, A Report*, Delhi, University of Delhi, 1996.
4. Kumar, C. and Chockalingam K. (eds), *Human Rights, Justice, and Constitutional Empowerment*, Delhi, Oxford University Press, 2010.
5. Wadhwa, B.L., *Public Interest Litigation - A Handbook* (with Model PIL Formats) Delhi, Universal Law Publishing Company, 2009.
6. Aggarwal, Nomita, *Women and Law in India*, Delhi, New Century, 2002.
7. Chawla, M., *Gender Justice: Women and Law in India*, New Delhi, Deep & Deep Publications, 2006.
8. Moslemzadeh, T.P., *Cyber terrorism: The Legal and Enforcement Issues*, London, World Scientific Publishing, 2017.

B.A. Political Science (Honours)
SEMESTER-III
POL-H-SEC-T-1(B): Public Opinion and Survey Research
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Identify the debates, principles and practices of public opinion polling in the context of democracies with special reference to India.
- Understand how to conceptualize and measure public opinion using quantitative methods, with particular attention being paid to developing basic skills pertaining to the collection, analysis and utilisation of quantitative data.

Unit 1: Definition and Characteristics of Public Opinion: Definition and characteristics of public opinion, conceptions and characteristics, debates about its role in a democratic political system, uses for opinion poll.

Unit 2: Measuring Public Opinion: What is sampling? Why do we need to sample? Sample design, Methods and Types of Sampling, Sampling error and non-response.

Unit 3: Interviewing: Interview techniques pitfalls, different types of and forms of interview

Unit4: Questionnaire: Question wording; fairness and clarity

Unit 5: Quantitative Data Analysis: Introduction to quantitative data analysis, Basic concepts: correlation research, causation and prediction, descriptive and inferential Statistics.

Unit 6: Prediction in polling research: possibilities and pitfalls

Suggested Readings:

1. Erikson R. and Tedin, K. *American Public Opinion*, 8th edition, New York, Pearson Longman Publishers, 2011.
2. Gallup, G. H., *A Guide to Public Opinion Polls*. Princeton: Princeton University Press, 1948.

3. Kothari, C. R., *Research Methodology*, New Delhi, PHI, 2004.
4. Ahuja, Ram, *Research Methods*, New Delhi, Rawat Publications, 2001.
5. Kalton, G., *Introduction to Survey Sampling*, London, Sage Publication, 1983.
6. Asher, H., 'Chapters 3 and 5', in *Polling and the Public: What Every Citizen Should Know*, Washington DC: Congressional Quarterly Press, 2001.
7. Kumar, S. and Rai, P. *Measuring Voting Behaviour in India*, New Delhi, Sage Publication. 2013.

B.A. Political Science (Honours)
SEMESTER-IV
POL-H-CC-T-8: Public Administration (Theories & Concepts)

Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Understand the nature of Public administration and distinguish it from private administration.
- Trace the evolution of Public administration as an academic discipline.
- Develop an understanding of the major concept & theories of public administration.

Unit 1: Public Administration: Definition, Nature and Scope; Difference between Private and Public Administration; Evolution of the Discipline of Public Administration.

Unit 2: Basic principles of Organization: Hierarchy, Unity of Command, Span of Control, Authority & Responsibility, Centralization & Decentralization, Coordination, and Delegation.

Unit 3: Theories of Administration: Classical Theory, (Fayol, Urwick and Gulick) Scientific Management Theory, (Taylor) Bureaucratic Theory, (Weber) and Human Relations Theory (Mayo).

Unit 4: Administrative Behaviour: Decision-making with special reference to H.Simon, Motivation with special reference to Abraham Maslow, Leadership with special reference to Trait Theory.

Unit 5: Development Administration: Meaning, nature and scope- Changing profile of Development administration - Riggs Prism-Sala Model.

Suggested Readings:

1. Bhattacharya Mohit, *New Horizons of Public Administration*, New Delhi, Jawahar Publishers, 2011.
2. Chakraborty, Bidyut & Bhattachrya, Mohit, *Public Administration : A Reader*, New Delhi, Oxford University Press, 2006.
3. Nigro, F.A. and Nigro, L.G. , *Modern Public Administration*, New York: Harper and Row, 1984.
4. Naidu, S.P., *Public Administration: Concepts and Theories*, New Delhi, New Age International (P) Ltd. Publishers, 2005.
5. Mishra, S. & Dhameja, A. eds., *Public Administration: Approaches & Applications*, New Delhi, Pearson, 2016.
6. Robbins, S., Judge, T.A., Millett, B. & Boyle, M., *Organizational Behaviour*, Australia, Pearson, 2014.

B.A. Political Science (Honours)
SEMESTER-IV
POL-H-CC-T-9: Dynamics of Indian Administration
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Trace the evolution of Indian administrative system.
- Understand the maladies in Indian civil service and identify the major reforms made.
- Identify the major issues affecting Indian administrative system in contemporary period.

Unit 1: Evolution of Indian Administration – Ancient-Medieval and Modern period- Value Premises of Indian administration.

Unit 2: Civil Service in India- All India Service- Training, Recruitment and Structure- Constitutional Position- Changing role of Civil Service- Public Service Commission's- UPSC & SPSC.

Unit 3: Administrative Reforms in India – Maladies of the administrative system in India- Major reform efforts since independence – O&M.

Unit 4: Accountability in Indian Administration: Concept of Accountability- Major forms of administrative accountability- Legislative- Executive & Judicial- Comptroller and Auditor General of India- Citizen's Charter- Right to Information Act, 2005.

Unit 5: Major Issues in Indian administration: Administrative Corruption & Ethics building, Minister - Civil Servant Relationship - Generalists and Specialists Debate – Globalization & Emerging challenges to Indian administration.

Suggested Readings:

1. Maheshwari, S.R., *Indian Administration*, New Delhi, Orient Longman Pvt. Ltd., 2001.
2. Chakrabarty, B. & Chand, P., *Indian Administration: Evolution and Practice*, New Delhi, SAGE Publications, 2016.
3. Arora, R.K. & Goyal, R., *Indian Public Administration: Institutions & Issues*, New Delhi, Wishwa Prakashan, 1996.
4. Prasad, K., *Indian Administration: Politics, Policies, and Prospects*, New Delhi, Pearson-Longman, 2006.
5. Singh, H. & Singh, P., *Indian Administration*, New Delhi, Pearson, 2011.

B.A. Political Science (Honours) SEMESTER-IV

POL-H-CC-T-10: India's Foreign Policy in a Globalizing World Core Course; Credit- 6. Full Marks-75

Course Objectives:

After completing of the course the students will be able to-

- Have an insightful understanding about India's foreign policy preferences in the globalizing World.
- Identify the pattern of India's engagements with global powers.

Unit 1: India's Foreign Policy: From a Postcolonial State to an Aspiring Global Power

Unit 2 : India's Relations with the USA and USSR/Russia

Unit 3: India's Engagements with China

Unit 4: India in South Asia: Debating Regional Strategies

Unit 5: India's Negotiating Style and Strategies: Trade, Environment, Energy and Security Regimes.

Suggested Readings:

1. Dubey, M, *India's Foreign Policy Coping with the Changing World: Updated Edition with a New Chapter on Pakistan*, New Delhi, Orient Black Swan, 2016.
2. Dutt, Sagarika, *India in a Globalized World*, Manchester, Manchester University Press, 2015.
3. Malone, David M. and others, *Oxford Handbook of India's Foreign Policy*, Oxford, Oxford University Press, 2015.
4. Ayres, A. and Raja Mohan, C. (eds), *Power Realignments in Asia: China, India, and the United States*, New Delhi, Sage, 2009.
5. Ganguly, Anirban, Chauthaiwale, Vijay & Sinha, Uttam Kumar, eds. *The Modi Doctrine: New Paradigms in India's Foreign Policy*, USA, Wisdom Tree, 2018.

B.A. Political Science (Honours)
SEMESTER-IV
POL-H-GE-T-4(A): India and Her Neighbours

Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to –

- Understand the dynamics of India's Foreign Policy making towards her neighbours.
- Have an idea of the nature of India's relations with her neighbours.

Unit 1: Basic Determinants of India's Foreign Policy towards her Neighbours.

Unit 2: Evolution of India's Foreign Policy towards Neighbours : From Nehru to Vajpayee.

Unit 3: India's relations with neighbours: Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka.

Unit 4: SAARC and India.

Unit5: India and Look East Policy

Suggested Readings:

1. Ganguly, Sumit, *Indian Foreign Policy: Retrospect and Prospect*, New Delhi, Oxford University Press, 2012.
2. Saez, Lawrence, *The South Asian Association for Regional Cooperation (SAARC): An emerging collaboration architecture*, New Delhi, Routledge, 2011.
3. Malone, David , Raja Mohan, C. & Raghavanedt. Srinath, eds. *The Oxford Handbook of Indian Foreign Policy*, New Delhi, Oxford University Press, 2015.
4. Pant, Harsh V. ,*Indian Foreign Policy: An overview*, Manchester, Manchester University Press, 2016.
5. Das Gurudas & Thomas C. J., ed. *Look East to Act East Policy: Implications for India's Northeast*, Routledge, 2016.
6. Ganguly, Anirban, Chauthaiwale, Vijay & Sinha, Uttam Kumar, eds. *The Modi Doctrine: New Paradigms in India's Foreign Policy*, USA, Wisdom Tree, 2018.

B.A. Political Science (Honours)

SEMESTER-IV

POL-H-GE-T-4(B): Research Methodology

Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to –

- Identify the critical difference between fact and value while doing research in the discipline of political science.
- Understand the Concept of Scientific Research and the methods of conducting Scientific Enquiry

Unit 1: Foundations of Research: Meaning, Objectives, Motivation, Utility- Types of Research - Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research - Concept, Construct, Definition, Variable.

Unit 2: Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues–Hypothesis–Qualities of a good Hypothesis–Null Hypothesis & Alternative Hypothesis. Hypothesis Testing– Logic & Importance.

Unit 3: Research Design : Concept and Importance in Research Design – Features of a good research design – Types- Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses, Experimental Design- Concept of Independent & Dependent variables.

Unit 4: Qualitative and Quantitative Research Methods- Sources of Data Collection - Primary and Secondary Sources, Techniques of Data Collection – Observation, Questionnaires, Sampling, Schedule, Interview and Statistical method.

Unit 5: Sampling Design - Steps in Sample Design - Characteristics of a good sample design - Random Samples and Random Sampling Design.

Suggested Readings:

1. Neuman W.L., Social Research Methods: Qualitative & Quantitative Approaches, New Delhi, Pearson Education, 2007.
2. Goode, William J., Methods in Social Research, Delhi, Surjeet Publications, 2006.
3. Kothari, C.R. & Garg G., Research Methodology: Methods and Techniques, Delhi, New Age International (P) Ltd., 1985.
4. Kumar Ranjit, Research Methodology: A Step by Step Guide for Beginners, New Delhi, Pearson Education, 2005.
5. Daniel, P.S. & Aroma, G.S., Research Methodology, Delhi, Kalpaz Publishers, 2011.
6. Panneerselvam, R., Research Methodology, Delhi, PHI Learning Private Ltd., 2014.

B.A. Political Science (Honours)
SEMESTER-IV
POL-H-SEC-T-2(A): Legislative Practices and Procedures
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- To Identify the legislative process in India at various levels,
- To understand the basic requirements of peoples' representatives in policy making process.
- To understand the basic skills required for understanding the political process.

Unit 1: Powers and functions of people's representative at different tiers of governance: Members of Parliament, State Legislative Assemblies - functionaries of rural and urban local governance.

Unit 2: Legislative Process - How a Bill becomes a Law, Role of the Standing Committee in reviewing a Bill, Legislative Consultations, amendments to a Bill, the framing of Rules and Regulations.

Unit 3: Legislative Committees: Types and role – Types of committees, Role of committees in reviewing government finances, policy, programmes, and legislation.

Unit 4 : Budget Document : Overview of Budget Process, Role of Parliament in reviewing the Union Budget, Railway Budget, Examination of Demands for Grants of Ministries, Working of Ministries.

Unit 5: Media monitoring and communication: Types of media and their significance for legislators. Basics of communication in print and electronic media.

Suggested Readings:

1. Jayal, N and Mehta , P (eds), *The Oxford Companion to Politics in India*, New Delhi Oxford University Press, 2010.
2. Jalan, B., *India's Politics*, New Delhi, Penguin, 2007.
3. Kalra, H., *Public Engagement with the Legislative Process* PRS, New Delhi, Centre for PolicyResearch, 2011.

4. Kashyap, Subhash , *Parliamentary Procedure, Law Privilege, Practice & Precedents* – Delhi, Universal Law Publishing, 2006.

Madhavan, M.R. & Wahi, N., *Financing of Election Campaigns PRS*, New Delhi, Centre for Policy Research, 2008: can be accessed on:

<http://www.prsindia.org/uploads/media/conference/Campaign_finance_brief.pdf>

6. Vanka, S. *Primer on MPLADS* , New Delhi, Centre for Policy Research, 2008.
can be accessed on:

<http://www.prsindia.org/parliamenttrack/primers/mplads-487/>

B.A. Political Science (Honours)

SEMESTER-IV

POL-H-SEC-T-2(B): Peace and Conflict Resolution

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Help build an understanding of a variety of conflict situations.
- Understand the various dimensions of Conflict.
- Identify the Gandhian Techniques of Peace-Building.
- Develop ideas on Conflict Responses.

Unit 1: Understanding Conflict and Conflict Resolution: Basic concepts

Unit 2: Dimensions of Conflict: Ideological, Economic (Resource Sharing) and Socio-Cultural (Ethnicity, Religion and Gender).

Unit 3: Nature of Local, Sub-national and International Conflicts

Unit 4: Theories & Techniques of Conflict Resolution: Johan Galtung, Morton Deutsch- Track-I, II & and Multi Track Diplomacy.

Unit 5: Ideas of Peace-building: Gandhi

Unit 6: Conflict Responses: Skills And Techniques - Negotiations: Trust Building, Mediation: Skill Building; Active Listening.

Suggested Readings:

1. Ramsbotham, O., Woodhouse T. and Miall, H., 'Understanding Contemporary Conflict', in *Contemporary Conflict Resolution*, (Third Edition), Cambridge: Polity Press, 2011.
2. S. Ryan, (1990) 'Conflict Management and Conflict Resolution', in *Terrorism and Political Violence*, 2:1, pp. 54-71.
3. R. Rubenstein, (2003) 'Sources', in S. Cheldelin, D. Druckman and L. Fast (eds.) *Conflict: From Analysis to Intervention*, London: Continuum, pp.55-67.
4. P. Le Billon, (2009) 'Economic and Resource Causes of Conflicts', in J. Bercovitch, V. Kremenyuk and I. Zartman (eds.), *The Sage Hand Book of Conflict Resolution*, London: Sage Publications, pp. 210-224.
5. S. AyseKadayifci Orellana, (2009) 'Ethno- Religious Conflicts: Exploring the Role of Religion in Conflict Resolution', in J. Bercovitch, V. Kremenyuk and I. Zartman (eds.) *The Sage Hand Book of Conflict Resolution*, London: Sage Publications, pp. 264- 284.
6. J Bercovitch, V. Kremenyuk, and I. Zartman (eds.) (2009), *The Sage Hand Book of Conflict Resolution*, London: Sage Publications.
7. M. Steger, (2001) 'Peacebuilding and Non- Violence: Gandhi's Perspective on Power', in D. Christie, R. Wagner and D. Winter, (eds.), *Peace, Conflict, and Violence: Peace Psychology for the 21st Century Englewood Cliffs*, New Jersey: Prentice- Hall.
8. I. Doucet, (1996) *Thinking About Conflict*, Resource Pack For Conflict Transformation: International Alert.
9. P. Le Billon, (2009) 'Economic and Resource Causes of Conflicts', in J. Bercovitch, V. Kremenyuk and I. Zartman (eds.) *The Sage Hand Book of Conflict Resolution*, London: Sage Publications, pp. 210-224.
10. J. Davies and E. Kaufman (eds.), (2003) *Second Track/Citizens' Diplomacy: Concepts and Techniques for Conflict Transformation*, Rowman & Littlefield: Maryland.

B.A. Political Science (Honours)

SEMESTER-V

POL-H-CC-T-11: Western Political Thought (Ancient & Medieval)

Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to –

- Have an insightful knowledge about the ancient and medieval western political thought.
- Understand the key ideas of western political thinkers of ancient and medieval period.

Unit 1: Background of Western Political Thought: A Brief Outline with special reference to Stoics and Sophists of ancient Greece.

Unit 2: Ancient Greek Political Thought: Plato – Theory of Justice and Education - Aristotle – Theory of State

Unit 3: Roman Jurisprudence: Basic Features, Contribution of Cicero, Polybius and Seneca.

Unit 4: Medieval Theological Thought: Basic Features, Conflict between Church and State- Contribution of St. Augustine, St. Thomas Aquinas and Marsiglio of Padua.

Unit 5: Religious Protest Movement: Contribution of Martin Luther and John Calvin.

Suggested Readings:

1. Inwood B. ed. *The Cambridge Companion to the Stoics*, Cambridge, Cambridge University Press, 2003.
2. Sabine G.H. & T.L. Thorson, *A History of Political Theory*, New Delhi, Oxford and IBH Publishing Company Pvt. Ltd., 1993.
3. Mukhopadhyay, A. K., *Western Political Thought: From Plato to Marx*, Kolkata, K. P. Bagchi, 1980.
4. Mukherjee S and S. Ramaswamy, *A History of Political Thought: Plato to Marx*, New Delhi: Prentice Hall of India, 2004.

5. Jha S., *Western Political Thought: From Plato to Marx*, New Delhi, Pearson, 2010.
6. Barnes, Jonathan, ed. *The Cambridge Companion to Aristotle*, Cambridge University Press, 1995.
7. Kraut, Richard, ed. *The Cambridge Companion to Plato*, Cambridge University Press 1992.
8. Lee, Francis Nigel., *A Christian Introduction to the History of Philosophy*, Craig Press, 1969.
9. Leff, Gordon. *Medieval Thought: St. Augustine to Ockham*, Penguin Books, Middlesex, England, 1968.

B.A. Political Science (Honours)
SEMESTER-V
POL-H-CC-T-12: Western Political Thought (Modern)

Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Have an insightful knowledge about the western political thought of modern times.
- Understand the key ideas of western political thinker's of modern period.

Unit 1: Thomas Hobbes – Materialism, Human Nature & Sovereignty- John Locke – Natural Rights and Property- JJ Rousseau – Concept of General Will & Social Contract.

Unit 2: Immanuel Kant – Moral Freedom and Hegel – Dialectics, Civil Society and State.

Unit 3: Bentham - Utilitarianism and J.S. Mill- Liberty, Democracy and Government. Main differences between Bentham and Mill.

Unit 4: David Hume – Refutations of Social Contract and Edmund Burke – Conservative Reforms, Human Rights, Critique of French Revolution.

Unit 5: Harold J.Laski – Rights, Sovereignty, Nationalism and Democracy.

Suggested Readings:

1. Sabine G.H. & T.L. Thorson, *A History of Political Theory*, New Delhi, Oxford and IBH Publishing Company Pvt. Ltd., 1993.
2. Mukhopadhyay, A. K., *Western Political Thought: From Plato to Marx*, Kolkata, K. P. Bagchi, 1980.
3. Mukherjee S and S. Ramaswamy, *A History of Political Thought: Plato to Marx*, New Delhi: Prentice Hall of India, 2004.
4. Jha S., *Western Political Thought: From Plato to Marx*, New Delhi, Pearson, 2010.
5. Germino, Dante, *Machiavelli to Marx: Modern Western Political Thought*, London, The University of Chicago Press, 1972.
6. Spellman W.M., *A Short History of Western Political Thought*, New York, Palgrave Macmillan, 2011.
7. Tannenbaum Donald, *Inventors of Ideas: Introduction to Western Political Philosophy*, Boston, USA, Wadsworth Cengage Learning, 2004.
8. Lamb, Peter, *Harold Laski: Problems of Democracy, the Sovereign State, and International Society*, New York, Palgrave Macmillan, 2004.

B.A. Political Science (Honours)

SEMESTER-V

POL-H-DSE-T-1/2(A): Human Rights: Theory and Practice

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course objectives:

After end of this course learner will able to-

- Understand various theories and concepts related to Human Rights.
- Develop an idea about major challenges to Human Rights in India.

Unit 1: Concept of Human Rights: Meaning, evolution and importance - UNO and Human Rights: Universal declaration of Human Rights - A brief analysis- Notion and Classification of Rights : Natural, Moral and Legal Rights, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights; Collective/Solidarity Rights)

Unit 2: Challenges to Human Rights in India: Human Rights violation Among minorities, Dalits and Adivasis, women, children and other marginalized sections. State and Human Rights: Police Atrocities.

Unit 3: Indian Constitution and Human Rights: Civil and Political Rights, Socio, Economic and Cultural Rights - Acts on Human Rights: Right to information Act

Unit 4: National Human Rights Commission – Composition and functions - Agencies for protecting Human Rights: Judiciary, Public Interest Litigation (PIL) & Media.

Unit5: Human Rights Movements in India – Evolution, nature, challenges and prospects, Peoples Union for Civil Liberties (PUCL).

Suggested Readings:

1. Priyam,M., Menon K. and Banerjee,M., *Human Rights, Gender and the Environment* New Delhi, Pearson, 2009.
2. Donnely, Jack, *Universal Human Rights in Theory and Practice*, Ithaca& London, Cornell University Press, 2013.
3. Clapham, Andrew, *Human Rights: A very short introduction*, Oxford, Oxford University Press, 2015.
4. Amartya Sen, *The Idea Justice*, New Delhi: Penguin Books, 2009.
5. Conor Greaty and Adam Tomkins (Eds). *Understanding Human Rights* , London: Manshell, 1996.
6. David Beetham, *Politics and Human Rights* , Oxford: Blackwell, 1995
7. Gurpreet Mahajan Ed., *Democracy, Difference and Social Justice*, New Delhi: Oxford University Press, 1998.

8. James Nickel, *Making Sense of Human Rights: Philosophical Reflections on the Universal Declaration of Human Rights*, Berkeley, University of California Press, 1987.

B.A. Political Science (Honours)

SEMESTER-V

POL-H-DSE-T-1/2(B): Environmental Politics in India

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to-

- Understand various concepts relating to Environment.
- Have an insightful knowledge regarding the environmental politics in India.

Unit 1: Environment and Sustainable Human Development - Definition, scope and importance.

Unit2: United Nations Environment Programme: Rio, Johannesburg and After.

Unit 3: Issue of Industrial Pollution, Global Warming and Threats to Biodiversity in India – Major Environmental Protection Laws in India – Green Justice.

Unit 4: Environment Policy in India - Solid waste Management: Causes, effects and control measures of urban and industrial wastes in India - Environmental ethics: Issues and possible solutions.

Unit 5: Environmental Movement in India: Chipko, Narmada Bachao Andolan and Silent Valley

Suggested Readings:

1. Ramachandra Guha, *Environmentalism : A Global History*, U.K., Penguin Publishers, 2014.
2. Shannon O' Lear, *Environmental Politics: Scale and Power*, Cambridge, Cambridge University Press,
3. Walter A. Rosenbaum, *Environmental Politics and Policy*, Washington, Sage, 2016.

4. Weber Thomas, *Hugging the Trees: The Story of the Chipko Movement*, Delhi, Penguin Publishers, 1988.
5. Jadhav, H & Bhosale, V.M., *Environmental Protection and Laws*, Delhi, Himalaya Publishing House, 1995.
6. Bharucha Erach, *The Biodiversity of India*, Mapin Publishing Pvt. Ltd., Ahmedabad, 2001.
7. Dwivedi O.P. , *India's Environmental Policies, Programmes and Stewardship*, New York, Macmillan Publishers, 2016.

B.A. Political Science (Honours)
SEMESTER-V
POL-H-DSE-T-1/2(C): Public Policy in India
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to:

- Be familiar with different public policies in India.
- Understand various theories and methods of understanding public policy and governance
- Identify the different challenges to governance which has hampered effective implementation of public policies

Unit 1: Public Policy: Meaning, Scope and Importance – The emergence of Policy Sciences.

Unit 2: Models of Public Policy Analysis – Public Policy Cycle.

Unit 3: Policy making in India – Pre and Post Liberalization period in India – Determinants of Public Policy in India.

Unit 4: Major Public Policies in India: a) Public Health; b) Education and c) Environment.

Unit5: Constraints and Challenges to Public Policy implementation in India: Economic, Political and Socio-Cultural.

Suggested Readings:

1. Hill, M., *The Policy Process: A Reader* (2nd Edition), London, Prentice Hall, 1997.
2. Dye, Thomas, *Understanding Pubic Policy*, Singapore , Pearson Education,2016.
3. R. K. Saprú, *Public Policy*, New Delhi, Sterling Publishers,
4. De Prabir Kr (edt.), *Public Policy and Systems*, Delhi, Pearson, 2011.
5. Michael Howlett and M.Ramesh, *Studying Public Policy*, Ontario: Oxford University Press, 2003.
6. Chakrabarti, R. & Sanyal, K., *Public Policy in India*, Delhi, OUP, 2016.

B.A. Political Science (Honours)
SEMESTER-V
POL-H-DSE-T-1/2(D): Understanding Gender Politics
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to –

- Understand about the concept of gender and its relations with society.
- Identify women’s role in social and political movements in India.
- Understand and engage with central debates in the field of Women's empowerment and development.
- Understand the constitutional positions and legal provisions related to women in India.

Unit 1: Approaches to understanding Gender: Liberal, Marxist, Socialist and Radical, Feminist theorizing of the sex/gender distinction, Understanding Patriarchy and Feminism.

Unit 2: Social Reforms Movement and position of women in India- History of Women’s struggle in India – Feminist issues and women’s participation in anti-colonial and national

liberation movements with special focus on India- Women's Movement in Post-independent India.

Unit 3: Theories of Development – Empowerment – Alternative approaches – Women in Development (WID), Women and Development (WAD) and Gender and Development (GAD) – State Policy and Programmes - Women Development approaches in Indian Five – Year Plans – Collectivity and Group dynamics – Self – Help Groups women.

Unit 4: Women's Education – Recent Trends in Women's Education – Committees and Commissions on Education - Adult Literacy and Non – formal education for women's development.

Unit 5: Indian Constitution and provisions relating to women- Personal laws – Labour Laws – Violence against, women – Legal protection – Family Courts – Enforcement machinery – Police and Judiciary- Human Rights as Women's Rights- Women Rights Commission in India: Central and State level: Composition, role, functions and limitations.

Suggested Readings:

1. Burton, A. *Burdens of History: British Feminists, Indian Women and Imperial Culture*, University of North Carolina Press, 1994.
2. Holton, S. *Suffrage Days: Stories from the Women's Suffrage Movement*, London: Routledge, 1996.
3. Legates, M. *In Their Time: A History of Feminism in Western Society*, London: Routledge, 2001.
4. Rendall, J. *The Origins of Modern Feminism: Women in Britain, France and the United States, 1780-1960*, Basingstoke: Macmillan, 1985.
5. Menon, Nivedita. *Gender and Politics in India*, New Delhi, OUP, 1999.
6. Sangari, Kumkum and Suresh Vaid (eds.). *Recasting Women: Essays in Colonial India*, New Delhi: OUP, 2003.
7. Bhasin, Kamala and Nighat Said Khan. *Some Questions on Feminism and Its Relevance in South Asia.*, Institute of Women's Studies (St. Scholastica's College), New Delhi, Kali Publishers, 2002.
8. Chaudhuri, Maitrayee (Ed.) *Feminism in India*, Kali for Women, New Delhi, 2004.
9. Sangari and Vaid (eds), *Recasting Women: Essays in Colonial History*, New Jersey, Rutgers University Press, 1989.

10. Lotika Sarkar and B. Sivaramayya. Edt. , *Women and law: contemporary problems*, New Delhi, Vikas, 1994.

11. Kapur, Ratna & Cossman, Brenda, *Subversive sites: feminist engagements with law in India*, New Delhi, Sage, 1996.

**B.A. Political Science (Honours)
SEMESTER-V**

**POL-H-DSE-T-1/2(E): Development Administration in India: Policies and Prospects
Discipline Specific Elective Course; Credit-6. Full Marks-75**

COURSE OBJECTIVES:

After end of this course the learners will able to:

- Understand the concept and scope of development administration in India.
- Have a definite idea about various issues relating to development in contemporary India.

Unit 1: Meaning and Scope of Development Administration in India. Welfare State: Meaning and Objectives, Concepts of Welfare State and the Directive Principles of State Policy. Role of Indian Administration in Socio-Economic Development of India.

Unit 2: Changing role of Bureaucracy in the context of Liberalization and Globalization, From Development administration to New Public Management in India – Current administrative Reforms in India.

Unit 3: Social Welfare Administration in India: Institutional Framework and Programmes of Centre and State Governments for the Welfare of Scheduled Castes, Women and Children. Role of Indian Administration in Socio-Economic Development of India

Unit 4: District Administration: Evolution, Features and Functions. District Collector: Evolution, Functions and Position. Local Government: Evolution, Meaning, Features and Significance. 73rd and 74th Constitution Amendment Acts.

Unit5: Meaning, Concept and Significance of Rural Development Administration. Growth of Rural Development Institutions in India (since Independence). Rural Development Programmes: National Rural Employment Guarantee Scheme, Indira Awas Yojna, Swarn Jayanti Gram Swa Rojgaar Yojna - Emerging Issues in Rural Development: Information Technology.

Suggested Readings:

1. Bhattacharya Mohit, *Development Administration*, New Delhi, JawaharPublishers, 2001
2. Mathur Kuldeep (ed.) *Development Policy and Administration*, New Delhi, Sage, 1996.
3. Mathur Hari Mohan, *Administering Development in the Third World: Constraints and Choices*, New Delhi, Sage, 1986.
4. Panandikar V.A. Pai and S S Kshirsagar (eds.), *Bureaucracy and Development*, New Delhi, Centre for Policy Research, 1978.
5. Verma S.P. and Sharma, S.K. (eds.), *Development Administration*, New Delhi, IIPA, 1984.
6. Singh, S.R. *Bureaucracy and Rural Development: Policy Making, Planning and Implementation*, New Delhi, Mittal Publication, 1989.
7. Shah, S.M., *Rural Development Planning and Reforms*, New Delhi, Abhinar Publications, 1977.
8. Jain, R.B., *Public Administration in India – 21st Century Challenges for Good Governance*, New Delhi ,Deep & Deep Publications Pvt. Ltd., 2001.
9. Sharma, K. Arvind, *Bureaucracy and Decentralization*, New Delhi, Mittal Publications, 2004.

B.A. Political Science (Honours)
SEMESTER-VI
POL-H-CC-T-13: Introducing Political Sociology
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Understand the nature and scope of Political Sociology
- Understand the concept of Social Stratification and the role of caste, class and elite in politics.
- Comprehend the concepts of Power, authority and Influence and their inter-relationships.
- Understand the meaning, nature and type of Political Culture
- Identify the process of political socialization

Unit 1: Nature, scope and emergence of Political Sociology – Sociology of politics and political sociology-Theoretical Approaches to the study of Political Sociology.

Unit 2: Social Stratification and Politics: Caste, class and elite.

Unit 3: Power, Influence, and Authority.

Unit 4: Political Culture: Meaning, nature and types.

Unit 5: Political Socialization: Meaning and agencies.

Unit 6: Political Development and Political Modernization.

Suggested Readings:

1. Tom Bottomore , *Political Sociology* , Pluto Press, 1993.
2. Janoski, Thomas, Alford R., Hicks Alexander & Schwartz M.A. edt. , *The Handbook of Political Sociology: States, Civil Societies and Globalization*, Cambridge, Cambridge University Press, 2005.
3. Ashraf, A. & Sharma, L.N., *Political Sociology: a New Grammar of Politics*, New Delhi, Orient Longman Pvt. Ltd., 2004.
4. Nash, K., *Contemporary Political Sociology: Globalization, Politics and Power*, Wiley-Blackwell, 2010.
5. Satyabrata Chakraborty (ed.), *Political Sociology* , New Delhi, Macmillan India, 2005.
6. Amal Kumar Mukhopadhyay, *Political Sociology: an introductory analysis*, K.P. Bagchi, 1977.
7. Guy Rocher, *A General introduction to sociology: A theoretical perspective*, Calcutta, Academic Publishers, 2004.
8. Gajanafar Alam, *Political Sociology*, New Delhi, Anmol Publications, 2011.

B.A. Political Science (Honours)
SEMESTER-VI
POL-H-CC-T-14: Comparative Government & Politics
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Identify the difference between Comparative Politics and Comparative Government.
- Identify the different types of Constitutional Systems.
- Gain knowledge about the basic features of the constitution in UK, USA and PRC.

Unit 1: The Importance and Scope of Comparative Government - Distinction between Comparative Politics and Comparative Government.

Unit 2: Constitutionalism – Concept, Evolution, Problems and Limitation.

Unit 3: Typology of Constitutional Systems: Unitary and Federal, Parliamentary and Presidential.

Unit 4: Political Parties and Pressure Groups: UK and USA.

Unit 5: Executive, Legislature and Judiciary: UK, USA and PRC.

Suggested Readings :

1. Hague, Rod, Harrop, Martin & McCormick, John., *Comparative Government and Politics: An Introduction*, UK, Macmillan Education, Palgrave, 2016.
2. Johari, J.C., *New Comparative Government*, New Delhi, Lotus Press, 2006.
3. Blondel, J., *Comparative Government Introduction*, New York, Routledge, 2013.
4. Bara, J & Pennington, M. (eds.). *Comparative Politics*. New Delhi: Sage, 2009.
5. Caramani, D. (edt.). *Comparative Politics*. Oxford: Oxford University Press, 2008.
6. Bhat, Mohd. Shafi, *Comparative Government and Politics: Political Analysis*, New Delhi,

Educreation Publishing, 2011.

B.A. Political Science (Honours)
SEMESTER-VI
POL-H-DSE-T-3/4(A): Local Government in West Bengal
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Have an insightful understanding of structures and functions of Local Government in West Bengal.
- Understand the role of Local Government in West Bengal.

Unit 1: Evolution of Rural and Urban local government in West Bengal since independence.

Unit 2: Perspectives on Urban Governance in West Bengal – The Urban Policy of the Government of West Bengal- West Bengal Municipality Act, 1993- Citizen’s Participation in Urban West Bengal – Metropolitan Governance in Kolkata – The Kolkata Metropolitan Planning Committee.

Unit 3: Rise of Panchayati Raj Institutions in West Bengal- The Approach of the Left Front Government towards Panchayats- Rural Development through People’s Participation in West Bengal- The West Bengal Panchayat Act, 1973 (as amended in 1994).

Unit 4: Local Government and empowerment of Women, SCs, and STs.

Unit5: State-Local Government Relations: Financial control of the State over PRIs - State Finance Commission.

Suggested Readings:

1. Chakraborty, Biswanath, *People’s Participation in West Bengal Panchayat System*, Kolkata: Mitram Publishers, 2008.
2. Datta, Prabhat, *Panchayat, Rural Development and Local Autonomy: West Bengal Experience*, Kolkata, Dasgupta and Co, 2001.

3. Bhattachariya, Moitree, *Panchayati Raj in West Bengal,,: Democratic Decentralization and Democratic Centralism*, New Delhi, Monak Publication, 2002.
4. Datta, Prabhat, *Democratic Governance and Decentralised Planning: Rhetoric and Reality*, Kolkata: Dasgupta and Co, 2012.
5. Datta, Prabhat, *Decentralisation, Participation and Governance*, New Delhi, Kalpaz Publications, 2006.

B.A. Political Science (Honours)
SEMESTER-VI
POL-H-DSE-T-3/4(B): Politics in West Bengal
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Understand the dynamics of the politics in West Bengal in the post-colonial period.
- Have an idea about the role of caste, class and civil society in politics in West Bengal.

Unit 1: Dynamics of politics in West Bengal: an overview.

Unit 2: The Politics of Caste in West Bengal

Unit 3: Protest Movements in West Bengal: Tebhaga, Naxalbari and Singur.

Unit 4: Politics of Ethnicity: Gorkhaland Movement and Kamtapur Movement.

Unit5: Civil Society in West Bengal – Nature and Role in West Bengal politics.

Suggested Readings:

1. Franda, Marcus F., *Radical politics in West Bengal*, MIT Press, 1971.
2. Chatterjee, Partha, *The Present History of West Bengal: Essays in Political Criticism*, Oxford University Press, 1997.
3. Chandra , U., Heierstad G., Nielsen K. Bo. Edt. , *The Politics of Caste in West Bengal*, Routledge, 2016.
4. Davis, M., *Rank and Rivalry: The Politics of Inequality in Rural West Bengal*, New Delhi, Cambridge University Press, 1983.

5. Roy, D., *Rural Politics in India: Political Stratification and Governance in West Bengal*, New Delhi, Cambridge University Press, 2014.
6. Samanta, A.K., *Gorkhaland Movement: A Study in Ethnic Separatism*, New Delhi, APH Publishing Corporation, 2000.
7. Jai J.R. & Jai, R., *SEZs, Massacre of Human Rights with Special Reference to Singur & Nandigram*, New Delhi, Regency Publication, 2007.
8. Samaddar, R. *Passive Revolution in West Bengal: 1977-2011*, New Delhi, Sage, 2013.
9. Singha Roy D.K., *Peasants' Movements in Post-Colonial India : Dynamics of Mobilization and Identity*, New Delhi, Sage Publications, 2004.
10. Kumar, A., ed., *Rethinking State Politics in India: Regions within Regions*, New York, Routledge, 2017.
11. Mitra Subrata K, Bhattacharyya Harihar, *Politics And Governance In Indian States: Bihar, West Bengal And Tripura*, Singapore, World Scientific, 2018.

B.A. Political Science (Honours)

SEMESTER-VI

POL-H-DSE-T-3/4 (C): Social Movements in Contemporary India Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Have an insightful understanding of the nature of Social and New Social Movements in India.
- Be familiar with various Social and New Social movements in India.

Unit 1: Meaning and features - Social Movement and New Social Movement

Unit 2: Peasant Movement – Telengana Movement in Andhra Pradesh and Shetkari Sanghatana Movement in Maharashtra.

Unit 3: Dalit Movements - Emergence, Ideology and Strategies of Mobilization, Regional Dalit Movements, Dalit Panthers of Maharashtra, the Dalit movement of Tamil Nadu, the Dalit Sangarsh Samiti of Karnataka, and BSP in North India, Lok Janshakti, R.P.I, Dalita Maha Sabha

Unit 4: Tribal Movements – POSCO and NiyamGirhi

Unit5: Civil Society Movement – J. P. Narayan and Anna Hazare

Suggested Readings:

1. Porta, Donatella della & Diani Mario, *Social Movements: An Introduction*, USA, Blackwell Publishing, 2006.
2. Ray, Raka and Katzenstain, Mary Fainsod, *Social Movements in India: Poverty, Power, and Politics*, Rowman and Littlefield Publishers, 2005.
3. Simha, A. P., *Development Process and Social Movements in Contemporary India*, Pinnacle Learning, 2015.
4. Shah G., *Social Movements in India: A Review of Literature*, New Delhi, Sage Publications, 2004.
5. Dhanagare D.N., *Populism and Power: Farmers' movement in western India, 1980—2014*, Routledge, 2016.
6. Chandra B., *In The Name Of Democracy: JP Movement and the Emergency*, New Delhi, Penguin Publishers, 2017.
7. Paswan, S. & Jaideva P. ed. , *Encyclopaedia of Dalits in India: Movements, Volume III*, New Delhi, Kalpaz Publishers, 2002.
8. Chandhoke, N., & Priyadarshi, P., *Contemporary India: Economy, Society, Politics*, New Delhi, Pearson, 2009.

B.A. Political Science (Honours)

SEMESTER-VI

**POL-H-DSE-T-3/4(D): Citizenship in Globalizing World
Discipline Specific Elective Course; Credit-6. Full Marks-75**

Course Objectives:

After end of this course learner will able to-

- Understand the theories of citizenship and the historical development of the concept.
- Develop an idea about citizenship as a practice in an increasingly globalizing world.

Unit 1: Classical conceptions of citizenship

Unit 2: The Evolution of Citizenship and the Modern State

Unit 3: Citizenship and Diversity

Unit 4: Citizenship beyond the Nation-state: Globalization and global justice

Unit5: The idea of cosmopolitan citizenship

Suggested Readings:

1. Acharya, Ashok. *Citizenship in a Globalising World*. New Delhi: Pearson, 2012.
2. Beiner, R. *Theorising Citizenship*. Albany: State University of New York Press, 1995.
3. Held, David, *Democracy and the Global Order: From the Modern State to Cosmopolitan Governance* , Stanford: Stanford University Press, 1995.
4. Kymlicka, Will, “Citizenship in an Era of Globalization: A Response to Held,” in Ian Shapiro and Casiano Hacker-Cordon (eds.), *Democracy's Edges* ,Cambridge, UK: Cambridge University Press, 1999.
5. Oliver, D. and D. Heater *The Foundations of Citizenship*. London, Harvester Wheatsheaf. 1994.
6. Scholte, Jan Aart, *Globalization: A Critical Introduction*, New York: St.Martin's, 2000.
7. Zolo, Danilo, *Cosmopolis: Prospects for World Government*, Cambridge, UK:Polity Press, 1997.
9. Nash, K., *Contemporary Political Sociology: Globalization, Politics and Power*, West Sussex, Wiley-Blackwell, 2010.

B.A. Political Science (Honours)
SEMESTER-VI
POL-H-DSE-T-3/4(E): Dissertation
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course objectives:

After completion of the course the learners will be able to:

- Apply the knowledge gained through different courses in practical field.
- Solve problems related to his course of study.
- Document, calculate, analyse and interpret data.

- Deduce findings from different studies
- Write and report in standard academic formats.

Guidelines:

- The students undertaking this course shall be allotted a supervisor/mentor/guide at the beginning of the semester.
- The student shall select a topic for dissertation from any field of Education taking help from the supervisor/mentor/guide.
- The work completed within the stipulated time and written in standard academic format shall be submitted at the end of the semester.
- The work shall be evaluated on the basis of the written document submitted by the student and a *viva-voce* conducted on the same.

Suggested Readings:

1. Smith, K., Todd M., Waldman, J., *Doing Your Undergraduate Social Science Dissertation*, USA, Rutledge, 2009.
2. Burnett Judith , *Doing Your Social Science Dissertation*, London, Sage Publications, 2009.
3. Lovitts, Barbara E. & Wert, Ellen L., *Developing Quality Dissertations in the Social Sciences: A Graduate Student's Guide to achieving excellence*, Virginia, Stylus Publishing, 2009.

Syllabus and Scheme of Examination
For
B.Sc. (Honors) and B.Sc. (General) with Chemistry

University of Kalyani
West Bengal



Under
Choice Based Credit System

December, 2017

Preamble

In response to the notification (No.FCUG/KU-914/17-18 dt 16.11.2017) of University of Kalyani, the Undergraduate Board of Studies in Chemistry of University of Kalyani has revised and modified syllabi of **B.Sc. (Honors) with Chemistry** and **Chemistry courses for B.Sc. (General)** under Semester and CBCS (Choice Based Credit System) scheme following the recommendations and Guidelines of UGC (University Grant Commission) and WBHEC (West Bengal Higher Education Council). Content, structure and date of effect of this proposed syllabus will be decided by the appropriate authority of University of Kalyani after acceptance and approval.

The objectives and overview of the requirements have been stated by the WBHEC in the Introduction of their proposed draft syllabus which has been reiterated below

“The main objective of framing this new syllabus is to give the students a holistic understanding of the subject giving substantial weightage to both the core content and techniques used in Chemistry. The syllabus has given equal importance to the three main branches of Chemistry – Physical, Inorganic and Organic.

The ultimate goal of the syllabus is that the students at the end are able to secure a job. Keeping in mind and in tune with the changing nature of the subject, adequate emphasis has been given on new techniques and understanding of the subject.

Each University should take necessary measure to ensure that affiliated college or department must have the following facilities: UV-VIS Spectrophotometer with printer, FT-IR Spectrophotometer with printer, Internet facility and requisite number of computers. Also, for proper maintenance of above mentioned facilities, clean & dry AC rooms are mandatory.

It is essential that Chemistry students select their general electives courses from Physics, Mathematics and/or any branch of Life Sciences disciplines.

Also, to maintain equal importance of all three major sections of Chemistry, it is recommended that elective course “Advanced Physical Chemistry” may be made compulsory and students are free to select any three out of remaining five recommended elective courses.

Project Work followed by a power point presentation may be introduced instead of the 4th Elective with a credit of 6 split into 2+4, where 2 credits will be for continuous evaluation and 4 credits reserved for the merit of the dissertation.”

Introduction

The new syllabus as stated in Preamble has been delineated in 7 sections. Course wise credit distributions are given in Section 1 and Section 5 for B.Sc(Honors) and B.Sc. (General) respectively in tabular form. Semester wise CBCS curricula, assignment of specific course names for Chemistry, credit in each course and choices of subjects are given in tabular form in Section 2 and Section 6 for B.Sc (Honors) and B.Sc. (General) respectively.

There are 14 Core courses distributed over six semesters of B.Sc. (Honors) with Chemistry. Each Core course consists of theory and practical components. Core courses have been named as CHEMHT- N (N= 1 to 14) for theory and CHEMHP-N (N=1 to 14) for practical. All these courses are compulsory for B.Sc. (Honors) with Chemistry.

There are 4 courses for “Skill Enhancement” from which candidates have to **choose** two, one out of two in Semester – I (CHEMHS-1A or CHEMHS-1B) and another (CHEMHS-2A or CHEMHS-2B) from the other two.

Candidates have to choose 4 courses out of 6 under “Discipline Specific Elective (DSE)” papers. The choices and names are given in tabular form in Section 2. One course under DSE has been assigned as project work following the suggestion of WBHEC.

Students of B.Sc. (Honors) have to choose 4 “Generic Elective (GE)” papers from two science subjects (Physics, Mathematics and any branch of Life Science) other than Chemistry. *E.g.*, if a student chooses Physics and Math then he/she have to choose 2 GE papers from Physics and 2 from Math.

Details of all the Chemistry courses are given in Section 3 and Section 7 for B.Sc(Honors) and B.Sc.(General) respectively.

The choices under GE courses for B.Sc. (Honors) with subjects other than Chemistry have been given in Section 4.

Syllabus and Scheme of Examination For B.Sc. (Honors) with Chemistry

1. Course wise Credit Distribution in B.Sc. (Honors)

Course	Total no of Papers	Credit			
		Theory		Practical	
		Per paper	Total	Per paper	Total
Core Courses	14	4	4 x 14=56	2	2x14=28
Discipline Specific Elective	4	4	4x4=16	2	2x4=8
Generic Elective	4	4	4x4=16	2	2x4=8
Ability Enhancement (Language)	2	2	2x2 = 4	-	-
Skill Enhancement	2	2	2x2 = 4	-	-
Total	26	NA	96	NA	44

2. Semester wise CBCS curricula (Courses, course names, broad area, credit and marks) for B.Sc. (Honors) with Chemistry

Semester	Course	Course Name	Broad area	Credit
I	Core Course-1 (Theory)	CHEMHT-1	Inorganic-1A + Physical – 1A	4
	Core Course-1 (Practical)	CHEMHP-1	Inorganic-1A + Physical – 1A	2
	Core Course-2 (Theory)	CHEMHT-2	Organic - 1	4
	Core Course-2 (Practical)	CHEMHP-2	Organic - 1	2
	Generic Elective-1 (Theory) *	TBD	TBD	4
	Generic Elective-1 (Practical)	TBD	TBD	2
	Ability Enhancement Compulsory Course - 1	TBD	English communication / Environmental Science	2
II	Core Course-3 (Theory)	CHEMHT-3	Inorganic-1B + Physical – 1B	4
	Core Course-3 (Practical)	CHEMHP-3	Inorganic-1B + Physical – 1B	2
	Core Course-4 (Theory)	CHEMHT-4	Organic - II	4
	Core Course-4 (Practical)	CHEMHP-4	Organic - II	2
	Generic Elective-2 (Theory)	TBD	TBD	4
	Generic Elective-2 (Practical)	TBD	TBD	2
	Ability Enhancement Compulsory Course - 2	TBD	English communication / Environmental Science	2
III	Core Course-5 (Theory)	CHEMHT-5	Physical – II	4
	Core Course-5 (Practical)	CHEMHP-5	Physical – II	2
	Core Course-6 (Theory)	CHEMHT-6	Inorganic - II	4
	Core Course-6 (Practical)	CHEMHP-6	Inorganic - II	2
	Core Course-7	CHEMHT-7	Organic-III	4

	(Theory)			
	Core Course-7 (Practical)	CHEMHP-7	Organic-III	2
	Generic Elective-3 (Theory)	TBD	TBD	4
	Generic Elective-3 (Practical)	TBD	TBD	2
	Skill Enhancement Course – 1 (Any one from this group)	CHEMHS – 1A	IT skills for Chemist	2
		CHEMHS-1B	Basic Analytical Chemistry	2
IV	Core Course-8 (Theory)	CHEMHT-8	Physical – III	4
	Core Course-8 (Practical)	CHEMHP-8	Physical – III	2
	Core Course-9 (Theory)	CHEMHT-9	Inorganic - III	4
	Core Course-9 (Practical)	CHEMHP-9	Inorganic - III	2
	Core Course-10 (Theory)	CHEMHT-10	Organic-IV	4
	Core Course-10 (Practical)	CHEMHP-10	Organic-IV	2
	Generic Elective-4 (Theory)	TBD	TBD	4
	Generic Elective-4 (Practical)	TBD	TBD	2
	Skill Enhancement Course – 2 (Any one from this group)	CHEMHS – 2A	Pharmaceutical Chemistry	2
CHEMHS - 2B		Analytical clinical Biochemistry	2	
V	Core Course-11 (Theory)	CHEMHT-11	Inorganic - IV	4
	Core Course-11 (Practical)	CHEMHP-11	Inorganic - IV	2
	Core Course-12 (Theory)	CHEMHT-12	Physical-IV	4
	Core Course-12 (Practical)	CHEMHP-12	Physical - IV	2
	Discipline Specific Elective-1 (Theory) (Any one from this group)	CHEMHTDSE-1A	Polymer Chemistry	4
		CHEMHTDSE-1B	Inorganic Materials of Industrial Importance	
	Discipline Specific Elective-1 (Practicals)	CHEMHPDSE-1A	Polymer Chemistry	2

	of DSE-1. Either of the two that corresponds to the theory chosen)	CHEMHPDSE-1B	Inorganic Materials of Industrial Importance		
	Discipline Specific Elective-2 (Theory) (Any one from this group)	CHEMHTDSE-2A	Analytical Methods in Chemistry	4	
		CHEMHTDSE-2B	Instrumental Methods of Chemical Analysis		
		CHEMHTDSE-2C	Green Chemistry		
	Discipline Specific Elective- 2 (Practical) (Any one, that corresponds to the theory, from this group)	CHEMHPDSE-2A	Analytical Methods in Chemistry	2	
		CHEMHPDSE-2B	Instrumental Methods of Chemical Analysis		
		CHEMHPDSE-2C	Green Chemistry		
	VI	Core Course-13 (Theory)	CHEMHT-13	Inorganic - V	4
		Core Course-13 (Practical)	CHEMHP-13	Inorganic - V	2
Core Course-14 (Theory)		CHEMHT-14	Organic-V	4	
Core Course-14 (Practical)		CHEMHP-14	Organic - V	2	
Discipline Specific Elective-3 (Theory)		CHEMHTDSE-3	Advanced Physical Chemistry	4	
Discipline Specific Elective- 3(Practical)		CHEMHPDSE-3	Advanced Physical Chemistry	2	
Discipline Specific Elective-4 (Theory)		CHEMHTDSE-4	Dissertation	4	
Discipline Specific Elective- 4 (Practical)		CHEMHPDSE-4	Project work Presentation (Power point)	2	

* B.Sc. (Honors) with Chemistry students should select their general electives courses, any two from Physics, Mathematics and any branch of Life Sciences disciplines.

3. Chemistry Syllabus of B.Sc.(Honors) with Chemistry

Semester - I		
CHEMHT-1	Theory: Extra nuclear structure of atom, Periodic properties, Kinetic Theory and Gaseous state, Chemical Thermodynamics - I	4 Credit
Inorganic Chemistry – IA		
<p>1. Extra nuclear Structure of atom: (16L) Bohr's model and atomic spectrum of hydrogen, Limitations of Bohr's model and Sommerfeld's modifications, de Broglie's concept, Heisenberg's uncertainty principle and its significance, Time independent Schrödinger's wave equation (without application and solution detail), Significance of ψ and ψ^2, Radial and angular wave functions for hydrogen atom (qualitative idea), radial probability distribution curves, shapes of s, p, d and f orbitals (qualitative idea), Quantum numbers and their significance, Pauli's exclusion principle, aufbau principle and limitations, Hund's rules, exchange energy, Electronic configurations of atoms. Elementary idea of microstates.</p> <p>2. Periodic properties : (14L) Modern IUPAC periodic table and classification of elements in the table; Effective nuclear charge and its calculation using Slater's rules; Atomic radii, Ionic radii and Pauling's method for determining univalent ionic radii; Electronegativity (Pauling's, Mulliken's, Allred-Rochow's and Sanderson's scales) and its applications, Ionization energy, Electron affinity and factors influencing these properties; Group trends and periodic trends of these properties with reference to s, p and d-block elements. Secondary periodicity; Inert pair effect.</p> <p>Reference Books:</p> <p>1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991. 2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970. 3. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962. 4. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010). 5. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India. 6. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005. 7. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006. 8. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006. 9. Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998). 10. Winter, M. J., The Orbitron, http:// winter.group.shef.ac.uk/orbitron/ (2002). An illustrated gallery of atomic and molecular orbitals. 11. Burgess, J., Ions in solution: basic principles of chemical interactions. Ellis Horwood (1999)</p>		
Physical Chemistry - IA		
<p>1. Kinetic Theory and Gaseous state 18 L <u>Kinetic Theory of gases</u>: Concept of pressure and temperature; Collision of gas molecules; Collision diameter; Collision number and mean free path; Frequency of binary collisions (similar and different molecules). <u>Maxwell's distribution of speed and energy</u>: Nature of distribution of velocities, Maxwell's distribution of speeds in one, two and three dimensions; Kinetic energy distribution in one, two and three dimensions, calculations of average, root mean square and most probable values in each case; Calculation of number</p>		

of molecules having energy $\geq \epsilon$, Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases.

Real gas and virial equation: Deviation of gases from ideal behavior; compressibility factor; Boyle temperature; Andrew's and Amagat's plots; van der Waals equation and its features; its derivation and application in explaining real gas behaviour, other equations of state (Berthelot, Dietrici); Existence of critical state, Critical constants in terms of van der Waals constants; Law of corresponding states; virial equation of state; van der Waals equation expressed in virial form and significance of second virial coefficient; Intermolecular forces (Debye, Keesom and London interactions; Lennard - Jones potential - elementary idea).

2. Chemical Thermodynamics - I

12 L

Zeroth and 1st law of Thermodynamics: Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics; Concept of heat, work, internal energy and statement of first law; enthalpy, H; relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions; Joule's experiment and its consequence.

Thermochemistry: Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Laws of thermochemistry; bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchoff's equations and effect of pressure on enthalpy of reactions.

Reference Books

- Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press.
- Castellan, G. W. Physical Chemistry, Narosa.
- McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press.
- Engel, T. & Reid, P. Physical Chemistry, Pearson.
- Levine, I. N. Physical Chemistry, Tata McGraw-Hill.
- Maron, S. & Prutton Physical Chemistry.
- Ball, D. W. Physical Chemistry, Thomson Press.
- Mortimer, R. G. Physical Chemistry, Elsevier.
- Laidler, K. J. Chemical Kinetics, Pearson.
- Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry.
- Rakshit, P.C., Physical Chemistry Sarat Book House.
- Zemansky, M. W. & Dittman, R.H. Heat and Thermodynamics, Tata-McGraw-Hill.
- Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas.
- Clauze & Rosenberg, Chemical Thermodynamics

CHEMHP-1	Practical :	2 Credit
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Inorganic Chemistry – IA

- Method of preparation of standard solutions of titrants
- Estimation of carbonate and hydroxide present together in a mixture
- Estimation of carbonate and bicarbonate present together in a mixture

Reference Book

Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.

Physical Chemistry - IA

- Determination of pH of unknown solution (buffer), by color matching method.
- Determination of heat of neutralization of a strong acid by a strong base.
- Determination of heat of solute ion of oxalic acid from solubility measurement.

Reference Books

1. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009). 2. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson. 3. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007). 4. Palit, S.R., De, S. K. Practical Physical Chemistry Science Book Agency. 5. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta. 6. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd. 7. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.

CHEMHT-2	Theory: Basics of Organic Chemistry, Bonding and Physical Properties, General Treatment of Reaction Mechanism and Stereochemistry	4 Credit
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Organic Chemistry – I**1. Bonding and Physical Properties: (18L)****Valence Bond Theory:**

Concept of hybridisation, shapes of molecules, resonance (including hyperconjugation); calculation of formal charges and double bond equivalent (DBE); orbital pictures of bonding (sp^3 , sp^2 , sp): C-C, C-N & C-O systems and s-cis and s-trans geometry for suitable cases).

Electronic displacements:

Inductive effect, field effect, mesomeric effect, resonance energy; bond polarization and bond polarizability; electromeric effect; steric effect, steric inhibition of resonance.

MO theory:

Qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about σ , σ^* , π , π^* , n – MOs; basic idea about Frontier MOs (FMO); concept of HOMO, LUMO and SOMO; interpretation of chemical reactivity in terms of FMO interactions; sketch and energy levels of π MOs of i) acyclic p orbital system (C=C, conjugated diene, triene, allyl and pentadienyl systems), ii) cyclic p orbital system (neutral systems: [4], [6]-annulenes; charged systems: 3-, 4-, 5-membered ring systems); Hückel's rules for aromaticity up to [10]-annulene (including mononuclear heterocyclic compounds up to 6-membered ring); concept of antiaromaticity and homoaromaticity; non-aromatic molecules; Frost diagram; elementary idea about α and β ; measurement of delocalization energies in terms of β for buta-1,3-diene, cyclobutadiene, hexa-1,3,5-triene and benzene.

Physical properties:

Influence of hybridization on bond properties: bond dissociation energy (BDE) and bond energy; bond distances, bond angles; concept of bond angle strain (Baeyer's strain theory); melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces; polarity of molecules and dipole moments; relative stabilities of isomeric hydrocarbons in terms of heat of hydrogenation, heat of combustion and heat of formation.

2. General Treatment of Reaction Mechanism – I : (24L)**Mechanistic classification:**

Ionic, radical and pericyclic (definition and example); reaction type: addition, elimination and substitution reactions (definition and example); nature of bond cleavage and bond formation: homolytic and heterolytic bond fission, homogenic

and heterogenic bond formation; curly arrow rules in representation of mechanistic steps; reagent type: electrophiles and nucleophiles (elementary idea); electrophilicity and nucleophilicity in terms of FMO approach.

Reactive intermediates:

Carbocations (carbenium and carbonium ions), carbanions, carbon radicals, carbenes, benzyne, nitrenes: generation and stability, structure using orbital picture and electrophilic/nucleophilic behavior of reactive intermediates (elementary idea).

3. Stereochemistry-I : (18L)

Bonding geometries of carbon compounds and representation of molecules:

Tetrahedral nature of carbon and concept of asymmetry; Fischer, sawhorse, flying-wedge and Newman projection formulae and their inter translations.

Concept of chirality and symmetry:

Symmetry elements and point groups (C_{nh} , C_{nv} , C_n , D_{nh} , D_{nd} , D_n , S_n (C_s , C_i); molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers; concept of epimers; concept of stereogenicity, chirotopicity and pseudoasymmetry; chiral centres and number of stereoisomerism: systems involving 1/2/3-chiral centre(s) (AA, AB, ABA and ABC types).

Relative and absolute configuration:

D/L and R/S descriptors; erythro/threo and meso nomenclature of compounds; syn/anti nomenclatures for aldols; E/Z descriptors for C=C, conjugated diene, triene, C=N and N=N systems; combination of R/S- and E/Z- isomerisms.

Optical activity of chiral compounds:

Optical rotation, specific rotation and molar rotation; racemic compounds, racemisation (through cationic, anionic, radical intermediates and through reversible formation of stable achiral intermediates); resolution of acids, bases and alcohols via diastereomeric salt formation; optical purity and enantiomeric excess; invertomerism of chiral trialkylamines.

Reference Books:

1. Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012. 2. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited. 3. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited. 4. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education). 6. Fleming, I. Molecular Orbitals and Organic Chemical Reactions, Reference/Student Edition, Wiley, 2009. 7. Eames, J., Peach, J. M. Stereochemistry at a Glance, Blackwell Publishing, 2003. 8. Robinson, M. J. T., Stereochemistry, Oxford Chemistry Primer, Oxford University Press, 2005.

CHEMHP-2	Practical :	2 Credit
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Organic Chemistry – I

1. Separation:

Based upon solubility, by using common laboratory reagents like water (cold, hot), dil. HCl, dil. NaOH, dil. NaHCO₃, etc., of components of a binary solid mixture; purification of any one of the separated components by crystallization

and determination of its melting point. The composition of the mixture may be of the following types: Benzoic acid/p-Toluidine; p-Nitrobenzoic acid/p-Aminobenzoic acid; p-Nitrotoluene/p-Anisidine; etc.

2. Determination of boiling point:

Determination of boiling point of common organic liquid compounds e.g., ethanol, cyclohexane, chloroform, ethyl methyl ketone, cyclohexanone, acetylacetone, anisole, crotonaldehyde, mesityl oxide, etc. [Boiling point of the chosen organic compounds should preferably be less than 160 °C]

3. Identification of a Pure Organic Compound by chemical test(s):

Solid compounds:

oxalic acid, tartaric acid, citric acid, succinic acid, resorcinol, urea, glucose, cane sugar, benzoic acid and salicylic acid.

Liquid Compounds:

formic acid, acetic acid, methyl alcohol, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene.

Reference Books:

1. Bhattacharyya, R. C, A Manual of Practical Chemistry. 2. Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors. 3. Mann, F. G. & Saunders, B. C. Practical Organic Chemistry, Pearson Education (2009). 4. Furniss, B. S., Hannaford, A.J., Smith, P. W. G., Tatchell, A. R. Practical Organic Chemistry, 5th Ed., Pearson (2012).

Semester – II

CHEMHT-3	Theory: Redox reactions and Precipitation reactions, Acid-Base Concepts and Solvents, Chemical Thermodynamics – II, Chemical kinetics	4 Credit
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Inorganic Chemistry – IB

a) Redox Reactions and precipitation reactions : (15L)

Qualitative idea about complimentary, noncomplimentary, disproportionation and comproportionation reactions, standard redox potentials with sign conventions, Electrochemical series and its application to explore the feasibility of reactions and equilibrium constants, Nernst equation; effect of pH, complexation and precipitation on redox potentials, formal potential; Basis of redox titration and redox indicators, Redox potential diagrams (Latimer and Frost) of common elements and their applications.

Solubility product principle, common ion effect and their applications to the precipitation and separation of common metallic ions as hydroxides, sulphides, carbonates, sulphates and halides.

b) Acid-Base Concepts and Solvents : (15L)

Recapitulation of Arrhenius concept, Bronsted-Lowry concept, Solvent system concept (in H₂O, liq. NH₃, liq. SO₂ and liq. HF), Lux-Flood concept, Lewis concept, Drago-Wayland equation, Solvent levelling and differentiating effects, Relative strength of different acids and bases, Pauling's rules, Hammett acidity function and super acids, HSAB principle and its applications, Acid-base equilibria in aqueous solution, pH, Buffer, Acid-base neutralization curves and choice of indicators. Gas phase acidity.

Reference Books:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991. 2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970. 3. Day, M.C. and Selbin,

J. Theoretical Inorganic Chemistry, ACS Publications, 1962. 4. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010). 5. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India. 6. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005. 7. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006. 8. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006. 9. Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998). 10. Winter, M. J., The Orbitron, [http:// winter.group.shef.ac.uk/orbitron/](http://winter.group.shef.ac.uk/orbitron/) (2002). An illustrated gallery of atomic and molecular orbitals. 11. Burgess, J., Ions in solution: basic principles of chemical interactions. Ellis Horwood (1999)

Physical Chemistry – IB

- 1. Chemical Thermodynamics - II** **12 L**
- Second Law: Need for a Second law; statement of the second law of thermodynamics; Concept of heat reservoirs and heat engines; Carnot cycle; Physical concept of Entropy; Carnot engine and refrigerator; Kelvin –Planck and Clausius statements and equivalence of the two statements with entropic formulation; Carnot's theorem; Values of $\int dQ/T$ and Clausius inequality; Entropy change of systems and surroundings for various processes and transformations; Entropy and unavailable work; Auxiliary state functions (G and A) and their variation with T, P and V. Criteria for spontaneity and equilibrium.
- Thermodynamic relations: Maxwell's relations; Gibbs-Helmholtz equation, Joule-Thomson experiment and its consequences; inversion temperature; Joule-Thomson coefficient for a van der Waals gas; General heat capacity relations.
- 2. Chemical kinetics** **18 L**
- Rate law, order and molecularity: Introduction of rate law, Extent of reaction; rate constants, order; Forms of rates of First, second and nth order reactions; Pseudo first order reactions (example using acid catalyzed hydrolysis of methyl acetate); Determination of order of a reaction by half -life and differential method; Opposing reactions, consecutive reactions and parallel reactions (with explanation of kinetic and thermodynamic control of products; all steps first order).
- Role of Temperature and theories of reaction rate: Temperature dependence of rate constant; Arrhenius equation, energy of activation; Rate-determining step and steady-state approximation –explanation with suitable examples; Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment).
- Homogeneous catalysis: Homogeneous catalysis with reference to acid-base catalysis; Primary kinetic salt effect; Enzyme catalysis; Michaelis-Menten equation, Lineweaver-Burk plot, turn-over number.

Reference Books

1. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press. 2. Castellan, G. W. Physical Chemistry, Narosa. 3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press. 4. Engel, T. & Reid, P. Physical Chemistry, Pearson. 5. Levine, I. N. Physical Chemistry, Tata McGraw-Hill. 6. Maron, S. & Prutton Physical Chemistry. 7. Ball, D. W. Physical Chemistry, Thomson Press. 8. Mortimer, R. G. Physical Chemistry, Elsevier. 9. Laidler, K. J. Chemical Kinetics, Pearson. 10. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry. 11. Rakshit, P.C., Physical Chemistry Sarat Book House. 12. Zemansky, M. W. & Dittman, R.H. Heat and Thermodynamics, Tata-McGraw-Hill. 13. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas. 14. Clauze & Rosenberg, Chemical Thermodynamics

CHEMHP-3	Practical	2 Credit
Inorganic Chemistry – IB		
i. Estimation of Fe(II) using $K_2Cr_2O_7$ solution ii. Estimation of Fe(III) using $K_2Cr_2O_7$ and $KMnO_4$ solution iii. Estimation of Ca^{2+} using $KMnO_4$ solution iv. Estimation of Cu^{2+} iodometrically v. Estimation of Cr^{3+} using $K_2Cr_2O_7$ solution		
Reference Book		
Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.		
Physical Chemistry – IB		
i. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate. ii. Study of kinetics of decomposition of H_2O_2 .		
Reference Books		
1. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009). 2. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson. 3. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007). 4. Palit, S.R., De, S. K. Practical Physical Chemistry Science Book Agency. 5. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta. 6. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd. 7. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.Ltd.		
CHEMHT-4	Theory: Stereochemistry, General Treatment of Reaction Mechanism, Substitution and Elimination Reactions	4 Credit
Organic Chemistry – II		
1. Stereochemistry-II: (14L) Chirality arising out of stereoaxis: Stereoisomerism of substituted cumulenes with even and odd number of double bonds; chiral axis in allenes, spiro compounds, alkylidenecycloalkanes and biphenyls; related configurational descriptors (R_a/S_a and P/M); atropisomerism; racemisation of chiral biphenyls; buttressing effect. Concept of prostereoisomerism: Prostereogenic centre; concept of pro^n -chirality: topicity of ligands and faces (elementary idea); pro-R/pro-S, pro-E/pro-Z and Re/Si descriptors; pro-r and pro-s descriptors of ligands on propseudoasymmetric centre. Conformation: Conformational nomenclature: eclipsed, staggered, gauche, syn and anti; dihedral angle, torsion angle; Klyne-Prelog terminology; P/M descriptors; energy barrier of rotation, concept of torsional and steric strains; relative stability of conformers on the basis of steric effect, dipole-dipole interaction and H-bonding; butane gauche interaction; conformational analysis of ethane, propane, n-butane, 2-methylbutane and 2,3-dimethylbutane; haloalkane, 1,2-dihaloalkanes and 1,2-diols (up to four carbons); 1,2-halohydrin; conformation of conjugated systems (s-cis and s-trans).		
2. General Treatment of Reaction Mechanism II : (18L) Reaction thermodynamics: Free energy and equilibrium, enthalpy and entropy factor, calculation of enthalpy change via BDE, intermolecular & intramolecular reactions.		

Concept of organic acids and bases:

Effect of structure, substituent and solvent on acidity and basicity; proton sponge; gas-phase acidity and basicity; comparison between nucleophilicity and basicity; HSAB principle; application of thermodynamic principles in acid-base equilibria.

Tautomerism:

Prototropy (keto-enol, nitro - aci-nitro, nitroso-oximino, diazo-amino and enamine-imine systems); valence tautomerism and ring-chain tautomerism; composition of the equilibrium in different systems (simple carbonyl; 1,2- and 1,3-dicarbonyl systems, phenols and related systems), factors affecting keto-enol tautomerism; application of thermodynamic principles in tautomeric equilibria.

Reaction kinetics:

Rate constant and free energy of activation; concept of order and molecularity; free energy profiles for one-step, two-step and three-step reactions; catalyzed reactions: electrophilic and nucleophilic catalysis; kinetic control and thermodynamic control of reactions; isotope effect: primary and secondary kinetic isotopic effect (k_H/k_D); principle of microscopic reversibility; Hammond's postulate.

3. Substitution and Elimination Reactions: (28L)**Free-radical substitution reaction:**

Halogenation of alkanes, mechanism (with evidence) and stereochemical features; reactivity-selectivity principle in the light of Hammond's postulate.

Nucleophilic substitution reactions:

Substitution at sp^3 centre: mechanisms (with evidence), relative rates & stereochemical features: S_N1 , S_N2 , S_N2' , S_N1' (allylic rearrangement) and S_Ni ; effects of solvent, substrate structure, leaving group and nucleophiles (including ambident nucleophiles, cyanide & nitrite); substitutions involving NGP; role of crown ethers and phase transfer catalysts; [systems: alkyl halides, allyl halides, benzyl halides, alcohols, ethers, epoxides]. Concept of aliphatic electrophilic substitution reactions (S_E1 , S_E2 , S_Ei).

Elimination reactions:

$E1$, $E2$, $E1c_b$ and E_i (pyrolytic syn eliminations); formation of alkenes and alkynes; mechanisms (with evidence), reactivity, regioselectivity (Saytzeff/Hofmann) and stereoselectivity; comparison between substitution and elimination; importance of Bredt's rule relating to the formation of $C=C$.

Reference Books:

1. Clayden, J., Greeves, N., Warren, S. Organic Chemistry, Second edition, Oxford University Press 2012.
2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson Education, 2003.
3. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.
4. Carey, F. A. & Giuliano, R. M. Organic Chemistry, Eighth edition, McGraw Hill Education, 2012.
5. Loudon, G. M. Organic Chemistry, Fourth edition, Oxford University Press, 2008.
6. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
7. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited.
8. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Finar, I. L. Organic Chemistry (Volume 1) Pearson Education.
10. Graham Solomons, T.W., Fryhle, C. B. Organic Chemistry, John Wiley & Sons, Inc.
11. Eames, J., Peach, J. M. Stereochemistry at a Glance, Blackwell Publishing, 2003.
12. Robinson, M. J. T. Stereochemistry, Oxford Chemistry Primer, Oxford University Press, 2005.
13. Maskill, H. Mechanisms of Organic Reactions, Oxford Chemistry Primer, Oxford University Press.
14. March, J. Advanced Organic Chemistry, Fourth edition, Wiley.

CHEMHP-4	Practical :	2 Credit
Organic Chemistry – II		
<p>Organic Preparations:</p> <p>A. The following reactions are to be performed, noting the yield of the crude product:</p> <ol style="list-style-type: none"> 1. Nitration of aromatic compounds 2. Condensation reactions 3. Hydrolysis of amides/imides/esters 4. Acetylation of phenols/aromatic amines 5. Benzoylation of phenols/aromatic amines 6. Side chain oxidation of aromatic compounds 7. Diazo coupling reactions of aromatic amines 8. Bromination of anilides using green approach (Bromate-Bromide method) 9. Redox reaction including solid-phase method 10. Green ‘multi-component-coupling’ reaction 11. Selective reduction of m-dinitrobenzene to m-nitroaniline <p>Students must also calculate percentage yield, based upon isolated yield (crude) and theoretical yield.</p> <p>B. Purification of the crude product is to be made by crystallisation from water/alcohol, crystallization after charcoal treatment, or sublimation, whichever is applicable.</p> <p>C. Melting point of the purified product is to be noted.</p> <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Vogel, A. I. Elementary Practical Organic Chemistry, Part 1: Small scale Preparations, CBS Publishers and Distributors. 2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003. 3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009). 4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012). 5. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000). 6. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015. 		
Semester – III		
CHEMHT-5	Theory: Transport processes, Applications of Thermodynamics – I, Foundation of Quantum Mechanics,	4 Credit
Physical Chemistry – II		
<p>1. Transport processes 20 L</p> <p><u>Viscosity</u>: General features of fluid flow (streamline flow and turbulent flow); Newton’s equation, viscosity coefficient; Poiseuille’s equation; Principle of determination of viscosity coefficient of liquids by falling sphere method; Temperature variation of viscosity of liquids and comparison with that of gases.</p> <p><u>Conductance and transport number</u>: Ion conductance; Conductance and measurement of conductance, cell constant, specific conductance and molar conductance; Variation of specific and equivalent conductance with dilution for strong and weak electrolytes; Kohlrausch's law of independent migration of ions; Equivalent and molar conductance at infinite dilution and their determination for strong and weak electrolytes; Debye –Huckel theory of Ion atmosphere (qualitative)-asymmetric effect, relaxation effect and electrophoretic effect; Ostwald's dilution law; Ionic mobility; Application of conductance measurement (determination of solubility product and ionic product of water); Conductometric titrations.</p>		

Transport number, Principles of Hittorf's and Moving-boundary method.

2. Applications of Thermodynamics –I **20 L**

Partial properties and chemical potential: Chemical potential and activity, partial molar quantities, relation between chemical potential and Gibb's free energy and other thermodynamic state functions; variation of chemical potential (μ) with temperature and pressure; Gibbs-Duhem equation; fugacity and fugacity coefficient; Variation of thermodynamic functions for systems with variable composition; Equations of states for these systems, Change in G, S H and V during mixing for binary solutions.

Chemical Equilibrium: Thermodynamic conditions for equilibrium, degree of advancement; Van't Hoff's reaction isotherm (deduction from chemical potential); Variation of free energy with degree of advancement; Equilibrium constant and standard Gibbs free energy change; Definitions of K_p , K_C and K_X ; Van't Hoff's reaction isobar and isochore from different standard states; Shifting of equilibrium due to change in external parameters e.g. temperature and pressure; variation of equilibrium constant with addition to inert gas; Le Chatelier's principle.

Nernst's distribution law; Application-(finding out K_{eq} using Nernst distribution law for $KI + I_2 = KI_3$ and dimerization of benzene.

Chemical potential and other properties of ideal substances-pure and mixtures:

Pure ideal gas: Its chemical potential and other thermodynamic functions and their changes during a change of thermodynamic parameters of mixing; Chemical potential of an ideal gas in an ideal gas mixture; Concept of standard states and choice of standard states of ideal gases.

Condensed Phase: Chemical potential of pure solid and pure liquids, Ideal solution-Definition, Raoult's law; Mixing properties of ideal solutions, chemical potential of a component in an ideal solution; Choice of standard states of solids and liquids.

3. Foundation of Quantum Mechanics **20 L**

Beginning of Quantum Mechanics: Wave-particle duality, light as particles: photoelectric and Compton effects; electrons as waves and the de Broglie hypothesis; Uncertainty relations (without proof).

Wave function: Schrodinger time-independent equation; nature of the equation, acceptability conditions imposed on the wave functions and probability interpretations of wave function.

Concept of Operators: Elementary concepts of operators, eigenfunctions and eigenvalues; Linear operators; Commutation of operators, commutator and uncertainty relation; Expectation value; Hermitian operator; Postulates of Quantum Mechanics.

Particle in a box: Setting up of Schrodinger equation for one-dimensional box and its solution; Comparison with free particle eigenfunctions and eigenvalues. Properties of particle in a box wave functions (normalisation, orthogonality, probability distribution); Expectation values of x , x^2 , p_x and p_x^2 and their significance in relation to the uncertainty principle; Extension of the problem to two and three dimensions and the concept of degenerate energy levels.

Reference Books

1. Atkins, P. W. & Paula, J. de Atkins', Physical Chemistry, Oxford University Press.
2. Castellan, G. W. Physical Chemistry, Narosa.
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press.
4. Levine, I. N. Physical Chemistry, Tata McGraw-Hill.
4. Rakshit, P.C., Physical Chemistry, Sarat Book House.
5. Moore, W. J. Physical Chemistry, Orient Longman.
6. Mortimer, R. G. Physical Chemistry, Elsevier.
7. Denbigh, K. The Principles of Chemical Equilibrium Cambridge

University Press. 8. Engel, T. & Reid, P. Physical Chemistry, Pearson. 9. Levine, I. N. Quantum Chemistry, PHI. 10. Atkins, P. W. Molecular Quantum Mechanics, Oxford. 11. emansky, M. W. & Dittman, R.H. Heat and Thermodynamics, Tata-McGraw-Hill. 12. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas. 13. Klotz, I.M., Rosenberg, R. M. Chemical Thermodynamics:Basic Concepts and Methods Wiley. 14. Glasstone, S. An Introduction to Electrochemistry, East-West Press.

CHEMHP-5	Practical :	2 Credit
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Physical Chemistry – II

- i. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water.
- ii. Determination of partition coefficient for the distribution of I₂ between water and CCl₄.
- iii. Determination of K_{eq} for KI + I₂ = KI₃, using partition coefficient between water and CCl₄.
- Iv. Conductometric titration of an acid (strong, weak/ monobasic, dibasic) against strong base.
- v. Study of saponification reaction conductometrically.
- vi. Verification of Ostwald's dilution law and determination of Ka of weak acid.

Reference Books

1. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009)
2. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson.
3. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007).
4. Palit, S.R., De, S. K. Practical Physical Chemistry Science Book Agency.
5. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta.
6. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd.
7. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co..Ltd.

CHEMHT-6	Theory: Chemical Bonding – I, Chemical Bonding – II, Metal extraction and purification from ores and minerals	4 Credit
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Inorganic Chemistry – II

- 1. Chemical Bonding – I: (22L)**
 Ionic Bond: Lattice energy, Born-Lande equation with derivation and importance of Kapustinskii expression for lattice energy, Born-Haber cycle and its applications, Polarising power and polarisability of ions, Fajan's rules and its applications, radius ratio rules – its applications and limitations, salvation energy and solubility energetics of dissolution process; Packing in crystals, voids in crystal lattice, packing efficiency, Structure of ionic solids: rock salt, zinc blende, wurtzite, fluorite, antiferite, perovskite and layer lattice. Qualitative idea about stoichiometric and non-stoichiometric crystal defects.
- 2. Chemical Bonding – II: (28L)**
 Covalent Bond: Lewis structures, formal charge; Qualitative idea of V.B.Theory, directional properties of covalent bond, Concept of Equivalent and non equivalent Hybridization and shapes of simple molecules and ions (examples from main groups), Stereochemically non-rigid molecules – Berry's pseudorotation, Resonance and Dipole moments of inorganic molecules and ions, VSEPR theory and Bent's rule and their applications; M.O. Theory (elementary pictorial approach), concept of bond order, MO diagram of homo-nuclear diatomics (1st and 2nd period elements), hetero-nuclear diatomics (HF, CO, NO, NO⁺ and CN⁻) and triatomics (H₂O and BeH₂). Electron sea model and elementary idea about band theory, classification of inorganic solids and their

conduction properties according to band theory; Hydrogen bonding: classifications, its effect on the properties of compounds and its importance in biological systems, vander Waal's forces.

3. Metal extraction and purification : Basic Metallurgy (10L)

Idea about ores and minerals, operations involved in metallurgy, Flow chart diagram for the extraction of pure Ti, Ni and U(including reactions) from their important ores and their uses.

Reference Books

1. Lee, J. D. Concise Inorganic Chemistry 5th Ed., John Wiley and sons 2008. 2. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson,2006. 3. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970. 4. Porterfield, H. W., Inorganic Chemistry, Second Edition, Academic Press, 2005. 5. Purecell, K.F. and Kotz, J.C., An Introduction to Inorganic Chemistry, Saunders: Philadelphia, 1980. 6. Cotton, F.A., Wilkinson, G., & Gaus, P.L. Basic Inorganic Chemistry 3rd Ed.; Wiley India. 7. Gillespie, R. J. and Hargittai, I., The VSEPR Model of Molecular Geometry, Prentice Hall (1992). 8. Albright, T., Orbital interactions in chemistry, John Wiley and Sons (2005). 9. Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998). 10. Miessler, G. L., Fischer, P. J., Tarr, D. A., Inorganic Chemistry, Pearson, 5th Edition.

CHEMHP-6	Practical :	2 Credit
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Inorganic Chemistry – II

- Estimation of Fe(II) and Fe(III) in a given mixture using $K_2Cr_2O_7$ solution
- Estimation of Fe(III) and Cu(II) in a given mixture using $K_2Cr_2O_7$ solution
- Estimation of Cr(VI) and Mn(II) in a given mixture using $K_2Cr_2O_7$ solution
- Estimation of Fe(III) and Cr(VI) in a given mixture using $K_2Cr_2O_7$ solution
- Estimation of Fe(II) and Mn(II) in a given mixture using $KMnO_4$ solution
- Estimation of Fe(III) and Ca(II) in a given mixture using $KMnO_4$ solution

Reference Books

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.

CHEMHT-7	Theory: Chemistry of alkenes and alkynes, Aromatic Substitution, Carbonyl and Related Compounds, Organometallics	4 Credit
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Organic Chemistry – III

1. Chemistry of alkenes and alkynes: (16L)

Addition to C=C: mechanism (with evidence wherever applicable), reactivity, regioselectivity (Markownikoff and anti-Markownikoff additions) and stereoselectivity; reactions: hydrogenation, halogenations, iodolactonisation, hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation, epoxidation, syn and anti-hydroxylation, ozonolysis, addition of singlet and triplet carbenes; electrophilic addition to diene (conjugated dienes and allene); radical addition: HBr addition; mechanism of allylic and benzylic bromination in competition with brominations across C=C; use of NBS; dissolving metal reduction of alkenes; interconversion of E - and Z - alkenes; contra-thermodynamic isomerization of internal alkenes.

Addition to C≡C (in comparison to C=C): mechanism, reactivity, regioselectivity (Markownikoff and anti-Markownikoff addition) and

stereoselectivity; reactions: hydrogenation, halogenations, hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation, dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes by exploring its acidity; interconversion of terminal and non-terminal alkynes.

2. **Aromatic Substitution:** (8L)

Electrophilic aromatic substitution: mechanisms and evidences in favour of it; orientation and reactivity; reactions: nitration, nitrosation, sulfonation, halogenation, Friedel-Crafts reaction; one-carbon electrophiles (reactions: chloromethylation, Gatterman-Koch, Gatterman, Houben-Hoesch, Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmidt); Ipso substitution.

Nucleophilic aromatic substitution: addition-elimination mechanism and evidences in favour of it; S_NAr mechanism; cine substitution (benzyne mechanism), structure of benzyne.

3. **Carbonyl and Related Compounds:** (30L)

Addition to C=O: structure, reactivity and preparation of carbonyl compounds; mechanism (with evidence), reactivity, equilibrium and kinetic control; Burgi-Dunitz trajectory in nucleophilic additions; formation of hydrates, cyano hydrins and bisulphite adduct; nucleophilic addition-elimination reactions with alcohols, thiols and nitrogen-based nucleophiles; reactions: benzoin condensation, Cannizzaro and Tischenko reactions, reactions with ylides: Wittig and Corey-Chaykovsky reaction; Rupe rearrangement, oxidations and reductions: Clemmensen, Wolff-Kishner, $LiAlH_4$, $NaBH_4$, MPV, Oppenauer, Bouveault-Blanc, acyloin condensation; oxidation of alcohols with PDC and PCC; periodic acid and lead tetraacetate oxidation of 1,2-diols.

Exploitation of acidity of α -H of C=O: formation of enols and enolates; kinetic and thermodynamic enolates; reactions (mechanism with evidence): halogenation of carbonyl compounds under acidic and basic conditions, Hell-Volhard-Zelinsky (H. V. Z.) reaction, nitrosation, SeO_2 (Riley) oxidation; condensations (mechanism with evidence): Aldol, Knoevenagel, Claisen-Schmidt, Claisen ester including Dieckmann, Stobbe; Mannich reaction, Perkin reaction, Favorskii rearrangement; alkylation of active methylene compounds; preparation and synthetic applications of diethyl malonate and ethyl acetoacetate; specific enol equivalents (lithium enolates, enamines, aza-enolates and silyl enol ethers) in connection with alkylation, acylation and aldol type reaction.

Elementary ideas of Green Chemistry: Twelve (12) principles of green chemistry; planning of green synthesis; common organic reactions and their counterparts: reactions: Aldol, Friedel-Crafts, Michael, Knoevenagel, Cannizzaro, benzoin condensation and Dieckmann condensation.

Nucleophilic addition to α,β -unsaturated carbonyl system: general principle and mechanism (with evidence); direct and conjugate addition, addition of enolates (Michael reaction), Stetter reaction, Robinson annulations.

Substitution at sp^2 carbon (C=O system): mechanism (with evidence): B_{AC2} , A_{AC2} , A_{AC1} , A_{AL1} (in connection to acid and ester); acid derivatives:

amides, anhydrides & acyl halides (formation and hydrolysis including comparison).

4. **Organometallics:** (6L)

Grignard reagent; Organolithiums; Gilman cuprates: preparation and reactions (mechanism with evidence); addition of Grignard and organolithium to carbonyl compounds; substitution on -COX; directed ortho metalation of arenes using organolithiums, conjugate addition by Gilman cuprates; Corey-House synthesis; abnormal behavior of Grignard reagents; comparison of reactivity among Grignard, organolithiums and organocopper reagents; Reformatsky reaction; Blaise reaction; concept of umpolung and base-nucleophile dichotomy in case of organometallic reagents.

Reference Books:

1. Clayden, J., Greeves, N., Warren, S. Organic Chemistry, Second edition, Oxford University Press 2012.
2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson Education, 2003.
3. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.
4. Carey, F. A., Giuliano, R. M. Organic Chemistry, Eighth edition, McGraw Hill Education, 2012.
5. Loudon, G. M. Organic Chemistry, Fourth edition, Oxford University Press, 2008.
6. Norman, R.O. C., Coxon, J. M. Principles of Organic Synthesis, Third Edition, Nelson Thornes, 2003.
7. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Finar, I. L. Organic Chemistry (Volume 1), Pearson Education.
9. Graham Solomons, T.W., Fryhle, C. B. Organic Chemistry, John Wiley & Sons, Inc.
10. March, J. Advanced Organic Chemistry, Fourth edition, Wiley.
11. Jenkins, P. R., Organometallic Reagents in Synthesis, Oxford Chemistry Primer, Oxford University Press.
12. Ward, R. S., Bifunctional Compounds, Oxford Chemistry Primer, Oxford University Press

CHEMHP-7

Practical :

2 Credit

Organic Chemistry – III

Qualitative Analysis of Single Solid Organic Compounds:

1. Detection of special elements (N, S, Cl, Br) by Lassaigne's test
2. Solubility and classification (solvents: H₂O, 5% HCl, 5% NaOH and 5% NaHCO₃)
3. Detection of the following functional groups by systematic chemical tests:
4. Aromatic amino (Ar-NH₂), aromatic nitro (Ar-NO₂), amido (-CONH₂, including imide), phenolic hydroxyl (Ph-OH), carboxylic acid (-COOH), carbonyl (-CHO and >C=O); only one test for each functional group is to be reported.
5. Melting point of the given compound
6. Preparation, purification and melting point determination of a crystalline derivative of the given compound
7. Identification of the compound through literature survey.

Each student, during laboratory session, is required to carry out qualitative chemical tests for all the special elements and the functional groups with relevant derivatisation in known and unknown (at least six) organic compounds

Reference Books:

1. Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003.
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).
4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
5. Clarke, H. T., A Handbook of Organic Analysis (Qualitative and Quantitative), Fourth Edition, CBS Publishers and Distributors (2007).
6. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015.

CHEMHS – 1A**IT skills for Chemist****2 Credit****1. Mathematics****(10L)**

- i. Fundamentals, mathematical functions, polynomial expressions, logarithms, the exponential function, units of a measurement, interconversion of units, constants and variables, equation of a straight line, plotting graphs.
- ii. Uncertainty in experimental techniques: Displaying uncertainties, measurements in chemistry, decimal places, significant figures, combining quantities.
- iii. Uncertainty in measurement: types of uncertainties, combining uncertainties. Statistical treatment. Mean, standard deviation, relative error. Data reduction and the propagation of errors. Graphical and numerical data reduction. Numerical curve fitting: the method of least squares (regression).
- iv. Algebraic operations on real scalar variables (e.g. manipulation of van der Waals equation in different forms). Roots of quadratic equations analytically and iteratively (e.g. pH of a weak acid). Numerical methods of finding roots (Newton-Raphson, binary –bisection, e.g. pH of a weak acid not ignoring the ionization of water, volume of a van der Waals gas, equilibrium constant expressions).
- v. Differential calculus: The tangent line and the derivative of a function, numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).
- vi. Numerical integration (Trapezoidal and Simpson's rule, e.g. entropy/enthalpy change from heat capacity data).

2. Computer programming**(10L)**

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis. BASIC programs for curve fitting, numerical differentiation and integration (Trapezoidal rule, Simpson's rule), finding roots (quadratic formula, iterative, Newton-Raphson method).

3. Hands On**(10L)**

- i. Introductory writing activities: Introduction to word processor and structure drawing (ChemSketch) software. Incorporating chemical structures, chemical equations, and expressions from chemistry (e.g. Maxwell-Boltzmann distribution law, Bragg's law, van der Waals equation, etc.) into word processing documents.
- ii. Handling numeric data: Spreadsheet software (Excel), creating a spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs. Incorporating tables and graphs into word processing documents. Simple calculations, plotting graphs using a

- spreadsheet (Planck's distribution law, radial distribution curves for hydrogenic orbitals, gas kinetic theory- Maxwell-Boltzmann distribution curves as function of temperature and molecular weight), spectral data, pressure-volume curves of van der Waals gas (van der Waals isotherms), data from phase equilibria studies. Graphical solution of equations.
- iii. Numeric modelling: Simulation of pH metric titration curves. Excel functions LINEST and Least Squares. Numerical curve fitting, linear regression (rate constants from concentration- time data, molar extinction coefficients from absorbance data), numerical differentiation (e.g. handling data from potentiometric and pH metric titrations, pKa of weak acid), integration (e.g. entropy/enthalpy change from heat capacity data).
 - iv. Statistical analysis: Gaussian distribution and Errors in measurements and their effect on data sets. Descriptive statistics using Excel. Statistical significance testing: The t test. The F test.
 - v. Presentation: Presentation graphics

Reference Books

1. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008).
2. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005).
3. Steiner, E. The Chemical Maths Book Oxford University Press (1996).
4. Yates, P. Chemical calculations. 2nd Ed. CRC Press (2007).
5. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.
6. Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis, Cambridge Univ. Press (2001) 487 pages.
7. Noggle, J. H. Physical chemistry on a Microcomputer. Little Brown & Co. (1985).
8. Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996).

CHEMHS – 1B

Basic Analytical Chemistry

2 Credit

1. Introduction (2L)

Strategies of Analytical Chemistry and its interdisciplinary applicability. Protocol of sampling. Variability and validity of analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

2. Complexometry (4L)

Complexometric titrations, Chelation, Chelating agents, use of indicators. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Soil Analysis

Composition, pH of soil samples, estimation of calcium and magnesium content.

3. Analysis of water (4L)

Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

Determination of pH, acidity and alkalinity of a water sample.

Determination of Biological Oxygen Demand (BOD).

4. Analysis of food products (4L)

Nutritional value of foods, idea about food processing and food preservations and adulteration.

Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

Analysis of preservatives and colouring matter.

5. Chromatography (4L)

Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

	Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}). To compare paint samples by TLC method.	
6. Ion-exchange	Column, ion-exchange chromatography etc. 2. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).	(4L)
7. Analysis of cosmetics	Major and minor constituents and their function Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration	(3L)
8. Suggested Applications (Any one)	To study the use of phenolphthalein in trap cases. To analyse arson accelerants. To carry out analysis of gasoline.	(2L)
9. Suggested Instrumental demonstrations	Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drinks	(3L)
Reference Books		
1. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988. 2. Skoog, D.A., Holler, F.J. & Crouch, S. Principles of Instrumental Analysis, Cengage Learning India Edition, 2007. 3. Skoog, D.A.; West, D.M. & Holler, F.J. Analytical Chemistry: An Introduction 6th Ed., Saunders College Publishing, Fort Worth, Philadelphia (1994). 4. Harris, D. C. Quantitative Chemical Analysis, 9th ed. Macmillan Education, 2016. 5. Dean, J. A. Analytical Chemistry Handbook, McGraw Hill, 2004. 6. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India, 1992. 7. Freifelder, D.M. Physical Biochemistry 2nd Ed., W.H. Freeman & Co., N.Y. USA (1982). 8. Cooper, T.G. The Tools of Biochemistry, John Wiley & Sons, N.Y. USA. 16 (1977). 9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall, 1996. 10. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. 11. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc., New York (1995). 12. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.		

Semester - IV

CHEMHT-8	Theory: Application of Thermodynamics – II, Electrical Properties of molecules, Quantum Chemistry,	4 Credit
Physical Chemistry – III		
1. Application of Thermodynamics – II <u>Colligative properties:</u> Vapour pressure of solution; Ideal solutions, ideally dilute solutions and colligative properties; Raoult's law; Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) Osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution; Abnormal colligative properties. <u>Phase rule:</u> Definitions of phase, component and degrees of freedom; Phase rule and its derivations; Definition of phase diagram; Phase diagram for water, CO_2 , Sulphur. First order phase transition and Clapeyron equation; Clausius-Clapeyron equation -		20 L

derivation and use; Liquid vapour equilibrium for two component systems; Phenol-water system.

Three component systems, water-chloroform-acetic acid system, triangular plots.

Binary solutions: Ideal solution at fixed temperature and pressure; Principle of fractional distillation; Duhem-Margules equation; Henry's law; Konowaloff's rule; Positive and negative deviations from ideal behavior; Azeotropic solution; Liquid-liquid phase diagram using phenol-water system; Solid-liquid phase diagram; Eutectic mixture.

2. Electrical Properties of molecules

20 L

Ionic equilibria: Chemical potential of an ion in solution; Activity and activity coefficients of ions in solution; Debye-Huckel limiting law-brief qualitative description of the postulates involved, qualitative idea of the model, the equation (without derivation) for ion-ion atmosphere interaction potential. Estimation of activity coefficient for electrolytes using Debye-Huckel limiting law; Derivation of mean ionic activity coefficient from the expression of ion-atmosphere interaction potential; Applications of the equation and its limitations.

Electromotive Force: Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry; Chemical cells, reversible and irreversible cells with examples; Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass electrodes.

Concentration cells with and without transference, liquid junction potential; Determination of activity coefficients and transference numbers; Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

Dipole moment and polarizability: Polarizability of atoms and molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules; Clausius-Mosotti equation and Debye equation (both without derivation) and their application; Determination of dipole moments.

3. Quantum Chemistry

20 L

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component; Rigid rotator model of rotation of diatomic molecule; Schrödinger equation, transformation to spherical polar coordinates; Separation of variables.

Qualitative treatment of hydrogen atom and hydrogen-like ions: Setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression); Average and most probable distances of electron from nucleus; Setting up of Schrödinger equation for many-electron atoms (He, Li).

LCAO and HF-SCF: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+ ; Bonding and antibonding orbitals; Qualitative extension to H_2 ; Comparison of LCAO-MO and VB treatments of H_2 and their limitations; Hartree-Fock method development, SCF and configuration interaction (**only basics**).

Reference Books

1. Castellan, G. W. Physical Chemistry, Narosa.
2. Atkins, P. W. & Paula, J. de Atkins', Physical Chemistry, Oxford University Press.
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, VivaPress.
4. Levine, I. N. Physical Chemistry, Tata McGraw-Hill.
5. Moore, W. J. Physical Chemistry, Orient Longman.
- 6.

Mortimer, R. G. Physical Chemistry, Elsevier. 7. Engel, T. & Reid, P. Physical Chemistry, Pearson. 8. Levine, I. N. Quantum Chemistry, PHI. 9. Atkins, P. W. Molecular Quantum Mechanics, Oxford. 10. Engel, T. & Reid, P. Physical Chemistry, Pearson. 11. Maron, S.H., Prutton, C. F., Principles of Physical Chemistry, McMillan. 12. Klotz, I.M., Rosenberg, R. M. Chemical Thermodynamics: Basic Concepts and Methods Wiley. 13. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas. 14. Glasstone, S. An Introduction to Electrochemistry, East-West Press.

CHEMHP-8	Practical :	2 Credit
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Physical Chemistry – III

- Determination of solubility of sparingly soluble salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator).
- Potentiometric titration of Mohr's salt solution against standard $K_2Cr_2O_7$ -solution.
- Determination of K_{sp} for AgCl by potentiometric titration of $AgNO_3$ solution against standard KCl solution.
- Effect of ionic strength on the rate of Persulphate –Iodide reaction.
- Study of phenol-water phase diagram.
- pH-metric titration of acid (mono-and di-basic) against strong base.

Reference Books

1. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009). 2. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson. 3. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007). 4. Palit, S.R., De, S. K. Practical Physical Chemistry Science Book Agency. 5. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta. 6. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd. 7. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.

CHEMHT-9	Theory: Radioactivity and nuclear chemistry, Chemistry of s and p-block elements, Coordination Chemistry - I	4 Credit
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Inorganic Chemistry – III

- Radioactivity and nuclear chemistry : (15L)**
Atomic nucleus – nuclear stability, n/p ratio and different modes of decay, mass defect, packing fraction and nuclear binding energy. Nuclear forces: Meson exchange theory, elementary idea of nuclear shell model and magic numbers. Fission, fusion and spallation reactions, artificial radioactivity, super heavy elements and their IUPAC nomenclature. Moderators, slow and fast neutrons, Applications of radio-isotopes in: determination of structures, establishment of reaction mechanisms and radio-carbon dating, hazards of radiation and safety measures.
- Chemistry of s and p-block elements : (30L)**
Diagonal relationship (Li-Mg; B-Si) and anomalous behaviour of first member of each group, Allotropy and catenation (examples of C, P and S compounds). Study of the following compounds with emphasis on preparation, properties, structure and bonding: Beryllium hydrides and halides; diborane; borazine; boron nitride, boric acid, borax, fluorocarbons (with environmental effect); oxides and oxyacids of nitrogen, phosphorous, sulphur and chlorine; Peroxo acids of sulphur; tetrasulphur tritranitride; interhalogens, pseudohalogens, polyhalides, fluorides and oxides of xenon. Noble gas clathrates; basic properties of iodine. Synthesis, structural aspects and applications of silicones and phosphazines;

Structural properties of various silicates.		
3. Coordination Chemistry - I :		(15L)
Idea about double salts and complex salts, Werner's theory, EAN rule, classification of ligands and their binding modes, IUPAC nomenclature of coordination compounds (up to two metal centres), overall and stepwise stability constants, chelates, innermetallic complexes, Stereochemistry and isomerism (constitutional and stereo) of complexes with coordination no. 4 and 6.		
Reference Books		
1. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006. 2. Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann, 1997. 3. Cotton, F.A., Wilkinson, G., Murrillo, C. A., Bochmann, M., Advanced Inorganic Chemistry 6th Ed. 1999., Wiley. 4. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson, 2010. 5. Purecell, K.F. and Kotz, J.C., An Introduction to Inorganic Chemistry, Saunders: Philadelphia, 1980. 6. Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998).		
CHEMHP-9	Practical :	2 Credit
Inorganic Chemistry – III		
<p>A. Complexometric Titration :</p> <ul style="list-style-type: none"> i. Estimation of Hardness of water ii. Estimation of Ca(II) and Mg(II) in a mixture iii. Estimation of Zn(II) and Mg(II) in a mixture <p>B. Inorganic Preparation :</p> <ul style="list-style-type: none"> i. Mohr's salt ii. Potassium tris(oxalato)chromate(III) trihydrate iii. Tetraamminecarbonatocobalt(III) nitrate iv. Potassiumbis(oxalato)cuprate(II) dihydrate v. Tris(ethylenediamine)nickel(II) chloride 		
Reference Book		
1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.		
CHEMHT-10	Theory: Nitrogen compounds, Rearrangements, The Logic of Organic Synthesis, Organic Spectroscopy,	4 Credit
Organic Chemistry – IV		
1. Nitrogen compounds:		(8L)
<p>Amines: Aliphatic & Aromatic: preparation, separation (Hinsberg's method) and identification of primary, secondary and tertiary amines; reaction (with mechanism): Eschweiler-Clarke methylation, diazo coupling reaction, Mannich reaction; formation and reactions of phenylenediamines, diazomethane and diazoacetic ester.</p> <p>Nitro compounds (aliphatic and aromatic): preparation and reaction (with mechanism): reduction under different conditions; Nef carbonyl synthesis, Henry reaction and conjugate addition of nitroalkane anion.</p> <p>Alkyl nitrile and isonitrile: preparation and reaction (with mechanism): Thorpe nitrile condensation, von Richter reaction.</p> <p>Diazonium salts and their related compounds: reactions (with mechanism) involving replacement of diazo group; reactions: Gomberg, Meerwein, Japp-Klingermann.</p>		

2. **Rearrangements: Mechanism with evidence and stereochemical features for the following:** (10L)

Rearrangement to electron-deficient carbon: Wagner-Meerwein rearrangement, pinacol rearrangement, dienone-phenol; Wolff rearrangement in Arndt-Eistert synthesis, benzil-benzilic acid rearrangement, Demjanov rearrangement, Tiffeneau–Demjanov rearrangement.

Rearrangement to electron-deficient nitrogen: rearrangements: Hofmann, Curtius, Lossen, Schmidt and Beckmann.

Rearrangement to electron-deficient oxygen: Baeyer-Villiger oxidation, cumene hydroperoxide-phenol rearrangement and Dakin reaction.

Aromatic rearrangements: Migration from oxygen to ring carbon: Fries rearrangement and Claisen rearrangement.

Migration from nitrogen to ring carbon: Hofmann-Martius rearrangement, Fischer-Hepp rearrangement, N-azo to C-azo rearrangement, Bamberger rearrangement, Orton rearrangement and benzdine rearrangement.

Rearrangement reactions by green approach: Fries rearrangement, Claisen rearrangement, Beckmann rearrangement, Baeyer-Villiger oxidation.

3. **The Logic of Organic Synthesis:** (20L)

Retrosynthetic analysis: disconnections; synthons, donor and acceptor synthons; natural reactivity and umpolung; latent polarity in bifunctional compounds: consonant and dissonant polarity; illogical electrophiles and nucleophiles; synthetic equivalents; functional group interconversion and addition (FGI and FGA); C-C disconnections and synthesis: one-group and two-group (1,2- to 1,5-dioxygenated compounds), reconnection (1,6-dicarbonyl); protection-deprotection strategy (alcohol, amine, carbonyl, acid).

Strategy of ring synthesis: thermodynamic and kinetic factors; synthesis of large rings, application of high dilution technique.

Asymmetric synthesis: stereoselective and stereospecific reactions; diastereoselectivity and enantioselectivity (only definition); enantioselectivity: kinetically controlled MPV reduction; diastereoselectivity: addition of nucleophiles to C=O adjacent to a stereogenic centre: Felkin-Anh and Zimmermann-Traxler models.

4. **Organic Spectroscopy:** (22L)

UV Spectroscopy: introduction; types of electronic transitions, end absorption; transition dipole moment and allowed/forbidden transitions; chromophores and auxochromes; Bathochromic and Hypsochromic shifts; intensity of absorptions (Hyper-/Hypochromic effects); application of Woodward's Rules for calculation of λ_{\max} for the following systems: conjugated diene, α,β -unsaturated aldehydes and ketones (alicyclic, homoannular and heteroannular); extended conjugated systems (dienes, aldehydes and ketones); relative positions of λ_{\max} considering conjugative effect, steric effect, solvent effect, effect of pH; effective chromophore concentration: keto-enol systems; benzenoid transitions.

IR Spectroscopy: introduction; modes of molecular vibrations

(fundamental and non-fundamental); IR active molecules; application of Hooke's law, force constant; fingerprint region and its significance; effect of deuteration; overtone bands; vibrational coupling in IR; characteristic and diagnostic stretching frequencies of C-H, N-H, O-H, C-O, C-N, C-X, C=C (including skeletal vibrations of aromatic compounds), C=O, C=N, N=O, C≡C, C≡N; characteristic/diagnostic bending vibrations are included; factors affecting stretching frequencies: effect of conjugation, electronic effects, mass effect, bond multiplicity, ring-size, solvent effect, H-bonding on IR absorptions; application in functional group analysis.

NMR Spectroscopy: introduction; nuclear spin; NMR active molecules; basic principles of Proton Magnetic Resonance; equivalent and non-equivalent protons; chemical shift and factors influencing it; ring current effect; significance of the terms: up-/downfield, shielded and deshielded protons; spin coupling and coupling constant (1st order spectra); relative intensities of first-order multiplets: Pascal's triangle; chemical and magnetic equivalence in NMR; elementary idea about non-first-order splitting; anisotropic effects in alkene, alkyne, aldehydes and aromatics; NMR peak area, integration; relative peak positions with coupling patterns of common organic compounds (both aliphatic and benzenoid-aromatic); rapid proton exchange; interpretation of NMR spectra of simple compounds.

Applications of IR, UV and NMR spectroscopy for identification of simple organic molecules.

Reference Books

1. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Norman, R.O. C., Coxon, J. M. Principles of Organic Synthesis, Third Edition, Nelson Thornes, 2003.
4. Clayden, J., Greeves, N., Warren, S., Organic Chemistry, Second edition, Oxford University Press 2012.
5. Silverstein, R. M., Bassler, G. C., Morrill, T. C. Spectrometric Identification of Organic Compounds, John Wiley and Sons, INC, Fifth edition.
6. Kemp, W. Organic Spectroscopy, Palgrave.
6. Pavia, D. L. et al. Introduction to Spectroscopy, 5th Ed. Cengage Learning India Ed. (2015).
7. Dyer, J. Application of Absorption Spectroscopy of Organic Compounds, PHI Private Limited.
8. March, J. Advanced Organic Chemistry, Fourth edition, Wiley.
9. Harwood, L. M., Polar Rearrangements, Oxford Chemistry Primer, Oxford University Press.
10. Bailey, Morgan, Organonitrogen Chemistry, Oxford Chemistry Primer, Oxford University Press.
11. Warren, S. Organic Synthesis the Disconnection Approach, John Wiley and Sons.
12. Warren, S., Designing Organic Synthesis, Wiley India, 2009.
13. Carruthers, W. Modern methods of Organic Synthesis, Cambridge University Press.
14. Willis, C. A., Wills, M., Organic Synthesis, Oxford Chemistry Primer, Oxford University Press.

CHEMHP-10	Practical :	2 Credit
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Organic Chemistry – IV

List of Practical

- i. Estimation of glycine by Sørensen's formol method
- ii. Estimation of glucose by titration using Fehling's solution
- iii. Estimation of sucrose by titration using Fehling's solution
- iv. Estimation of vitamin-C (reduced)

- v. Estimation of aromatic amine (aniline) by bromination (Bromate-Bromide) method
- vi. Estimation of phenol by bromination (Bromate-Bromide) method
- vii. Estimation of formaldehyde (Formalin)
- viii. Estimation of acetic acid in commercial vinegar
- ix. Estimation of urea (hypobromite method)
- x. Estimation of saponification value of oil/fat/ester

Reference Books:

1. Arthur, I. V. Quantitative Organic Analysis, Pearson
2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta

CHEMHS – 2A

Pharmaceutical Chemistry

2 Credit

1. Drugs & Pharmaceuticals: (16L)

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

2. Fermentation: (6L)

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

3. Hands On Practical: (8L)

Preparation of Aspirin and its analysis.
Preparation of magnesium bisilicate (Antacid).

Reference Books

1. Patrick, G. L. Introduction to Medicinal Chemistry, Oxford University Press, UK, 2013.
2. Singh, H. & Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi, 2012.
3. Foye, W.O., Lemke, T.L. & William, D.A.: Principles of Medicinal Chemistry, 4th ed., B.I. Waverly Pvt. Ltd. New Delhi.

CHEMHS – 2B

Analytical clinical Biochemistry

2 Credit

1. Review of Concepts from Core Course (8L)

Carbohydrates: Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle. Isolation and characterization of polysachharides.

Proteins: Classification, biological importance; Primary and secondary and tertiary structures of proteins: α -helix and β -pleated sheets, Isolation, characterization, denaturation of proteins.

Enzymes: Nomenclature, Characteristics (mention of Ribozymes), and Classification; Active site, Mechanism of enzyme action, Stereospecificity of

enzymes, Coenzymes and cofactors, Enzyme inhibitors, Introduction to Biocatalysis: Importance in “Green Chemistry” and Chemical Industry.

Lipids: Classification. Biological importance of triglycerides and phosphoglycerides and cholesterol; Lipid membrane, Liposomes and their biological functions and underlying applications. Lipoproteins. Properties, functions and biochemical functions of steroid hormones. Biochemistry of peptide hormones.

2. Biochemistry of disease: A diagnostic approach by blood/ urine analysis.(12L)

Blood: Composition and functions of blood, blood coagulation. Blood collection and preservation of samples. Anaemia, Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin.

Urine: Sampling and preservation, composition and estimation of constituents of normal and pathological urine.

3. Hands On Practical (10L)

Identification and estimation of the following:

- i. Carbohydrates – qualitative and quantitative.
- ii. Lipids – qualitative.
- iii. Determination of the iodine number of oil.
- iv. Determination of the saponification number of oil.
- v. Determination of cholesterol using Liebermann- Burchard reaction.
- vi. Proteins – qualitative.
- vii. Isolation of protein.
- viii. Determination of protein by the Biuret reaction.
- ix. Determination of nucleic acids

Reference Books

1.Cooper, T.G. Tool of Biochemistry. Wiley-Blackwell (1977). 2. Wilson, K. & Walker, J. Practical Biochemistry. Cambridge University Press (2009). 3. Varley, H., Gowenlock, A.H & Bell, M.: Practical Clinical Biochemistry, Heinemann, London (1980). 4. Devlin, T.M., Textbook of Biochemistry with Clinical Correlations, John Wiley & Sons, 2010. 5. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, W.H. Freeman, 2002. 6. Talwar, G.P. & Srivastava, M. Textbook of Biochemistry and Human Biology, 3rd Ed. PHI Learning. 7. Nelson, D.L. & Cox, M.M. Lehninger Principles of Biochemistry, W.H. Freeman, 2013. 8. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods, D. Van Nostrand & Co., 1961.

Semester - V

CHEMHT-11	Theory: Coordination Chemistry – II, Magnetochemistry, Chemistry of d- and f-block elements, Reaction Kinetics and Mechanism	4 Credit
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Inorganic Chemistry – IV

1. Coordination Chemistry – II : (28L)

Structure and bonding of coordination compounds on the basis of V.B.Theory and its limitations. Elementary idea about CFT, splitting of d^n configuration in ML_4 to ML_6 and ML_8 systems, factors affecting Δ , measurement of Δ_o , spectrochemical series of ligands, CFSE in weak and strong fields, OSSE, High spin and low spin complexes, spin isomerism, tetragonal distortion, Jahn Teller theorem and applications, achievements and limitations of CFT, nephelauxetic effect, stabilisation of unusually high and low oxidation states of 3d series elements, MOT (elementary idea), σ and π bonding in octahedral complexes (a pictorial approach). Colour and electronic spectra of complexes: selection rules for electronic transitions, d-d transition, charge transfer transition (qualitative

idea), L-S coupling and R-S ground state term for atomic no. up to 30, qualitative ORGEL diagram for $3d^1 - 3d^9$ ions with appropriate symbols for the energy levels.

- 2. Magnetochemistry :** (12L)
 Classification of magnetic substances, Origin of para magnetic moments, temperature dependence of para magnetism – Curie and Curie-Weiss law, TIP, magnetic susceptibility and its measurement (Gouy method), diamagnetic correction, effective magnetic moment, spin only moment for 3d metals, Orbital contribution to magnetic moment, spin-orbit coupling, quenching of orbital contribution, Sub-normal magnetic moments and antiferromagnetic interactions (elementary idea with examples).
- 3. Chemistry of d- and f-block elements :** (12L)
d-block elements: Characteristic properties, Comparison among the elements of 3d series with reference to electronic configuration, oxidation states and E^0 values; General comparison between 3d, 4d and 5d series elements in term of electronic configuration, oxidation states, atomization energy, magnetic properties and coordination chemistry.
f-block elements: Comparison between d and f-block elements; Electronic configuration, oxidation states, variation of magnetic properties (Ln^{3+}), atomic and ionic(3+) radii of lanthanoids; consequences of lanthanide contraction, separation of lanthanides by ion exchange and solvent extraction methods; comparison between lanthanoids and actinoids.
- 4. Reaction Kinetics and Mechanism:** (8L)
 Introduction to inorganic reaction mechanisms, substitution reactions in square planar complexes; *trans*-effect - theories and applications; lability and inertness in octahedral complexes towards substitution reactions. Elementary concept of *cis*-effect.

Reference Books

1. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006. 2. Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann. 1997. 3. Cotton, F.A., Wilkinson, G., Murrillo, C. A., Bochmann, M., Advanced Inorganic Chemistry 6th Ed. 1999., Wiley. 4. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010). 5. Purecell, K.F. and Kotz, J.C., An Introduction to Inorganic Chemistry, Saunders: Philadelphia, 1980. 6. Sinha, S. P., Ed., Lanthanide and Actinide Research (Journal, Vol. 1, 1986). 7. Wulfsberg, G., Principles of Descriptive Inorganic Chemistry, Brooks/Cole: Monterey, CA, 1987.

CHEMHP-11	Practical :	2 Credit
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Inorganic Chemistry – IV

- A. Quantitative:**
- i. Estimation of available chlorine in bleaching powder using iodometry
 - ii. Estimation of available oxygen in pyrolusite using permanganometry
 - iii. Estimation of Cu in brass using iodometry
 - iv. Estimation of Fe in cement using permanganometry
 - v. Estimation of chloride gravimetrically
 - vi. Estimation of Ni(II) using DMG gravimetrically
- B. Experiment :**
- i. Paper chromatographic separation of Ni(II) and Co(II)
 - ii. Measurement of 10Dq by spectrophotometric method
 - iii. Preparation of $Mn(acac)_3$ and determination of its λ_{max} colorimetrically

Reference Book		
1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.		
CHEMHT-12	Theory: Molecular Spectroscopy, Photochemistry, Surface phenomenon,	4 Credit
Physical Chemistry – IV		
1. Molecular Spectroscopy		24 L
Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation <u>Rotation spectroscopy</u> : Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution. <u>Vibrational spectroscopy</u> : Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies; Diatomic vibrating rotator, P, Q, R branches. <u>Raman spectroscopy</u> : Qualitative treatment of Rotational Raman effect; Vibrational Raman spectra, Stokes and anti-Stokes lines. <u>Nuclear Magnetic Resonance (NMR) spectroscopy</u> : Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra. <u>Electron Spin Resonance (ESR) spectroscopy</u> : Its principle, ESR of simple radicals.		
2. Photochemistry		18 L
<u>Lambert-Beer's law</u> : Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients; Laws of photochemistry, Stark-Einstein law of photochemical equivalence quantum yield, actinometry, examples of low and high quantum yields. <u>Photochemical Processes</u> : Potential energy curves (diatomic molecules), Frank-Condon principle and vibrational structure of electronic spectra; Bond dissociation and principle of determination of dissociation energy (ground state); Decay of excited states by radiative and non-radiative paths; Pre-dissociation; Fluorescence and phosphorescence, Jablonskii diagram. <u>Rate of Photochemical processes</u> : Photochemical equilibrium and the differential rate of photochemical reactions, Photostationary state; HI decomposition, H ₂ -Br ₂ reaction, dimerisation of anthracene; photosensitised reactions, quenching; Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.		
3. Surface phenomenon		18 L
<u>Surface tension and energy</u> : Surface tension, surface energy, excess pressure, capillary rise and surface tension; Work of cohesion and adhesion, spreading of liquid over other surface; Vapour pressure over curved surface; Temperature dependence of surface tension. <u>Adsorption</u> : Physical and chemical adsorption; Freundlich and Langmuir adsorption isotherms; multilayer adsorption and BET isotherm (no derivation required); Gibbs adsorption isotherm and surface excess; Heterogenous catalysis (single reactant); Zero order and fractional order reactions. <u>Colloids</u> : Lyophobic and lyophilic sols, Origin of charge and stability of lyophobic colloids, coagulation and Schultz-Hardy rule, Zeta potential and Stern double layer (qualitative idea), Tyndall effect; Electrokinetic phenomena (qualitative idea only); Determination of Avogadro number by Perrin's method; Stability of colloids and zeta potential; Micelle formation.		

Reference Books

1. Castellan, G. W. Physical Chemistry, Narosa. 2. Levine, I. N. Physical Chemistry, Tata McGraw-Hill. 3. Atkins, P. W. & Paula, J. de Atkin's, Physical Chemistry, Oxford University Press. 4. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press. 5. Mortimer, R. G. Physical Chemistry, Elsevier. 6. Laidler, K. J. Chemical Kinetics, Pearson. 7. Banwell, C. N. Fundamentals of Molecular Spectroscopy, Tata-McGraw-Hill. 8. Barrow, G. M. Molecular Spectroscopy, McGraw-Hill. 9. Hollas, J.M. Modern Spectroscopy, Wiley India. 10. McHale, J. L. Molecular Spectroscopy, Pearson Education. 11. Wayne, C. E. & Wayne, R. P. Photochemistry, OUP. 12. Brown, J. M. Molecular Spectroscopy, OUP. 13. Levine, I. N. Quantum Chemistry, PHI. 14. Atkins, P. W. Molecular Quantum Mechanics, Oxford.

CHEMHP-12	Practical :	2 Credit
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Physical Chemistry – IV

- Determination of surface tension of a liquid using Stalagmometer.
- Determination of CMC from surface tension measurements.
- Verification of Beer and Lambert's Law for KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ solution.
- Study of kinetics of $\text{K}_2\text{S}_2\text{O}_8 + \text{KI}$ reaction, spectrophotometrically.
- Determination of pH of unknown buffer, spectrophotometrically.
- Spectrophotometric determination of CMC.

Reference Books

1. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009).
 2. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson. 3. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007.). 4. Palit, S.R., De, S. K. Practical Physical Chemistry Science Book Agency. 5. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta. 6. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd. 7. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.

CHEMHTDSE-1A	Theory: Introduction, Functionality and its importance, Kinetics of Polymerization, Crystallization and crystallinity, Nature and structure of polymers, molecular weight of polymers, T_g, Solubility and Properties	4 Credit
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Polymer Chemistry

- Introduction and history of polymeric materials** **4 L**
Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.
- Functionality and its importance** **6 L**
Criteria for synthetic polymer formation, classification of polymerization processes, relationships between functionality, extent of reaction and degree of polymerization. Bi-functional systems, Poly-functional systems.
- Kinetics of Polymerization** **8 L**
Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations.
- Crystallization and crystallinity** **4 L**
Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.
- Nature and structure of polymers** **4 L**
Structure Property relationships.

6. Determination of molecular weight of polymers	6 L
(M _n , M _w , etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.	
7. Glass transition temperature (T_g) and determination of T_g	4 L
Free volume theory, WLF equation, Factors affecting glass transition temperature (T _g).	
8. Polymer Solution	10 L
Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Lower and Upper critical solution temperatures.	
9. Properties of Polymer	14 L
(Physical, thermal, Flow & Mechanical Properties)	
<u>Brief introduction to preparation, structure, properties and application of the following polymers:</u> polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, Polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].	
Reference Book	
1. R.B. Seymour & C.E. Carraher: Polymer Chemistry: An Introduction, Marcel Dekker, Inc. New York, 1981. 2. G. Odian: Principles of Polymerization, 4th Ed. Wiley, 2004. 3. F.W. Billmeyer: Textbook of Polymer Science, 2nd Ed. Wiley Interscience, 1971. 4. P. Ghosh: Polymer Science & Technology, Tata McGraw-Hill Education, 1991. 5. R.W. Lenz: Organic Chemistry of Synthetic High Polymers. Interscience Publishers, New York, 1967.	
CHEMHPDSE-1A	Practical : 2 Credit
Polymer Chemistry	
1. Polymer Synthesis	
a. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA).	
b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutyronitrile (AIBN)	
c. Preparation of nylon 66/6.	
2. Polymer characterization	
a. Determination of molecular weight by viscometry:	
i. Polyacrylamide-aq. NaNO ₂ solution	
ii. Poly vinyl propylidene (PVP) in water	
b. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer.	
c. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).	
d. Determination of hydroxyl number of a polymer using colorimetric method.	
3. Polymer analysis	
a. Estimation of the amount of HCHO in the given solution by sodium sulphite method.	

Reference Books

1. M.P. Stevens, Polymer Chemistry: An Introduction, 3rd Ed., Oxford University Press, 1999. 2. H.R. Allcock, F.W. Lampe & J.E. Mark, Contemporary Polymer Chemistry, 3rd ed. Prentice-Hall (2003). 3. F.W. Billmeyer, Textbook of Polymer Science, 3rd ed. Wiley-Interscience (1984). 4. J.R. Fried, Polymer Science and Technology, 2nd ed. Prentice-Hall (2003). 5. P. Munk & T.M. Aminabhavi, Introduction to Macromolecular Science, 2nd ed. John Wiley & Sons (2002). 6. L. H. Sperling, Introduction to Physical Polymer Science, 4th ed. John Wiley & Sons (2005). 7. M.P. Stevens, Polymer Chemistry: An Introduction 3rd ed. Oxford University Press (2005). 8. Seymour/Carraher's Polymer Chemistry, 9th ed. by Charles E. Carraher, Jr. (2013).

CHEMHTDSE-1B	Theory: Silicate Industries, Fertilizers, Surface Coatings, Batteries, Alloys, Catalysis and explosives	4 Credit
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Inorganic Materials of Industrial Importance

- 1. Silicate Industries (9L)**
 - i. Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.
 - ii. Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.
 - iii. Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.
- 2. Fertilizers (9L)**
Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.
- 3. Surface Coatings (9L)**
Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Pigments, toners and laker pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Water and Oil paints, additives, Metallic coatings (electrolytic and electroless),
- 4. Batteries (9L)**
Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.
- 5. Alloys (9L)**
Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation).. Composition and properties of different types of steels.
- 6. Catalysis (9L)**
General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.

7. Chemical explosives (6L)	
Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.	
Reference Books	
1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK. 2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi. 3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi. 4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi. 5. P. C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi. 6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi. 7. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996)	
CHEMHPDSE-1B	Practical : 2 Credit
Inorganic Materials of Industrial Importance	
List of Practicals	
<ol style="list-style-type: none"> 1. Determination of free acidity in ammonium sulphate fertilizer. 2. Estimation of Calcium in Calcium ammonium nitrate fertilizer. 3. Estimation of phosphoric acid in superphosphate fertilizer. 4. Electroless metallic coatings on ceramic and plastic material. 5. Determination of composition of dolomite (by complexometric titration). 6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples. 7. Analysis of Cement. 8. Preparation of pigment (zinc oxide). 	
Reference Books	
1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK. 2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi. 3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi. 4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi. 5. P. C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi. 6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi. 7. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996)	
CHEMHTDSE-2A	Theory: Qualitative and quantitative, Optical methods of analysis. Thermal and Electroanalytical methods of analysis. Separation techniques 4 Credit
Analytical Methods in Chemistry	
<ol style="list-style-type: none"> 1. Qualitative and quantitative aspects of analysis (10L) Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution of errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals 2. Optical methods of analysis (20L) <ol style="list-style-type: none"> i. Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. ii. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; 	

iii. Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

iv. Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution.

v. Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, and detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

3. Thermal methods of analysis (8L)

Theory of thermogravimetry (TG), instrumentation. Composition determination of Ca and Mg from their mixture.

4. Electroanalytical methods (10L)

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

5. Separation techniques (12L)

i. Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation.

ii. Technique of extraction: batch, continuous and counter current extractions.

iii. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.

iv. Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange.

v. Development of chromatograms: frontal, elution and displacement methods.

vi. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

vii. Separation and analysis using GC and HPLC (dye and pesticide analysis)

viii. Role of computers in instrumental methods of analysis

Reference Books

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
2. Willard, H.H. Et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, D.C.: Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.
6. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
7. Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
8. Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974.

CHEMHPDSE-2A	Practical :	2 Credit
Analytical Methods in Chemistry		
<p>1. Separation Techniques – Chromatography</p> <p>i. Separation of mixtures Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the RF values.</p> <p>ii. Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their RF values.</p> <p>iii. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC</p> <p>2. Solvent Extractions To separate a mixture of Ni²⁺ & Fe²⁺ by complexation with DMG and extracting the Ni²⁺ - DMG complex in chloroform, and determine its concentration by spectrophotometry.</p> <p>3. Ion exchange: Determination of exchange capacity of cation exchange resins and anion exchange resins.</p> <p>4. Spectrophotometry</p> <p>i. Determination of pK_a values of indicator using spectrophotometry</p> <p>ii. Analysis of soil: a. Determination of pH of soil. b. Total soluble salt c. Estimation of calcium / magnesium / phosphate / nitrate.</p> <p>Reference Books</p> <p>1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. 2. Willard, H.H. Et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988. 3. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004. 4. Harris, D.C.: Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016. 5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009. 6. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed. 7. Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979. 8. Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974.</p>		
CHEMHTDSE-2B	Theory: Introduction to spectroscopic methods of analysis, Molecular spectroscopy, Chromatography, Elemental analysis, NMR spectroscopy, Electroanalytical techniques, Radiochemical Methods: Elementary Analysis, Radiochemical Methods: Elementary Analysis	4 Credit
Instrumental Methods of Chemical Analysis		
<p>1. Introduction to spectroscopic methods of analysis (8L) Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: Classification of analytical methods and the types of instrumental methods. Consideration of electromagnetic radiation</p> <p>2. Molecular spectroscopy (14L) <u>Infrared spectroscopy:</u> Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and</p>		

quality control, Special problems for portable instrumentation and rapid detection.

UV-Visible/ Near IR – emission, absorption and fluorescence

Excitation sources (lasers, time resolution), wavelength dispersion (grating, prism, filter). Resolution, detection of signal (photocells, photomultipliers, diode arrays), sensitivity and S/N, Single and Double Beam instruments, Interpretation (quantification, mixtures).

3. Chromatography (12L)

Principles of Gas chromatography, liquid chromatography, supercritical fluid chromatography, Importance of column chromatographic technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field)

Detection of different samples, single and coupled / hyphenated detector

4. Elemental analysis (12L)

Mass spectrometry (electrical discharges).

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence.

Excitation and atomisation (flames, electrical discharges, plasmas), Wavelength separation and resolution (dependence on technique), Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

5. NMR spectroscopy (6L)

Principle, Instrumentation, Factors affecting chemical shift, Spin- coupling, Applications.

6. Electroanalytical techniques (4L)

Potentiometry & Voltammetry

7. Radiochemical Methods: Elementary Analysis (4L)

Basic idea of X-ray analysis and electron spectroscopy (surface analysis)

Reference Books

1. D.A. Skoog, F.J. Holler & S. Crouch (ISBN 0-495-01201-7) Principles of Instrumental Analysis, Cengage Learning India Edition, 2007. 2. Willard, Merritt, Dean, Settle, Instrumental Methods of Analysis, 7th ed, IBH Book House, New Delhi. 3. Atkins, P.W & Paula, J.D. Physical Chemistry, 10th Ed., Oxford University Press (2014). 4. Kakkar, R. Atomic and Molecular Spectroscopy: Concepts and Applications. Cambridge University Press, 2015. 5. Castellan, G. W. Physical Chemistry 4th Ed., Narosa (2004). 6. Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw- Hill: New Delhi (2006). 7. Smith, B.C. Infrared Spectral Interpretations: A Systematic Approach. CRC Press, 1998. 8. Moore, W.J., Physical Chemistry Orient Blackswan, 1999.

CHEMHPDSE-2B	Practical :	2 Credit
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Instrumental Methods of Chemical Analysis

1. Safety Practices in the Chemistry Laboratory
2. Determination of Cobalt and Nickel from mixture
3. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water)
4. IR Absorption Spectra (Study of Aldehydes and Ketones)
5. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption
6. Potentiometric Titration of a Chloride - Iodide Mixture
7. Analysis of illicit drugs.
8. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
9. Detection of steroids.

10. Detection of pollutants from wastes.
11. Fibre analysis
12. Titration curve of an amino acid.
13. Determination of the void volume of a gel filtration column.
14. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)
15. Separation of Carbohydrates by HPLC
16. Determination of Caffeine in Beverages by HPLC
17. Cyclic Voltammetry of the Ferrocyanide/ Ferricyanide Couple
18. Nuclear Magnetic Resonance
19. Use of fluorescence to do “presumptive tests” to identify blood or other body fluids.
20. Use of “presumptive tests” for anthrax or cocaine
21. Collection, preservation, and control of blood evidence being used for DNA testing
22. Use of capillary electrophoresis with laser fluorescence detection for nuclear DNA (Y chromosome only or multiple chromosome)
23. Use of sequencing for the analysis of mitochondrial DNA

Reference Books

1. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.

CHEMHTDSE-2C	Theory: Introduction to Green Chemistry, Principles of Green Chemistry and Designing a Chemical synthesis, Examples, Future Trends	4 Credit
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Green Chemistry

1. **Introduction to Green Chemistry: (4L)**
 What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry
2. **Principles of Green Chemistry and Designing a Chemical synthesis: (26L)**
 Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following:
 Designing a Green Synthesis using these principles; Prevention of Waste/byproducts; maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.
 Prevention/ minimization of hazardous/ toxic products reducing toxicity.
 $\text{risk} = (\text{function}) \text{hazard} \times \text{exposure}$; waste or pollution prevention hierarchy.
 Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents.
 Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy.
 Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups.
 Use of catalytic reagents (wherever possible) in preference to

stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis.

Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD "What you don't have cannot harm you", greener alternative to Bhopal Gas Tragedy (safer route to carcarbaryl) and Flixiborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation.

Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

3. **Examples of Green Synthesis/ Reactions and some real world cases (26L)**

Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)

Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction

Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)

Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments.

Designing of Environmentally safe marine antifoulant.

Right fit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.

An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.

Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils

Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting

4. **Future Trends in Green Chemistry: (4L)**

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C2S3); Green chemistry in sustainable development.

Reference Books

1. Anastas, P.T. & Warner, J.K.: Green Chemistry - Theory and Practical, Oxford University Press (1998).
2. Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker (2001).
3. Cann, M.C. & Connely, M.E. Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).
4. Ryan, M.A. & Tinnesand, M. Introduction to Green Chemistry, American Chemical Society, Washington (2002).
5. Lancaster, M. Green Chemistry: An Introductory Text RSC Publishing, 2nd Edition, 2010.

CHEMHPDSE-2C	Practical :	2 Credit
Green Chemistry		
<p>Safer starting materials: Preparation and characterization of nanoparticles of gold using tea leaves.</p> <p>Using renewable resources: Preparation of biodiesel from vegetable/ waste cooking oil.</p> <p>Avoiding waste: Principle of atom economy. Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry. Preparation of propene by two methods can be studied</p> <p>a. Triethylamine ion + OH⁻ → propene + trimethylpropene + water</p> <p>b. 1-propanol $\xrightarrow{\text{H}_2\text{SO}_4}$ Propene + water</p> <p>Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.</p> <p>Use of enzymes as catalysts: Benzoin condensation using Thiamine cation (anchored enzyme) as a catalyst instead of cyanide.</p> <p>Alternative Green solvents: Extraction of D-limonene from orange peel using liquid CO₂ prepared from dry ice. Mechanochemical solvent free synthesis of azomethines</p> <p>Alternative sources of energy: Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II). Photoreduction of benzophenone to benzopinacol in the presence of sunlight.</p> <p>Reference Books</p> <p>1. Anastas, P.T & Warner, J.C. Green Chemistry: Theory and Practice, Oxford University Press (1998). 2. Kirchoff, M. & Ryan, M.A. Greener approaches to undergraduate chemistry experiment. American Chemical Society, Washington DC (2002). 3. Ryan, M. A. Introduction to Green Chemistry, Tinnesand; (Ed), American Chemical Society, Washington DC (2002). 4. Sharma, R. K.; Sidhwani, I. T. & Chaudhari, M. K. I. K. Green Chemistry Experiment: A monograph International Publishing House Pvt Ltd. New Delhi. Bangalore CISBN 978-93-81141-55-7 (2013). 5. Cann, M. C. & Connelly, M. E. Real world cases in Green Chemistry, American Chemical Society (2008). 6. Cann, M. C. & Thomas, P. Real world cases in Green Chemistry, American Chemical Society (2008). 7. Lancaster, M. Green Chemistry: An Introductory Text RSC Publishing, 2nd Edition, 2010. 8. Pavia, D. L., Lampman, G. M., Kriz, G. S. & Engel, R. G. Introduction to Organic Laboratory Techniques: A Microscale and Macro Scale Approach, W.B.Saunders, 1995.</p>		

Semester - VI

CHEMHT-13	Theory: Molecular Symmetry and Point group, (12 L) Bio-inorganic Chemistry, Organometallic Chemistry and Catalysis	4 Credit
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Inorganic Chemistry – V

- 1. Molecular symmetry and Point group : (10)**
Symmetry as a universal theme, concept of symmetry elements and operations (with examples); symmetry properties of atomic orbitals (s, p and d); concept of point groups, identification of molecular point groups in some simple molecules and ions; applications of symmetry for polarity and chirality.
- 2. Bio-inorganic Chemistry : (25)**
Essential elements of life, Role of metal ions in living systems- a brief review, Elementary idea about proteins, enzymes and ionophores; Structure of ATP, Na⁺ ion pump and transport of Na⁺ and K⁺ across cell membrane; active site structures and bio-functions of haemoglobin, myoglobin, carboxy peptidase A, carbonic anhydrase B, cytochrome c, ferredoxins and chlorophyll; biological nitrogen fixation; toxic metals (Pb, Cd and Hg) and their effects, Wilson disease, chelation therapy; platinum and gold complexes as drugs (examples only).
- 3. Organometallic Chemistry and Catalysis : (25)**
Definition, Classification of organometallic compounds, hapticity of ligands, nomenclature, 16- electron & 18-electron rule and its applications; preparation and structure of mono- and bi-nuclear carbonyls of 3d series, synergic effect of CO and use of IR data to explain extent of back bonding; General methods of preparation of metal-carbon σ -bonded complexes, Zeise's salt, Metal-carbon multiple bonding; Preparation, structures, properties and reactions of ferrocene; elementary idea about oxidative addition, reductive elimination, insertion reactions; Study of the following catalytic processes: alkene hydrogenation (Wilkinson's catalyst), hydroformylation, Wacker process, Synthetic gasoline (Fischer Tropsch reaction) and Olefin polymerization reaction (Ziegler-Natta catalyst)

CHEMHP-13	Practical :	2 Credit
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Inorganic Chemistry – V

Qualitative semimicro analysis

Qualitative semimicro analysis of mixtures containing four radicals (excluding oxide and carbonate). Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition.

Basic Radicals: K⁺, NH₄⁺, Mg²⁺, Ca²⁺, Ba²⁺, Sr²⁺, Al³⁺, Cr³⁺, Mn²⁺, Fe³⁺/Fe²⁺, Co²⁺, Ni²⁺, Cu²⁺, Zn²⁺, Pb²⁺, Cd²⁺, Bi³⁺, Sn²⁺/Sn⁴⁺, As³⁺/As⁵⁺, Sb³⁺/Sb⁵⁺

Acid Radicals: Cl⁻, Br⁻, I⁻, S²⁻, SO₄²⁻, S₂O₃²⁻, SCN⁻, NO₃⁻, NO₂⁻, BO₃³⁻, PO₄³⁻, AsO₄³⁻ and H₃BO₃

Insoluble Materials: Cr₂O₃(ig), Fe₂O₃(ig), Al₂O₃, SnO₂, PbSO₄, BaSO₄, SrSO₄

CHEMHT-14		
CHEMHT-14	Theory: Carbocycles and Heterocycles, Cyclic Stereochemistry, Pericyclic reactions, Carbohydrates, Carbohydrates, Biomolecules	4 Credit
Organic Chemistry – V		
1.	<p>Carbocycles and Heterocycles: (16L) Polynuclear hydrocarbons and their derivatives: synthetic methods include Haworth, Bardhan-Sengupta, Bogert-Cook and other useful syntheses (with mechanistic details); fixation of double bonds and Fries rule; reactions (with mechanism) of naphthalene, anthracene, phenanthrene and their derivatives. Heterocyclic compounds: 5- and 6-membered rings with one heteroatom; reactivity, orientation and important reactions (with mechanism) of furan, pyrrole, thiophene and pyridine; synthesis (including retrosynthetic approach and mechanistic details): pyrrole: Knorr synthesis, Paal-Knorr synthesis, Hantzsch; furan: Paal-Knorr synthesis, Feist-Benary synthesis and its variation; thiophenes: Paal-Knorr synthesis, Hinsberg synthesis; pyridine: Hantzsch synthesis; benzo-fused 5- and 6-membered rings with one heteroatom: reactivity, orientation and important reactions (with mechanistic details) of indole, quinoline and isoquinoline; synthesis (including retrosynthetic approach and mechanistic details): indole: Fischer, Madelung and Reissert; quinoline: Skraup, Doebner- Miller, Friedlander; isoquinoline: Bischler-Napieralski synthesis.</p>	
2.	<p>Cyclic Stereochemistry: (10L) Alicyclic compounds: concept of I-strain; conformational analysis: cyclohexane, mono and disubstituted cyclohexane; symmetry properties and optical activity; topomerisation; ring-size and ease of cyclisation; conformation & reactivity in cyclohexane system: consideration of steric and stereoelectronic requirements; elimination (E2, E1), nucleophilic substitution (S_N1, S_N2, S_Ni, NGP), merged substitution-elimination; rearrangements; oxidation of cyclohexanol, esterification, saponification, lactonisation, epoxidation, pyrolytic syn elimination and fragmentation reactions.</p>	
3.	<p>Pericyclic reactions: (8L) Mechanism, stereochemistry, regioselectivity in case of Electrocyclic reactions: FMO approach involving 4π- and 6π-electrons (thermal and photochemical) and corresponding cycloreversion reactions. Cycloaddition reactions: FMO approach, Diels-Alder reaction, photochemical [2+2] cycloadditions. Sigmatropic reactions: FMO approach, sigmatropic shifts and their order; [1,3]- and [1,5]-H shifts and [3,3]-shifts with reference to Claisen and Cope rearrangements.</p>	
4.	<p>Carbohydrates: (12L) Monosaccharides: Aldoses up to 6 carbons; structure of D-glucose & D-fructose (configuration & conformation); ring structure of monosaccharides (furanose and pyranose forms): Haworth representations and non-planar conformations; anomeric effect (including stereoelectronic explanation); mutarotation; epimerization; reactions (mechanisms in relevant cases): Fischer glycosidation, osazone formation, bromine-water</p>	

oxidation, HNO₃ oxidation, selective oxidation of terminal –CH₂OH of aldoses, reduction to alditols, Lobry de Bruyn-van Ekenstein rearrangement; stepping-up (Kiliani-Fischer method) and stepping-down (Ruff's & Wohl's methods) of aldoses; end-group-interchange of aldoses; acetonide (isopropylidene) and benzylidene protections; ring-size determination; Fischer's proof of configuration of (+)-glucose.

Disaccharides: Glycosidic linkages, concept of glycosidic bond formation by glycosyl donor-acceptor; structure of sucrose, inversion of cane sugar.

Polysaccharides: starch (structure and its use as an indicator in titrimetric analysis).

5. **Biomolecules:** (14L)

Amino acids: synthesis with mechanistic details: Strecker, Gabriel, acetamido malonic ester, azlactone, Bücherer hydantoin synthesis, synthesis involving diketopiperazine; isoelectric point, zwitterions; electrophoresis, reaction (with mechanism): ninhydrin reaction, Dakin-West reaction; resolution of racemic amino acids.

Peptides: peptide linkage and its geometry; syntheses (with mechanistic details) of peptides using N-protection & C-protection, solid-phase (Merrifield) synthesis; peptide sequence: C-terminal and N-terminal unit determination (Edman, Sanger & 'dansyl' methods); partial hydrolysis; specific cleavage (enzymatic) of peptides: use of CNBr.

Nucleic acids: pyrimidine and purine bases (only structure & nomenclature); nucleosides and nucleotides corresponding to DNA and RNA; mechanism for acid catalysed hydrolysis of nucleosides (both pyrimidine and purine types); comparison of alkaline hydrolysis of DNA and RNA; elementary idea of double helical structure of DNA (Watson-Crick model); complimentary base-pairing in DNA.

Reference Books

1. Clayden, J., Greeves, N., Warren, S. Organic Chemistry, Second edition, Oxford University Press 2012.
2. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London.
3. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited.
4. Sengupta, Subrata. Basic Stereochemistry of Organic molecules.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, Eighth edition, New Age International, 2014.
6. Fleming, I. Molecular Orbitals and Organic Chemical reactions, Reference/Student Edition, Wiley, 2009.
7. Fleming, I. Pericyclic Reactions, Oxford Chemistry Primer, Oxford University Press.
8. Gilchrist, T. L. & Storr, R. C. Organic Reactions and Orbital symmetry, Cambridge University Press.
9. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
10. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
11. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
12. Loudon, G. M. Organic Chemistry, Fourth edition, Oxford University Press.
13. Eames, J., Peach, J. M. Stereochemistry at a Glance, Blackwell Publishing, 2003.
14. Robinson, M. J. T., Stereochemistry, Oxford Chemistry Primer, Oxford University Press, 2005.
15. Davis, B. G., Fairbanks, A. J., Carbohydrate Chemistry, Oxford Chemistry Primer, Oxford University Press.
16. Joule, J. A. Mills, K. Heterocyclic Chemistry, Blackwell Science.
17. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).
18. Gilchrist, T. L. Heterocyclic

Chemistry, 3rd edition, Pearson. 19. Bansal, R. K. Heterocyclic Chemistry, New Age International Publishers. 20. Davies, D. T., Heterocyclic Chemistry, Oxford Chemistry Primer, Oxford University Press.

CHEMHP-14	Practical :	2 Credit
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Organic Chemistry – V

Chromatographic Separations:

1. TLC separation of a mixture containing 2/3 amino acids
2. TLC separation of a mixture of dyes (fluorescein and methylene blue)
3. Column chromatographic separation of leaf pigments from spinach leaves
4. Column chromatographic separation of mixture of dyes
5. Paper chromatographic separation of a mixture containing 2/3 amino acids
6. Paper chromatographic separation of a mixture containing 2/3 sugars

Spectroscopic Analysis of Organic Compounds:

1. Assignment of labelled peaks in the ¹H NMR spectra of the known organic compounds explaining the relative δ -values and splitting pattern.
2. Assignment of labelled peaks in the IR spectrum of the same compound explaining the relative frequencies of the absorptions (C-H, O-H, N-H, C-O, C-N, C-X, C=C, C=O, N=O, C \equiv C, C \equiv N stretching frequencies; characteristic bending vibrations are included).
3. The students must record full spectral analysis of at least 15 (fifteen) compounds from the following list:
 - a. 4-Bromoacetanilide
 - b. 2-Bromo-4'-methylacetophenone
 - c. Vanillin
 - d. 2-Methoxyacetophenone
 - e. 4-Aminobenzoic acid
 - f. Salicylamide
 - g. 2-Hydroxyacetophenone
 - h. 1,3-Dinitrobenzene
 - i. Benzylacetate
 - j. trans-4-Nitrocinnamaldehyde
 - k. Diethyl fumarate
 - l. 4-Nitrobenzaldehyde
 - m. 4-Methylacetanilide
 - n. Mesityl oxide
 - o. 2-Hydroxybenzaldehyde
 - p. 4-Nitroaniline
 - q. 2-Hydroxy-3-nitrobenzaldehyde
 - r. 2,3-Dimethylbenzotrile
 - s. Pent-1-yn-3-ol
 - t. 3-Nitrobenzaldehyde
 - u. 3-Ethoxy-4-hydroxybenzaldehyde
 - v. 2-Methoxybenzaldehyde
 - w. Methyl 4-hydroxybenzoate
 - x. Methyl 3-hydroxybenzoate
 - y. 3-Aminobenzoic acid

- z. Ethyl 3-aminobenzoate
 aa. Ethyl 4-aminobenzoate
 bb. 3-nitroanisole
 cc. 5-Methyl-2-nitroanisole
 dd. 3-Methylacetanilide

Reference Books

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003. 2. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015. 3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012). 4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education.

CHEMHTDSE-3	Theory: Crystal Structure, Statistical Thermodynamics, Special selected topics,	4 Credit
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Advanced Physical Chemistry

- 1. Crystal Structure 20 L**
Bravais Lattice and Laws of Crystallography: Types of solid, Bragg's law of diffraction; Laws of crystallography (Haüy's law and Steno's law); Permissible symmetry axes in crystals; Lattice, space lattice, unit cell, crystal planes, Bravais lattice. Packing of uniform hard sphere, close packed arrangements (fcc and hcp).
Crystal planes: Distance between consecutive planes [cubic, tetragonal and orthorhombic lattices]; Indexing of planes, Miller indices; calculation of dhkl; Relation between molar mass and unit cell dimension for cubic system; Bragg's law (derivation).
Determination of crystal structure: Powder method; Structure of NaCl and KCl crystals.
- 2. Statistical Thermodynamics 18 L**
Configuration: Macrostates, microstates and configuration; variation of W with E; equilibrium configuration.
Boltzmann distribution: Thermodynamic probability, entropy and probability, Boltzmann distribution formula (with derivation); Applications to barometric distribution; Partition function, concept of ensemble -canonical ensemble and grand canonical ensembles.
Partition function: molecular partition function and thermodynamic properties.
- 3. Special selected topics 22 L**
Specific heat of solid: Coefficient of thermal expansion, thermal compressibility of solids; Dulong -Petit's law; Perfect Crystal model, Einstein's theory - derivation from partition function, limitations.
3rd law: Absolute entropy, Plank's law, Calculation of entropy, Nernst heat theorem.
Polymers: Classification of polymers, nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers; Criteria for synthetic polymer formation; Relationships between functionality, extent of reaction and degree of polymerization.

Reference Books

1. Castellan, G. W. Physical Chemistry, Narosa. 2. Levine, I. N. Physical Chemistry, Tata McGraw-Hill. 3. Moore, W. J. Physical Chemistry, Orient Longman. 4. Atkins, P. W. & Paula, J. de Atkins', Physical Chemistry, Oxford University Press. 5. McQuarrie, D. A. &

Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press. 6. Engel, T. & Reid, P. Physical Chemistry, Pearson. 7. Nash, L. K. Elements of Statistical Thermodynamics, Dover. 8. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas. 9. Zemansky, M. W. & Dittman, R.H. Heat and Thermodynamics, Tata-McGraw-Hill. 10. Billmeyer, F. W. Textbook of Polymer Science, John Wiley & Sons, Inc. 11. Seymour, R. B. & Carraher, C. E. Polymer Chemistry: An Introduction, Marcel Dekker, Inc. 12. Odian, G. Principles of Polymerization, Wiley. 13. Billmeyer, F. W. Textbook of Polymer Science, Wiley Interscience, 1971.

CHEMHPDSE-3	Practical :	2 Credit
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Advanced Physical Chemistry

Computer Programming based on numerical methods for:

- i. Roots of equations: (e.g. volume of van der Waals gas and comparison with ideal gas, pH of a weak acid).
- ii. Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).
- iii. Numerical integration (e.g. entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values.
- iv. Simple exercises using molecular visualization software.

Reference Books

1. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008). 2. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005). 3. Yates, P. Chemical Calculations. 2nd Ed. CRC Press (2007). 4. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5. 5. Noggle, J. H. Physical Chemistry on a Microcomputer. Little Brown & Co. (1985).

CHEMHTDSE-4	Theory:	4 Credit
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Project Work

A dissertation has to be prepared on consultation with teachers/mentors on a topic from any area of Chemistry. During examination a thorough viva-voce will be conducted by the examiners/adjudicators. The dissertation will be evaluated on the basis of written documents submitted by the candidate, originality and importance.

CHEMHPDSE-4	Practical :	2 Credit
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Project Work

A power point presentation has to be prepared and a short oral presentation will be considered for continuous evaluation. A PDF file/print copy of the power point will be required to be submitted.

Syllabus and Scheme of Examination B.Sc. (General) with Chemistry

4. Generic Elective Papers for B.Sc. (Honors) with subjects other than Chemistry

Course	Course Name	Marks	Credit
Generic Elective-1 (Any one set from this group)	CHEMGT-1 + CHEMGP-1	50 + 50	4+2
	CHEMGT-2 + CHEMGP-2	50 + 50	4+2
Generic Elective- II (Any one set from this group)	CHEMGT-3 + CHEMGP-3	50 + 50	4+2
	CHEMGT-4 + CHEMGP-4	50 + 50	4+2

Details of syllabi are given below in Section 7.

5. Course wise Credit Distribution in B.Sc. (General) with Science

Course	Total no of Papers	Credit			
		Theory		Practical	
		Per paper	Total	Per paper	Total
Core Courses	12 4 papers from each of the three chosen combinations of subjects	4	4 x 12=48	2	2x12=24
Discipline Specific Elective	6 2 papers from each of the three chosen combinations of subjects	4	4x6=24	2	2x6=12
Ability Enhancement (Language)	2	2	2x2 = 4	-	-
Skill Enhancement	4	2	2x4 = 8	-	-
Total	24	NA	84	NA	36

6. Semester wise CBCS curricula (Courses, course names, broad area, credit and marks) for B.Sc. (General) with Science

Semester	Course	Course Name	Broad area	Credit
I	Core Course-1 (Theory)	CHEMGT-1	Chemistry 1A	4
	Core Course-1 (Practical)	CHEMGP-1	Chemistry 1A	2
	Core Course-2 (Theory)	TBD	TBD	4
	Core Course-2 (Practical)	TBD	TBD	2
	Core Course-3 (Theory)	TBD	TBD	4
	Core Course-3 (Practical)	TBD	TBD	2
	Ability Enhancement Compulsory Course - 1	TBD	English communication / Environmental Science	2
II	Core Course-4 (Theory)	CHEMGT-2	Chemistry – 1B	4
	Core Course-4 (Practical)	CHEMGP-2	Chemistry – 1B	2
	Core Course-5 (Theory)	TBD	TBD	4
	Core Course-5 (Practical)	TBD	TBD	2
	Core Course-6 (Theory)	TBD	TBD	4
	Core Course-6 (Practical)	TBD	TBD	2
	Ability Enhancement Compulsory Course - 2	TBD	English communication / Environmental Science	2
III	Core Course-7 (Theory)	CHEMGT-3	Chemistry – 1C	4
	Core Course-7 (Practical)	CHEMGP-3	Chemistry – 1C	2
	Core Course-8 (Theory)	TBD	TBD	4
	Core Course-8 (Practical)	TBD	TBD	2
	Core Course-9 (Theory)	TBD	TBD	4
	Core Course-9 (Practical)	TBD	TBD	2
	Skill enhancement Course - 1	TBD	TBD	2
IV	Core Course-10 (Theory)	CHEMGT-4	Chemistry – 1D	4
	Core Course-10 (Practical)	CHEMGP-4	Chemistry – 1D	2
	Core Course-11 (Theory)	TBD	TBD	4
	Core Course-11 (Practical)	TBD	TBD	2
	Core Course-12 (Theory)	TBD	TBD	4
	Core Course-12 (Practical)	TBD	TBD	2
	Skill enhancement Course - 2	TBD	TBD	2

V	Discipline Specific Elective-1 (Theory)	CHEMGTDSE-1	Analytical and Industrial Chemistry	4
	Discipline Specific Elective-1 (Practical)	CHEMGPDSE-1	Analytical and Industrial Chemistry	2
	Discipline Specific Elective-2 (Theory)	TBD	TBD	4
	Discipline Specific Elective-2 (Practical)	TBD	TBD	2
	Discipline Specific Elective-3 (Theory)	TBD	TBD	4
	Discipline Specific Elective-3 (Practical)	TBD	TBD	2
	Skill enhancement Course - 3	TBD	TBD	2
VI	Discipline Specific Elective-4 (Theory)	CHEMGTDSE-2	Advanced Organic and Industrial Chemistry	4
	Discipline Specific Elective-4 (Practical)	CHEMGPDSE-2	Advanced Organic and Industrial Chemistry	2
	Discipline Specific Elective-5 (Theory)	TBD	TBD	4
	Discipline Specific Elective-5 (Practical)	TBD	TBD	2
	Discipline Specific Elective-6 (Theory)	TBD	TBD	4
	Discipline Specific Elective-6 (Practical)	TBD	TBD	2
	Skill enhancement Course - 4	TBD	TBD	2

7. Chemistry Syllabi of B.Sc.(General) with Science

Semester - I		
CHEMGT-1	Theory: Atomic Structure, Chemical Periodicity, Acids and Bases, Redox Reactions, General Organic Chemistry & Aliphatic Hydrocarbons	4 Credit
Inorganic Chemistry - I		
1. Atomic Structure		(9L)
Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, Aufbau principle and its limitations.		
2. Chemical Periodicity		(9L)
Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements. Positions of hydrogen and noble gases in the periodic table. Atomic and ionic radii, ionization potential, electron affinity, and electronegativity; periodic and group-wise variation of above properties in respect of s- and p- block elements.		
3. Acids and bases		(8L)
Brønsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.		
4. Redox reactions		(4L)
Balancing of equations by oxidation number and ion-electron method, Standard electrode potential, formal potential, redox indicator and redox titrations.		
Organic Chemistry – I		
1. Fundamentals of Organic Chemistry		(5L)
Electronic displacements: Inductive effect, resonance and hyperconjugation; cleavage of bonds: homolytic and heterolytic; structure of organic molecules on the basis of VBT; nucleophiles and electrophiles; reactive intermediates: carbocations, carbanions and free radicals.		
2. Stereochemistry		(5L)
Different types of isomerism; geometrical and optical isomerism; concept of chirality and optical activity (up to two carbon atoms); asymmetric carbon atom; elements of symmetry (plane and centre); interconversion of Fischer and Newman representations; enantiomerism and diastereomerism, meso compounds; threo and erythro, D and L, cis and trans nomenclature; CIP Rules: R/S (upto 2 chiral carbon atoms) and E/Z nomenclature.		
3. Nucleophilic Substitution and Elimination Reactions		(4L)
Nucleophilic substitutions: S _N 1 and S _N 2 reactions; eliminations: E1 and E2 reactions (elementary mechanistic aspects); Saytzeff and Hofmann eliminations; elimination vs substitution.		
4. Aliphatic Hydrocarbons		(12L)
Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures.		
Alkanes (up to 5 Carbons).		
Preparation: catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: mechanism for free radical substitution: halogenation.		
Alkenes: (up to 5 Carbons).		
Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides; cis alkenes (partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alkaline KMnO ₄) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition],		

hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction.

Alkynes: (up to 5 Carbons).

Preparation: acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alkaline KMnO_4 .

Reference Books

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991. 2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley. 3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons. 4. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education Ind 5. Sethi, A. Conceptual Organic Chemistry; New Age International Publisher. 6. Parmar, V. S. A Text Book of Organic Chemistry, S. Chand & Sons. 7. Madan, R. L. Organic Chemistry, S. Chand & Sons. 8. Wade, L. G., Singh, M. S., Organic Chemistry. 9. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 10. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 11. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994. 12. Sen Gupta, Subrata. Basic Stereochemistry of Organic molecules. 13. Kalsi, P. S. Stereochemistry Conformation and Mechanism, Eighth edition, New Age International, 2014. 14. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

CHEMGP-1	Practical	2 Credit
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Inorganic Chemistry - I

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO_4 .
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$.
5. Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.

Organic Chemistry – I

Qualitative Analysis of Single Solid Organic Compound(s)

1. Detection of special elements (N, Cl, and S) in organic compounds.
2. Solubility and Classification (solvents: H_2O , dil. HCl , dil. NaOH , dil. NaHCO_3)
3. Detection of functional groups: Aromatic- NO_2 , Aromatic- NH_2 , $-\text{COOH}$, carbonyl (no distinction of $-\text{CHO}$ and $>\text{C}=\text{O}$ needed), $-\text{OH}$ (phenolic) in solid organic compounds.

Experiments 1 to 3 with unknown (at least 6) solid samples containing not more than two of the above type of functional groups should be done.

Reference Books

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta, 2003. 2. Das, S. C., Chakraborty, S. B., Practical Chemistry. 3. Mukherjee, K. S. Text book on Practical Chemistry, New Oriental Book Agency. 4. Ghosal, Mahapatra & Nad, An Advanced course in practical Chemistry, New Central Book Agency. 5. Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors. 6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996. 7. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

Semester – II

CHEMGT-2	Theory: States of Matter & Chemical Kinetics, Chemical Bonding & Molecular Structure, P-Block Elements	4 Credit
Physical Chemistry – I		
<p>1. Kinetic Theory of Gases and Real gases (12L)</p> <p>a. Concept of pressure and temperature; Collision of gas molecules; Collision diameter; Collision number and mean free path; Frequency of binary collisions (similar and different molecules); Rate of effusion</p> <p>b. Nature of distribution of velocities, Maxwell's distribution of speed and kinetic energy; Average velocity, root mean square velocity and most probable velocity; Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases</p> <p>c. Deviation of gases from ideal behavior; compressibility factor; Boyle temperature; Andrew's and Amagat's plots; van der Waals equation and its features; its derivation and application in explaining real gas behaviour; Existence of critical state, Critical constants in terms of van der Waals constants; Law of corresponding states</p> <p>d. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only)</p>		
<p>2. Liquids (5L)</p> <p>Definition of Surface tension, its dimension and principle of its determination using stalagmometer; Viscosity of a liquid and principle of determination of coefficient of viscosity using Ostwald viscometer; Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only)</p>		
<p>3. Solids (5L)</p> <p>Forms of solids, crystal systems, unit cells, Bravais lattice types, Symmetry elements; Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices; Miller indices of different planes and interplanar distance, Bragg's law; Structures of NaCl, KCl and CsCl (treatment only); Defects in crystals; Glasses and liquid crystals.</p>		
<p>4. Chemical Kinetics (8L)</p> <p>a. Introduction of qualitative rate law, order and molecularity; Extent of reaction; rate constants; Rates of First, second and nth order reactions and their Differential and integrated forms (with derivation); Pseudo first order reactions; Determination of order of a reaction by half-life and differential method; Opposing reactions, consecutive reactions and parallel reactions</p> <p>b. Temperature dependence of rate constant; Arrhenius equation, energy of activation; Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment)</p>		
Inorganic Chemistry - II		
<p>1. Chemical Bonding and Molecular Structure (20L)</p> <p>a. Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.</p> <p>b. Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples from s and p block elements of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.</p> <p>c. Concept of resonance and resonating structures in various inorganic and organic compounds.</p> <p>d. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of</p>		

orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (including idea of s- p mixing) and heteronuclear diatomic molecules such as CO, NO and NO⁺. Comparison of VB and MO approaches.

2. Comparative study of p-block elements

(10L)

a. Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements:

- i. B-Al-Ga-In-Tl
- ii. C-Si-Ge-Sn-Pb
- iii. N-P-As-Sb-Bi
- iv. O-S-Se-Te
- v. F-Cl-Br-I

Reference Books

1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
5. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
6. Chugh, K.L., Agnish, S.L. A Text Book of Physical Chemistry Kalyani Publishers.
7. Bahl, B.S., Bahl, A., Tuli, G.D., Essentials of Physical Chemistry S. Chand & Co. Ltd.
8. Palit, S. R., Elementary Physical Chemistry Book Syndicate Pvt. Ltd.
9. Mandal, A. K. Degree Physical and General Chemistry Sarat Book House.
10. Pahari, S., Physical Chemistry New Central Book Agency.
11. Pahari, S., Pahari, D., Problems in Physical Chemistry New Central Book Agency.
12. Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
13. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
14. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
15. Rodgers, G.E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.

CHEMG-2	Practical:	2 Credit
Physical Chemistry – I		
1. Surface tension measurement (use of organic solvents excluded) <ol style="list-style-type: none"> a. Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer b. Study of the variation of surface tension of a detergent solution with concentration 2. Viscosity measurement (use of organic solvents excluded) <ol style="list-style-type: none"> a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer b. Study of the variation of viscosity of an aqueous solution with concentration of solute 3. Study the kinetics of the following reactions <ol style="list-style-type: none"> a. Initial rate method: Iodide-persulphate reaction b. Integrated rate method: <ol style="list-style-type: none"> i. Acid hydrolysis of methyl acetate with hydrochloric acid ii. Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methyl acetate 		
Inorganic Chemistry – II		
Qualitative semi-micro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions. Acid Radicals: Cl ⁻ , Br ⁻ , I ⁻ , NO ₂ ⁻ , NO ₃ ⁻ , S ²⁻ , SO ₄ ²⁻ , BO ₃ ³⁻ , H ₃ BO ₃ . Basic Radicals: Na ⁺ , K ⁺ , Ca ²⁺ , Sr ²⁺ , Ba ²⁺ , Cr ³⁺ , Mn ²⁺ , Fe ³⁺ , Ni ²⁺ , Cu ²⁺ , NH ₄ ⁺ .		
Reference Books <ol style="list-style-type: none"> 1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta, 2003. 2. Palit, S.R., Practical Physical Chemistry Science Book Agency. 3. Mukherjee, N.G., Selected Experiments in Physical Chemistry J. N. Ghose & Sons. 4. Dutta, S.K., Physical Chemistry Experiments Bharati Book Stall. 5. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012. 6. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011). 		

Semester - III

CHEMGT-3

Theory: Chemical Energetics, Equilibria, Organic Chemistry-II

4 Credit

Physical Chemistry - II

1. Chemical Energetics

(12L)

a. Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics; Concept of heat, work, internal energy and statement of first law; enthalpy, H; relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases

b. Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Laws of thermochemistry; bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equations and effect of pressure on enthalpy of reactions; Adiabatic flame temperature; explosion temperature

c. Statement of the second law of thermodynamics; Concept of heat reservoirs and heat engines; Carnot cycle; Physical concept of Entropy; Carnot engine, refrigerator and efficiency; Entropy change of systems and surroundings for various processes and transformations; Auxiliary state functions (G and A) and Criteria for spontaneity and equilibrium.

2. Chemical Equilibrium:

(9L)

Thermodynamic conditions for equilibrium, degree of advancement; Variation of free energy with degree of advancement; Equilibrium constant and standard Gibbs free energy change; Definitions of K_p , K_C and K_X and relation among them; van't Hoff's reaction isotherm, isobar and isochore from different standard states; Shifting of equilibrium due to change in external parameters e.g. temperature and pressure; variation of equilibrium constant with addition to inert gas; Le Chatelier's principle

3. Ionic Equilibria:

(9L)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water; Ionization of weak acids and bases, pH scale, common ion effect; Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts; Buffer solutions; Solubility and solubility product of sparingly soluble salts – applications of solubility product principle

Organic Chemistry - II

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures.

1. Aromatic Hydrocarbons

(7L)

Benzene: Preparation: from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: electrophilic substitution (general mechanism); nitration (with mechanism), halogenations (chlorination and bromination), sulphonation and Friedel-Craft's reaction (alkylation and acylation) (up to 4 carbons on benzene); side chain oxidation of alkyl benzenes (up to 4 carbons on benzene).

2. Organometallic Compounds

(4L)

Introduction; Grignard reagents: Preparations (from alkyl and aryl halide); concept of umpolung; Reformatsky reaction.

3. Aryl Halides

(4L)

Preparation: (chloro-, bromo- and iodobenzene): from phenol, Sandmeyer reactions. Reactions (Chlorobenzene): nucleophilic aromatic substitution (replacement by $-OH$ group) and effect of nitro substituent (activated nucleophilic substitution).

4. Alcohols, Phenols and Ethers

(8L)

a. Alcohols: (up to 5 Carbons). Preparation: 1^o-, 2^o- and 3^o- alcohols: using Grignard reagent, reduction of aldehydes, ketones, carboxylic acid and esters; Reactions: With sodium, HX (Lucas test), oxidation (alkaline $KMnO_4$, acidic dichromate, concentrated HNO_3); Oppenauer oxidation;
b. Diols: Preparation (with OsO_4); pinacol- pinacolone rearrangement (with mechanism) (with

symmetrical diols only).

c. Phenols: Preparation: cumene hydroperoxide method, from diazonium salts; acidic nature of phenols; Reactions: electrophilic substitution: nitration and halogenations; Reimer-Tiemann reaction, Houben-Hoesch condensation, Schotten-Baumann reaction, Fries rearrangement and Claisen rearrangement.

d. Ethers: Preparation: Williamson's ether synthesis; Reaction: cleavage of ethers with HI.

5. Carbonyl Compounds

(7L)

Aldehydes and Ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde): Preparation: from acid chlorides, from nitriles and from Grignard reagents; general properties of aldehydes and ketones; Reactions: with HCN, ROH, NaHSO₃, NH₂-G derivatives and with Tollens' and Fehling's reagents; iodoform test; aldol condensation (with mechanism); Cannizzaro reaction (with mechanism), Wittig reaction, benzoin condensation; Clemmensen reduction, Wolff-Kishner reduction and Meerwein-Ponndorf-Verley (MPV) reduction.

Reference Books

1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
5. Ekambaram, S. General Chemistry, Pearson.
6. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
8. Chugh, K.L., Agnish, S.L. A Text Book of Physical Chemistry Kalyani Publishers.
9. Bahl, B.S., Bahl, A., Tuli, G.D., Essentials of Physical Chemistry S. Chand & Co. Ltd.
10. Palit, S. R., Elementary Physical Chemistry Book Syndicate Pvt. Ltd.
11. Mandal, A. K. Degree Physical and General Chemistry Sarat Book House.
12. Pahari, S., Physical Chemistry New Central Book Agency.
13. Pahari, S., Pahari, D., Problems in Physical Chemistry New Central Book Agency.
14. Sethi, A. Conceptual Organic Chemistry; New Age International Publisher.
15. Parmar, V. S. A Text Book of Organic Chemistry, S. Chand & Sons.
16. Madan, R. L. Organic Chemistry, S. Chand & Sons.
17. Wade, L. G., Singh, M. S., Organic Chemistry, Pearson.
18. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
19. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
20. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

CHEMGP-3	Practical	2 Credit
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Physical Chemistry - II

(Minimum five experiments to complete)

Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide
3. Determination of enthalpy of ionization of acetic acid
4. Determination of enthalpy of hydration of copper sulphate

Ionic Equilibria

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter and compare it with the indicator method
2. Preparation of buffer solutions and find the pH of an unknown buffer solution by colour matching method (using following buffers)
 - a. Sodium acetate-acetic acid
 - b. Ammonium chloride-ammonium hydroxide
3. Study of the solubility of benzoic acid in water.

Organic Chemistry - II

Identification of a pure organic compound

1. Solid compounds: oxalic acid, tartaric acid, succinic acid, resorcinol, urea, glucose, benzoic

acid and salicylic acid.

2. Liquid Compounds: methyl alcohol, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene

Reference Books

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta, 2003. 2. Palit, S.R., Practical Physical Chemistry Science Book Agency. 3. Mukherjee, N.G., Selected Experiments in Physical Chemistry J. N. Ghose & Sons. 4. Dutta, S.K., Physical Chemistry Experiments Bharati Book Stall. 5. Bhattacharyya, R. C, A Manual of Practical Chemistry. 6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996. 7. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

Semester – IV

CHEMGT-4	Theory:Solutions, PhaseEquilibria, Conductance, Electrochemistry, Transition Metal & Coordination Chemistry	4 Credit
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Physical Chemistry – III

- 1. Solutions (7L)**
a. Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions; Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions; Distillation of solutions; Lever rule; Azeotropes
b. Critical solution temperature; effect of impurity on partial miscibility of liquids; Immiscibility of liquids- Principle of steam distillation; Nernst distribution law and its applications, solvent extraction
- 2. Phase Equilibria (7L)**
a. Phases, components and degrees of freedom of a system, criteria of phase equilibrium; Gibbs Phase Rule and its thermodynamic derivation; Derivation of Clausius – Clapeyron equation and its importance in phase equilibria; Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $\text{FeCl}_3\text{-H}_2\text{O}$ and Na-K only)
- 3. Conductance (8L)**
a. Conductance, cell constant, specific conductance and molar conductance; Variation of specific and equivalent conductance with dilution for strong and weak electrolytes; Kohlrausch's law of independent migration of ions; Equivalent and molar conductance at infinite dilution and their determination for strong and weak electrolytes; Ostwald's dilution law; Application of conductance measurement (determination of solubility product and ionic product of water); Conductometric titrations (acid-base)
b. Transport Number and principles of Hittorf's and Moving-boundary method
- 4. Electromotive force (8L)**
a. Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry; Chemical cells, reversible and irreversible cells with examples; Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential; Electrochemical series; Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data
b. Concentration cells with and without transference, liquid junction potential; pH determination using hydrogen electrode and quinhydrone; Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation)

Inorganic Chemistry - III

- 1. Transition Elements (3d series) (10L)**
a. General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.

b. Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

2. Coordination Chemistry (10L)

a. Werner's coordination theory, Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6.

b. Drawbacks of VBT. IUPAC system of nomenclature.

3. Crystal Field Theory (CFT) (10L)

a. Postulates of CFT, splitting of d-orbitals in octahedral and tetrahedral fields, Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Factors affecting the magnitude of Δ . Spectrochemical series. Comparison of CFSE for O_h and T_d complexes, Tetragonal distortion of octahedral geometry.

b. Jahn-Teller distortion

Reference Books

1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
5. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
6. Chugh, K.L., Agnish, S.L. A Text Book of Physical Chemistry Kalyani Publishers.
7. Bahl, B.S., Bahl, A., Tuli, G.D., Essentials of Physical Chemistry S. Chand & Co. Ltd.
8. Palit, S. R., Elementary Physical Chemistry Book Syndicate Pvt. Ltd.
9. Pahari, S., Physical Chemistry New Central Book Agency.
10. Pahari, S., Pahari, D., Problems in Physical Chemistry New Central Book Agency.
11. Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
12. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
13. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
14. Rodgers, G.E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.

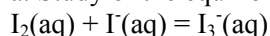
CHEMGP-4	Practical	2 Credit
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Physical Chemistry - III

(Minimum six experiments to complete)

1. Distribution Law (Any one)

a. Study of the equilibrium of one of the following reactions by the distribution method:



2. Conductance

a. Determination of dissociation constant of a weak acid (cell constant, equivalent conductance are also determined)

b. Perform the following conductometric titrations: (Any one)

i. Strong acid vs. strong base

ii. Weak acid vs. strong base

3. Potentiometry

a. Perform the following potentiometric titrations:

i. Weak acid vs. strong base

ii. Potassium dichromate vs. Mohr's salt

Inorganic Chemistry – III

1. Complexometric estimation of (i) Mg^{2+} or (ii) Zn^{2+} using EDTA.

2. Preparation of any two of the following complexes:

a. tetraamminecarbonatocobalt (III) nitrate

b. tetraamminecopper(II) sulphate

c. potassium trioxalatochromate(III) trihydrate

d. potassium bisoxalatocuprate(II) trihydrate

Semester - V

CHEMGTDSE-1 **Theory: Analytical, Environmental and Industrial Chemistry** **and 4 Credit**

Analytical and Environmental Chemistry

1. Chemical Analysis (14L)

- a. Gravimetric analysis: solubility product and common ion effect; requirements of gravimetry; gravimetric estimation of chloride, sulphate, lead, barium, nickel, copper and zinc.
- b. Volumetric analysis: primary and secondary standard substances; principles of acid-base, oxidation-reduction and complexometric titrations; indicators: acid-base, redox and metal ion; principles of estimation of mixtures: NaHCO_3 and Na_2CO_3 (by acidimetry); iron, copper, manganese and chromium (by redox titration); zinc, aluminum, calcium and magnesium (by complexometric EDTA titration).
- c. Chromatography: Chromatographic methods of analysis: column chromatography and thin layer chromatography.

2. Environmental Chemistry (16L)

- a. The Atmosphere: composition and structure of the atmosphere; troposphere, stratosphere, mesosphere and thermosphere; ozone layer and its role; major air pollutants: CO , SO_2 , NO_x and particulate matters – their origin and harmful effects; problem of ozone layer depletion; green house effect; acid rain and photochemical smog; air pollution episodes: air quality standard; air pollution control measures: cyclone collector, electrostatic precipitator, catalytic converter.
- b. The Hydrosphere: environmental role of water, natural water sources, water treatment for industrial, domestic and laboratory uses; water pollutants; action of soaps and detergents, phosphates, industrial effluents, agricultural runoff, domestic wastes; thermal pollution, radioactive pollution and their effects on animal and plant life; water pollution episodes: water pollution control measures : waste water treatment; chemical treatment and microbial treatment; water quality standards: DO, BOD, COD, TDS and hardness parameters; desalination of sea water : reverse osmosis, electrodialysis.
- c. The Lithosphere: water and air in soil, waste matters and pollutants in soil, waste classification, treatment and disposal; soil pollution and control measures.

Analytical Industrial Chemistry

1. Error Analysis and Computer Applications (12L)

- a. Error analysis: accuracy and precision of quantitative analysis, determinate, indeterminate, systematic and random errors; methods of least squares and standard deviations.
- b. Computer applications: general introduction to computers, different components of a computer; hardware and software; input and output devices; binary numbers and arithmetic; introduction to computer languages; programming and operating systems.

2. Industrial Chemistry (18L)

- a. Fuels: classification of fuel; heating values; origin of coal, carbonization of coal, coal gas, producer gas, water gas, coal based chemicals; origin and composition of petroleum, petroleum refining, cracking, knocking, octane number, antiknock compounds, kerosene, liquefied petroleum gas (LPG), liquefied natural gas (LNG); petrochemicals (C_1 to C_3 compounds and their uses).
- b. Fertilizers: manufacture of ammonia and ammonium salts, urea, superphosphate, biofertilizers.
- c. Glass and ceramics: definition and manufacture of glasses, optical glass and coloured glass; clay and feldspar, glazing and vitrification, glazed porcelain, enamel.
- d. Cement: portland cement: composition and setting of cement, white cement.

Reference Books

1. Banerjee, S. P. A Text Book of Analytical Chemistry, The New Book Stall.
2. Gangopadhyay, P. K. Application Oriented Chemistry, Book Syndicate.
3. Mondal, A. K & Mondal, S. Degree Applied Chemistry, Sreedhar Publications.
4. Banerjee, S. P. A Text Book

of Analytical Chemistry, The New Book Stall. 5. Gangopadhyay, P. K. Application Oriented Chemistry, Book Syndicate. 6. Mondal, A. K & Mondal, S. Degree Applied Chemistry, Sreedhar Publications. 7. Banerjee, S. P. A Text Book of Analytical Chemistry, The New Book Stall.

CHEMGPDSE-1	Practical	2 Credit
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Analytical and Environmental Chemistry

1. To find the total hardness of water by EDTA titration.
2. To find the pH of an unknown solution by comparing color of a series of HCl solutions + 1 drop of methyl orange, and a similar series of NaOH solutions + 1 drop of phenolphthalein.
3. To determine the rate constant for the acid catalysed hydrolysis of an ester.
4. Determination of the strength of the H₂O₂ sample.
5. To determine the solubility of a sparingly soluble salt, e.g. KHTa (one bottle)

Analytical and Industrial Chemistry

1. Titration of Na₂CO₃ and NaHCO₃ mixture vs HCl using phenolphthalein and methyl orange indicators.
2. Titration of HCl and CH₃COOH mixture vs NaOH using two different indicators to find the concentration.
3. Estimation of available oxygen in pyrolusite

Reference Books

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003.
2. Das, S. C., Chakraborty, S. B., Practical Chemistry.
3. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003.
4. Das, S. C., Chakraborty, S. B., Practical Chemistry.
5. Ghosal, Mahapatra & Nad, An Advanced Course in Practical Chemistry, New Central Book Agency.

Semester - VI

CHEMGTDSE-2	Theory: Advanced Organic Chemistry and Industrial Chemistry	4 Credit
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Advanced Organic Chemistry

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures.

1. **Carboxylic Acids and Their Derivatives** (10L)
 - a. Carboxylic acids (aliphatic and aromatic): strength of organic acids: comparative study with emphasis on factors affecting pK values; Preparation: acidic and alkaline hydrolysis of esters (B_{AC}2 and A_{AC}2 mechanisms only) and from Grignard reagents; Reactions: Hell - Vohlard - Zelinsky reaction and Claisen condensation; Perkin reaction.
 - b. Carboxylic acid derivatives (aliphatic): (up to 5 carbons). Preparation: acid chlorides, anhydrides, esters and amides from acids; Reactions: Comparative study of nucleophilicity of acyl derivatives; interconversion among acid derivatives.
2. **Amines and Diazonium Salts** (10L)
 - a. Amines (aliphatic and aromatic): strength of organic bases; Preparation: from alkyl halides, Gabriel's phthalimide synthesis, Hofmann degradation, by reduction of nitro compounds; Reactions: with HNO₂ (distinction of 1°-, 2°- and 3°- amines), Schotten – Baumann reaction , Diazo coupling reaction (with mechanism).
 - b. Diazonium salts: Preparation: from aromatic amines; Reactions: conversion to benzene, phenol, benzoic acid and nitrobenzene.
 - c. Nitro compounds (aromatic): reduction under different conditions (acidic, neutral and alkaline).
3. **Amino Acids and Carbohydrates** (10L)
 - a. Amino Acids: Preparations (glycine and alanine only): Strecker synthesis, Gabriel's phthalimide synthesis; general properties; zwitterion, isoelectric point; ninhydrin reaction.

b. Carbohydrates: classification and general properties; glucose and fructose: constitution; osazone formation; oxidation-reduction reactions; epimers of glucose (definition and example only); cyclic structures of glucose (determination of ring-size excluded); ascending (Kiliani – Fischer method) and descending (Ruff's and Wohl's methods) in monosaccharides (aldoses only); mutarotation.

Industrial Chemistry

1. Polymers:	(4L)
Basic concept, structure and types of plastics, polythene, polystyrene, phenolformaldehydes, PVC; manufacture, physical properties and uses of natural rubber, synthetic rubber, silicone rubber; synthetic fibres, nylon-66, polyester, terylene, rayon; foaming agents, plasticizers and stabilizers.	
2. Paints:	(3L)
Primary constituents; formulation of paints; binders and solvents for paints; oil based paints, latex paints, alkyd resin paint.	
3. Varnishes:	(2L)
Constituents of varnishes; formulation of varnishes.	
4. Synthetic dyes:	(2L)
Synthesis of methyl orange, congo red, malachite green, crystal violet.	
5. Drugs and pharmaceuticals:	(3L)
Concept and necessity of drugs and pharmaceuticals; preparation and uses: aspirin, paracetamol, sulphadiazine, quinine, chloroquine, phenobarbital, metronidazole.	
6. Fermentation chemicals:	(3L)
Production and purification of ethyl alcohol, citric acid, lactic acid, vitamin B12, penicillin. Industrial Chemistry.	
7. Fats and oils:	(3L)
Natural fat, edible and inedible oil of vegetable origin; common fatty acids; glycerides; hydrogenation of unsaturated oil, production of vanaspati and margarine.	
8. Soaps and detergents:	(3L)
Production of toilet and washing soaps; enzyme-based detergents, detergent powder; liquid soaps.	
9. Pesticides:	(3L)
Common pesticides: production, applications and residual toxicity of gammaxane, aldrin, parathion, malathion, DDT, paraquat, decamethrin.	
10. Food additives:	(4L)
Food flavour, food colour, food preservatives, artificial sweeteners, acidulants, alkalies, edible emulsifiers and edible foaming agents, sequesterants – uses and abuses of these substances in food beverages.	

Reference Books

- Sethi, A. Conceptual Organic Chemistry; New Age International Publisher.
- Parmar, V. S. A Text Book of Organic Chemistry, S. Chand & Sons.
- Madan, R. L. Organic Chemistry, S. Chand & Sons.
- Ekambaram, S. General Chemistry, Pearson.
- Wade, L. G., Singh, M. S., Organic Chemistry.
- Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
- Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (Pearson Education).
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
- Gangopadhyay, P. K. Application Oriented Chemistry, Book Syndicate.
- Mondal, A. K & Mondal, S. Degree Applied Chemistry, Sreedhar Publications.
- Banerjee, S. P. A Text Book of Analytical Chemistry, The New Book Stall.

CHEMGPDSE-2	Practical:	2 Credit
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Advanced Organic Chemistry

1. The following reactions are to be performed, noting the yield of the crude product:
a. Nitration of aromatic compounds

- b. Condensation reactions
- c. Hydrolysis of amides/imides
- d. Acetylation of aromatic amines
- e. Benzoylation of aromatic amines

2. Purification of the crude product is to be made by crystallisation from water/alcohol.

Industrial Chemistry

- 1. Estimation of saponification value of oil / ester / fat.
- 2. Estimation of available chlorine in bleaching powder.
- 3. Estimation of acetic acid in commercial vinegar.
- 4. Estimation of amino acid by formol titration

Reference Books

1. Vogel, A. I. Elementary Practical Organic Chemistry, Part 1: Small scale Preparations, CBS Publishers and Distributors. 2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta, 2003. 3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson education. 4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012). 5. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000). 6. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015. 7. Arthur, I. V. Quantitative Organic Analysis, Pearson. 8. Das, S. C., Chakraborty, S. B., Practical Chemistry. 9. Ghosal, Mahapatra & Nad, An Advanced Course in Practical Chemistry, New Central Book Agency.

ECONOMICS (GENERAL)
UG-CBCS SYLLABUS IN THE UNIVERSITY OF KALYANI

* INTRODUCTION ABOUT UG-CBCS SYLLABUS AS PER UGC GUIDELINES MAY BE GIVEN:

A. TOTAL Number of courses in ECONOMICICS - UG-CBCS (B.A./B.Sc GENERAL):

Types of course	Core course (CC)	Elective course		Ability Enhncemnt Course		T O T A L
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancmnt compulsory course(AECC)	Skill Enhancmnt course (SEC)	
No. of course	12	6(BSc)/4(BA/B.Com)	2((BA/B.Com)	2	2	24
Credit/course	6	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.A./ B.SC ECONOMICS (GENERAL) UNDER CBCS

S. No.	Particulars of Course	
1.	Core Course: 14 Papers	Theory + Tutorial
1.A.	Core Course: Theory (12 papers)	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x1 = 12
2.		
A.	DSE (4 papers for B.A in Economics)	4x5 = 20
B.	DSE(Tutorial)* (4 papers for B.A in Economics)	4x1 = 4
C.	GE (Interdisciplinary) (2 papers for B.A in Economics)	2x5 = 10
D.	GE (Tutorial)* (2 papers for B.A in Economics)	2x1 = 2
A.	AECC(2 papers of 2 credits each) ENVS, English Communication / MIL	2x2 = 4
B.	Skill Enhancement Course(SEC) (4 papers of 2 credits each)	4x2 = 8
Total Credit:		120

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.A in ECONOMICS (GENERAL)

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC-1,2 (6)	2(1A,2A)	2 1B,2B)	2 (1C,2C)	2 (1D,2D)			8	48
Language CC - 1,2 (6)	1 (L1-1)	1 (L2-1)	1 (L1-2)	1 (L2-2)			4	24
DSE (6)	-	-	-	-	2(1A,2A)	2 (1B,2B)	4	24
GE (6)					1(GE-1)	1(GE-2)	2	12
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Courses/ Sem.	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

**TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN B.A (GENERAL) in ECONOMICS
(6 Credit: 75 Marks)**

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
ECON-G-CC-T-1	Principles of Microeconomics – I	Core	6(5L+1T)
ECON-G-CC-T-2	To be chosen from other discipline	Core	6(5L+1T)
ECON-G-CC-T-3	Language 1 – I	Core	6(5L+1T)
ECON-G-AECC-T-1	English/ENVS	AECC	2
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
ECON-G-CC-T-4	Principles of Macroeconomics – I	Core	6(5L+1T)
ECON-G-CC-T-5	To be chosen from other discipline	Core	6(5L+1T)
ECON-G-CC-T-6	Language 2 – I	Core	6(5L+1T)
ECON-G-AECC-T-2	English/ENVS	AECC	2
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
ECON-G-CC-T-7	Principles of Microeconomics – II	Core	6(5L+1T)
ECON-G-CC-T-8	To be chosen from other discipline	Core	6(5L+1T)
ECON-G-CC-T-9	Language 1- II	Core	6(5L+1T)
ECON-G-SEC-T-1	Financial Economics	SEC	2
Total	5 courses	Total	20
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
ECON-G-CC-T-10	Principles of Macroeconomics – II	Core	6(5L+1T)
ECON-G-CC-T-11	To be chosen from other discipline	Core	6(5L+1T)
ECON-G-CC-T-12	Language 2 – II	Core	6(5L+1T)
ECON-G-SEC-T-2	Statistical Tools for Data Analysis – I	SEC	2
Total	5 courses	Total	20
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
ECON-G-DSE-T-1A or ECON-G-DSE-T-1B	Economic Development and Policy in India – I Money and Banking	DSE	6(5L+1T)
ECON-G-DSE-T-2	To be chosen from other discipline	DSE	6(5L+1T)
ECON-G-GE-T-1	Principles of Microeconomics – I	GE	6(5L+1T)
ECON-G-SEC-T-3	Statistical Tools for Data Analysis – II	SEC	2
Total	4 courses	Total	20
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
ECON-G-DSE-T-3A or ECON-G-DSE-T-3B	Economic Development and Policy in India – II Economic History of India (1857-1947)	DSE	6(5L+1T)
ECON-G-DSE-T-4	To be chosen from other discipline	DSE	6(5L+1T)
ECON-G-GE-T-2	Principles of Macroeconomics – I	GE	6(5L+1T)
ECON-G-SEC-T-4	Introduction to Indian Public Finance	SEC	2
Total	4 courses	Total	20
Total (All semesters)	26 courses	Total	120

*Detail Course & Contents of each subject specific syllabus will be given as per standard format as provided below.

- ❖ **COURSE CODE & COURSE TITLE:**
- ❖ **Each paper of any course denoted by-(2-4 letters Subject Code--Honours/General (H/G)--Course Type(CC/GE/DSE)-(Theory/Tutorial/Practical)-Number of course. Ex.-Chemistry-CHEM-H-CC-T-1)**
- A. Core courses (CC)**
 1. ECON—G-CC- T-01: Principles of Microeconomics - I
 2. ECON—G-CC- T -02: To be chosen from other discipline
 3. ECON-G-CC-T-03: Language 1 – I
 4. ECON-G-CC-T-04: Principles of Macroeconomics – I
 5. ECON-G-CC-T-05: To be chosen from other discipline
 6. ECON-G-CC-T-06: Language 2 – I
 7. ECON-G-CC-T-07: Principles of Microeconomics – II
 8. ECON-G-CC-T-08: To be chosen from other discipline
 9. ECON-G-CC-T-09: Language 1 – II
 10. ECON-G-CC-T-10: Principles of Macroeconomics – II
 11. ECON-G-CC-T-11: To be chosen from other discipline
 12. ECON-G-CC-T-12: Language 2 - II
- B. Discipline specific elective courses (DSE)**
 1. ECON—G-DSE- T-1A: Economic Development and Policy in India - I
 1. ECON—G-DSE- T-1B: Money and Banking
 2. ECON-G-DSE-T-2: To be chosen from other discipline
 3. ECON—G-DSE- T -3A: Economic Development and Policy in India – II
 3. ECON-G-DSE-T-3B: Economic History of India (1857-1947)
- C. Generic elective courses (GE):**
 1. ECON—G-GE- T-01: Principles of Microeconomics - I
 1. ECON—G-GE- T-02: Principles of Macroeconomics - I
- D. Ability enhancement compulsory courses (AECC)**
 1. AECC-01: English/ENVS
 2. AECC-02: English/ENVS
- E. Skill enhancement courses (SEC)**
 1. ECON—G-SEC- T-01: Financial Economics
 1. ECON—G-SEC- T-02: Statistical Tools for Data Analysis - I
 3. ECON- G-SEC-T-03: Statistical Tools for Data Analysis – II
 4. ECON-G-SEC-T-04: Introduction to Indian Public Finance

B.A./ B.Sc.. ECONOMICS (GENERAL)

SEMESTER-I

Course: ECON—G-CC-T-01

Course title: Principles of Microeconomics - I

Core Course; Credit-6; Full Marks-75

COURSE OBJECTIVES:

After completion of the course the learners will be able to:

- Learn the basic functioning of individual economic agents in a market economy

COURSE CONTENT:

1. Introduction

a. Problem of scarcity and choice: scarcity, choice and opportunity cost; production possibility frontier; economic systems.

b. Demand and supply: law of demand, determinants of demand, shifts of demand versus movements along a demand curve, market demand, law of supply, determinants of supply, shifts of supply versus movements along a supply curve, market supply, market equilibrium.

c. Applications of demand and supply: price rationing, price floors, consumer surplus, producer surplus.

d. Elasticity: price elasticity of demand, calculating elasticity, determinants of price elasticity, other elasticities.

2. Consumer Theory

Budget constraint, concept of utility, diminishing marginal utility, Diamond-water paradox, income and substitution effects; consumer choice: indifference curves, derivation of demand curve from indifference curve and budget constraint.

3. Production and Costs

a. Production: behaviour of profit maximising firms, production process, production functions, law of variable proportions, choice of technology, isoquant and isocost lines, cost minimizing equilibrium condition.

b. Costs: costs in the short run, costs in the long run, revenue and profit maximizations, minimizing losses, short run industry supply curve, economies and diseconomies of scale, long run adjustments.

4. Perfect Competition

Assumptions: theory of a firm under perfect competition, demand and revenue; equilibrium of the firm in the short run and long run; long run industry supply curve: increasing, decreasing and constant cost industries.

SUGGESTED READINGS:

1. Case, Karl E. & Ray C. Fair, *Principles of Economics*, Pearson Education, Inc., 8th edition, 2007.
2. Samuelson, P. & Nordhaus, *Economics*,
3. Lipsey and Chrystal: *An Introduction to Positive Economics*

Course: ECON—G-CC-T-02
Course title: *To be chosen from other discipline*
Core Course; Credit-6; Full Marks-75

Course: ECON—G-CC-T-03
Course title: Language 1 - I
Core Course; Credit-6; Full Marks-75

Course: ECON—G-AECC-T-01
Course title: English/ENVS
Ability Enhancement Compulsory Course; Credit-2; Full Marks-50

SEMESTER - II

Course: ECON—G-CC-T-04
Course title: Principles of Macroeconomics - I
Core Course; Credit-6; Full Marks-75

COURSE OBJECTIVES:

After the completion of the course the learner will be able to:

- Learn the basic variables of a market economy at the macro level.
- Learn the concepts like national income and money in modern market economy

COURSE CONTENT:

1. Introduction

What is macroeconomics? Macroeconomic issues in an economy.

2. National Income Accounting

Concepts of GDP and National Income; measurement of national income and related aggregates; nominal and real income; limitations of the GDP concept.

3. Determination of GDP

Actual and potential GDP; aggregate expenditure; consumption function; investment function; equilibrium GDP; concepts of MPS, APS, MPC, APC; autonomous expenditure; Concept of multiplier.

4. National Income Determination in an Open Economy with Government

Fiscal Policy: impact of changes in government expenditure and taxes; net exports function; net exports and equilibrium national income.

5. Money in a Modern Economy

Concept of money in a modern economy; monetary aggregates; demand for money; quantity theory of money; liquidity preference and rate of interest; money supply and credit creation; monetary policy.

SUGGESTED READINGS:

1. Case, Karl E. & Ray C. Fair, *Principles of Economics*, Pearson Education, Inc., 8th edition, 2007.
2. Sikdar, Soumyen, *Principles of Macroeconomics*, 2nd Edition, Oxford University Press, India
3. Lipsey and Chrystal: *An Introduction to Positive Economics*

Course: ECON—G-CC-T-05

Course title: *To be chosen from other discipline*
Core Course; Credit-6; Full Marks-75

Course: ECON—G-CC-T-06

Course title: Language 2 - I
Core Course; Credit-6; Full Marks-75

Course: ECON—G-AECC-T-02

Course title: English/ENVS
Ability Enhancement Compulsory Course; Credit-2; Full Marks-50

SEMESTER - III

Course: ECON—G-CC-T-07

Course title: Principles of Microeconomics - II
Core Course; Credit-6; Full Marks-75

COURSE OBJECTIVES:

This is a sequel to Principles of Microeconomics–I covered in the first semester. The objective of the course is the same as in Principles of Microeconomics I.

COURSE CONTENT:

1. Market Structures

a. Theory of a Monopoly Firm

Concept of imperfect competition; short run and long run price and output decisions of a monopoly firm; concept of a supply curve under monopoly; comparison of perfect competition and monopoly, social cost of monopoly, price discrimination; remedies for monopoly: Antitrust laws, natural monopoly.

b. Imperfect Competition

Monopolistic competition: Assumptions, SR & LR price and output determinations under monopolistic competition, economic efficiency and resource allocation; oligopoly (concepts only)

2. Consumer and Producer Theory

a. Consumer and Producer Theory in Action

Externalities, marginal cost pricing, internalising externalities, public goods

b. Markets and Market Failure

Market adjustment to changes in demand, efficiency of perfect competition; sources of market failure: imperfect markets, public goods, externalities, imperfect information; evaluating the market mechanism. (Concepts only)

3. Income Distribution and Factor pricing

Input markets: demand for inputs; labour markets, land markets, profit maximisation condition in input markets, input demand curves, distribution of Income.

4. International Trade

Absolute advantage, comparative advantage, terms of trade, sources of comparative advantage, trade barriers, free trade/ protectionism.

SUGGESTED READINGS:

1. Case, Karl E. & Ray C. Fair, *Principles of Economics*, Pearson Education, Inc., 8th edition, 2007.
2. Samuelson, P. & Nordhaus, *Economics*,

Course: ECON—G-CC-T-08

Course title: *To be chosen from other discipline*

Core Course; Credit-6; Full Marks-75

Course: ECON—G-CC-T-09

Course title: Language 1 - II

Core Course; Credit-6; Full Marks-75

Course: ECON—G-SEC-T-01
Course title: Financial Economics
Skill Enhancement Course; Credit-2; Full Marks-50

COURSE OBJECTIVES:

This course introduces students to the economics of finance. The course does not require any prior knowledge of economics. This course should be accessible to anyone with an exposure to elementary mathematics. The course is designed to impart the essential aspects of financial asset valuation. The students will be introduced to numerical techniques in finance using spreadsheet programmes such as Microsoft Excel. The course will impart skills that will be useful in a variety of business settings including investment banks, asset management companies and in the field of financial and business journalism.

COURSE CONTENT:

1. Deterministic cash-flow streams

Basic theory of interest; discounting and present value; internal rate of return; evaluation criteria; fixed-income securities; bond prices and yields; the term structure of interest rates; yield curves; spot rates and forward rates.

2. Single-period random cash flows

Random asset returns; portfolios of assets; portfolio mean and variance;

SUGGESTED READINGS:

1. David G. Luenberger, *Investment Science*, Oxford University Press, USA, 1997.
2. Richard A. Brealey and Stewart C. Myers, *Principles of Corporate Finance*, McGraw-Hill, 7th edition, 2002.
3. Burton G. Malkiel, *A Random Walk Down Wall Street*, W.W. Norton & Company, 2003.
4. Simon Benninga, *Financial Modeling*, MIT Press, USA, 1997.
5. Chandra, Prasanna, *Fundamentals of Financial Management*

SEMESTER IV

Course: ECON—G-CC-T-10
Course title: Principles of Macroeconomics - II
Core Course; Credit-6; Full Marks-75

COURSE OBJECTIVES:

This is a sequel to Principles of Macroeconomics–I. It analyses various theories of determination of National Income in greater detail. It also introduces students to concept of inflation, its relationship with unemployment and some basic concepts in an open economy.

COURSE CONTENT:

1. IS-LM Analysis

Derivations of the IS and LM functions; IS-LM and aggregate demand; shifts in the AD curve.

2. GDP and Price Level in Short Run and Long Run

Aggregate demand and aggregate supply; multiplier Analysis with AD curve and changes in price levels; aggregate supply in the SR and LR.

3. Inflation and Unemployment

Concept of inflation; determinants of inflation; relationship between inflation and unemployment: Phillips Curve in short run and long run.

SUGGESTED READINGS:

1. Case, Karl E. & Ray C. Fair, *Principles of Economics*, Pearson Education, Inc., 8th edition, 2007.
2. Sikdar, Soumyen, *Principles of Macroeconomics*, 2nd Edition, Oxford University Press, India

Course: ECON—G-CC-T-11
Course title: *To be chosen from other discipline*
Core Course; Credit-6; Full Marks-75

Course: ECON—G-CC-T-12
Course title: Language 2 - II
Core Course; Credit-6; Full Marks-75

Course: ECON—G-SEC-T-02
Course title: Statistical Tools for Data Analysis - I
Skill Enhancement Course; Credit-2; Full Marks-50

COURSE OBJECTIVES:

This course introduces the student to collection and presentation of data. It also discusses how data can be summarized and analysed for drawing statistical inferences. The students will be introduced to important data sources that are available and will also be trained in the use of free statistical software to analyse data.

COURSE CONTENT:

1. Sources of data. Population census versus sample surveys. Random sampling.
2. Univariate frequency distributions. Measures of central tendency: mean, median and mode; arithmetic, geometric and harmonic mean. Measures of dispersion, skewness and kurtosis.

SUGGESTED READINGS:

1. P.H. Karmel and M. Polasek (1978), *Applied Statistics for Economists*, 4th edition, Pitman.
2. M.R. Spiegel (2003), *Theory and Problems of Probability and Statistics* (Schaum Series).
3. Das, N.G, *Statistical Methods*
4. Goon, Gupta and Dasgupta, *Fundamentals of Statistics* (Volume I)
5. A.L. Nagar and R. K. Das, *Basic Statistics*, OUP, Second Edition

SEMESTER V

Course: ECON—G-DSE-T-1A
Course title: Economic Development and Policy in India - I
Discipline Specific Elective; Credit-6; Full Marks-75

COURSE OBJECTIVES:

This course reviews major trends in aggregate economic indicators in India and places these against the backdrop of major policy debates in India in the post- Independence period.

COURSE CONTENT:

- 1. Issues in Growth, Development and Sustainability**
- 2. Factors in Development**

Capital formation (Physical and Human); technology; institutions.

3. Population and Economic Development

Demographic trends; urbanisation.

4. Employment

Occupational structure in the organised and the unorganised sectors; open-, under and disguised unemployment (rural and urban); employment schemes and their impact.

5. Indian Development Experience

Critical evaluation of growth, inequality, poverty and competitiveness, pre and post reforms era; savings and investment; mobilisation of internal and external finance; monetary and fiscal policies; centre-state financial relations.

SUGGESTED READINGS:

1. Michael P Todaro and Stephen Smith. *Economic Development*, Pearson, 11th edition (2011).
2. Uma Kapila, *Indian Economy since Independence*, Academic Foundation, 19th edition (2009).
3. United Nations Development Programme, *Human Development Report 2010*, Palgrave Macmillan (2010).
4. Government of India, *Economic Survey* (latest)
5. Government of India, *Five Year Plan* (latest)
6. Government of India, *Finance Commission Report* (latest)
7. Dutt and Sundaram, *Indian Economy* (Latest Edition)
8. Mishra and Puri, *Indian Economy* (Latest Edition)

Course: ECON—G-DSE-T-1B
Course title: Money and Banking
Discipline Specific Elective; Credit-6; Full Marks-75

COURSE OBJECTIVES:

This course exposes students to the theory and functioning of the monetary and financial sectors of the economy. It highlights the organization, structure and role of financial markets and institutions. It also discusses interest rates, monetary management and instruments of monetary control. Financial and banking sector reforms and monetary policy with special reference to India are also covered.

COURSE CONTENT:

1. Money

Concept, functions, measurement; theories of money supply determination.

2. Financial Institutions, Markets, Instruments and Financial Innovations

- a. Role of financial markets and institutions; problem of asymmetric information – adverse selection and moral hazard; financial crises.
- b. Money and capital markets: organization, structure and reforms in India; role of financial derivatives and other innovations.

3. Interest Rates

Determination; sources of interest rate differentials; theories of term structure of interest rates; interest rates in India.

4. Banking System

- a. Balance sheet and portfolio management.
- b. Indian banking system: Changing role and structure; banking sector reforms.

5. Central Banking and Monetary Policy

Functions, balance sheet; goals, targets, indicators and instruments of monetary control; monetary management in an open economy; current monetary policy of India.

SUGGESTED READINGS:

1. F. S. Mishkin and S. G. Eakins, *Financial Markets and Institutions*, Pearson Education, 6th edition, 2009.
2. F. J. Fabozzi, F. Modigliani, F. J. Jones, M. G. Ferri, *Foundations of Financial Markets and Institutions*, Pearson Education, 3rd edition, 2009.
3. L. M. Bhole and J. Mahukud, *Financial Institutions and Markets*, Tata McGraw Hill, 5th edition, 2011.
4. M. Y. Khan, *Indian Financial System*, Tata McGraw Hill, 7th edition, 2011.
5. Various latest issues of R.B.I. Bulletins, Annual Reports, Reports on Currency and Finance and Reports of the Working Group, IMF Staff Papers.

Course: ECON—G-DSE-T-2
Course title: *To be chosen from other discipline*
Discipline Specific Elective; Credit-6; Full Marks-75

Course: ECON—G-GE-T-1
Course title: Principles of Microeconomics - I
Generic Elective; Credit-6; Full Marks-75

COURSE OBJECTIVES:

After completion of the course the learners will be able to:

- Learn the basic functioning of individual economic agents in a market economy

COURSE CONTENT:

1. Introduction

a. Problem of scarcity and choice: scarcity, choice and opportunity cost; production possibility frontier; economic systems.

b. Demand and supply: law of demand, determinants of demand, shifts of demand versus movements along a demand curve, market demand, law of supply, determinants of supply, shifts of supply versus movements along a supply curve, market supply, market equilibrium.

c. Applications of demand and supply: price rationing, price floors, consumer surplus, producer surplus.

d. Elasticity: price elasticity of demand, calculating elasticity, determinants of price elasticity, other elasticities.

2. Consumer Theory

Budget constraint, concept of utility, diminishing marginal utility, Diamond-water paradox, income and substitution effects; consumer choice: indifference curves, derivation of demand curve from indifference curve and budget constraint.

3. Production and Costs

a. Production: behaviour of profit maximising firms, production process, production functions, law of variable proportions, choice of technology, isoquant and isocost lines, cost minimizing equilibrium condition.

b. Costs: costs in the short run, costs in the long run, revenue and profit maximizations, minimizing losses, short run industry supply curve, economies and diseconomies of scale, long run adjustments.

4. Perfect Competition

Assumptions: theory of a firm under perfect competition, demand and revenue; equilibrium of the firm in the short run and long run; long run industry supply curve: increasing, decreasing and constant cost industries.

SUGGESTED READINGS:

1. Case, Karl E. & Ray C. Fair, *Principles of Economics*, Pearson Education, Inc., 8th edition, 2007.
2. Samuelson, P. & Nordhaus, *Economics*,
3. Lipsey and Chrystal: *An Introduction to Positive Economics*

Course: ECON—G-SEC-T-03

**Course title: Statistical Tools for Data Analysis - II
Skill Enhancement Course; Credit-2; Full Marks-50**

COURSE OBJECTIVES:

This paper is a sequel to Statistical Tools for Data Analysis – I. It will teach the students how to use bivariate data and how to construct different index numbers.

COURSE CONTENT:

1. Bivariate frequency distribution. Correlation and regression. Rank correlation.
2. Basics of index numbers: price and quantity index numbers.

SUGGESTED READINGS:

1. P.H. Karmel and M. Polasek (1978), *Applied Statistics for Economists*, 4th edition, Pitman.
2. M.R. Spiegel (2003), *Theory and Problems of Probability and Statistics* (Schaum Series).
3. Das, N.G, *Statistical Methods*
4. Goon, Gupta and Dasgupta, *Fundamentals of Statistics* (Volume I)
5. A.L. Nagar and R. K. Das, *Basic Statistics*, OUP, Second Edition

SEMESTER VI

Course: ECON—G-DSE-T-3A

Course title: Economic Development and Policy in India - II
Discipline Specific Elective; Credit-6; Full Marks-75

COURSE OBJECTIVES:

Building on the more aggregative analysis of trends in the Indian Economy offered in Economic Development and Policy–I, this course examines sector-specific trends in key indicators and their implications in the post-Independence period.

COURSE CONTENT:

1. Agriculture: Policies and Performance

Production and productivity; credit; labour; markets and pricing; land reforms; regional variations.

2. Industry: Policies and Performance

Production trends; small scale industries; public sector; foreign investment.

3. Foreign Trade: Trends and Policies

Balance of trade and balance of payments; India and the World Trade Organisation.

SUGGESTED READINGS:

1. Uma Kapila, *Indian Economy since Independence*, Academic Foundation, 19th edition (2009).
2. Government of India, *Economic Survey* (latest)
3. Government of India, *Five Year Plan* (latest)
4. Dutt and Sundaram, *Indian Economy* (Latest Edition)
5. Mishra and Puri, *Indian Economy* (Latest Edition)

Course: ECON—G-DSE-T-3B

Course title: Economic History of India (1857-1947)
Discipline Specific Elective; Credit-6; Full Marks-75

COURSE OBJECTIVES:

This course analyses key aspects of Indian economic development during the second half of British colonial rule. In doing so, it investigates the place of the Indian economy in the wider colonial context, and the mechanisms that linked economic development in India to the compulsions of colonial rule. This course links directly to the course on India's economic development after independence in 1947.

COURSE CONTENT:

1. Introduction: Colonial India: Background and Introduction

Overview of colonial economy.

2. Macro Trends

National Income; population; occupational structure.

3. Agriculture

Agrarian structure and land relations; agricultural markets and institutions – credit, commerce and technology; trends in performance and productivity; famines.

4. Railways and Industry

Railways; the de-industrialisation debate; evolution of entrepreneurial and industrial structure; nature of industrialisation in the interwar period; constraints to industrial breakthrough; labor relations.

5. Economy and State in the Imperial Context

The imperial priorities and the Indian economy; drain of wealth; international trade, capital flows and the colonial economy – changes and continuities; government and fiscal policy.

SUGGESTED READINGS:

1. Lakshmi Subramanian, “*History of India 1707-1857*”, Orient Blackswan, 2010, Chapter 4.
2. Sumit Guha, 1991, ‘Mortality decline in early 20th century India’, *Indian Economic and Social History Review (IESHR)*, pp 371-74 and 385-87.
3. Tirthankar Roy, *The Economic History of India 1857-1947*, Oxford University Press, 3rd edition, 2011.
4. J. Krishnamurty, *Occupational Structure*, Dharma Kumar (editor), The Cambridge Economic History of India, Vol. II, (henceforth referred to as CEHI), 2005, Chapter 6.
5. Irfan Habib, *Indian Economy 1858-1914*, A People’s History of India, Vol.28, Tulika, 2006.
6. Ira Klein, 1984, —When Rains Fail: Famine relief and mortality in British India, *IESHR* 21.
7. Jean Dreze, *Famine Prevention in India in Dreze and Sen (eds.) Political Economy of Hunger*, WIDER Studies in Development Economics, 1990, pp.13-35.
8. John Hurd, *Railways*, CEHI, Chapter 8, pp.737-761.
9. Rajat Ray (ed.), *Entrepreneurship and Industry in India*, 1994.
10. AK Bagchi, —Deindustrialization in India in the nineteenth century: Some theoretical implications, *Journal of Development Studies*, 1976.

11. MD Morris, *Emergence of an Industrial Labour Force in India*, OUP 1965, Chapter 11, Summary and Conclusions.
12. K.N. Chaudhuri, *Foreign Trade and Balance of Payments*, CEHI, Chapter 10.
13. B.R. Tomlison, 1975, *India and the British Empire 1880-1935*, IESHR, Vol.XII.
14. Dharma Kumar, *The Fiscal System*, CEHI, Chapter 12.
15. Basudev Chatterjee, *Trade, Tariffs and Empire*, OUP 1992, Epilogue. Background reading for students: Irfan Habib, *Indian Economy 1858-1914* (A People's History of India), Vol.28, Tulika 2006.
- 16 Daniel Thorner, *Agrarian Prospect in India*, 1977.
17. L. Visaria and P. Visaria, *Population*. CEHI, Chapter 5.

Course: ECON—G-DSE-T-4

Course title: *To be chosen from other discipline*
Discipline Specific Elective; Credit-6; Full Marks-75

Course: ECON—G-GE-T-2

Course title: Principles of Macroeconomics - I
Generic Elective; Credit-6; Full Marks-75

COURSE OBJECTIVES:

After the completion of the course the learner will be able to:

- Learn the basic variables of a market economy at the macro level.
- Learn the concepts like national income and money in modern market economy

COURSE CONTENT:

1. Introduction

What is macroeconomics? Macroeconomic issues in an economy.

2. National Income Accounting

Concepts of GDP and National Income; measurement of national income and related aggregates; nominal and real income; limitations of the GDP concept.

3. Determination of GDP

Actual and potential GDP; aggregate expenditure; consumption function; investment function; equilibrium GDP; concepts of MPS, APS, MPC, APC; autonomous expenditure; Concept of multiplier.

4. National Income Determination in an Open Economy with Government

Fiscal Policy: impact of changes in government expenditure and taxes; net exports function; net exports and equilibrium national income.

5. Money in a Modern Economy

Concept of money in a modern economy; monetary aggregates; demand for money; quantity theory of money; liquidity preference and rate of interest; money supply and credit creation; monetary policy.

SUGGESTED READINGS:

1. Case, Karl E. & Ray C. Fair, *Principles of Economics*, Pearson Education, Inc., 8th edition, 2007.
2. Sikdar, Soumyen, *Principles of Macroeconomics*, 2nd Edition, Oxford University Press, India
3. Lipsey and Chrystal: *An Introduction to Positive Economics*

Course: ECON—G-SEC-T-04

**Course title: Introduction to Indian Public Finance
Skill Enhancement Course; Credit-2; Full Marks-50**

COURSE OBJECTIVES:

This course is intended to equip students with some of the current conceptual issues and empirical trends pertaining to fiscal policy and budget making in India.

COURSE CONTENT:

1. Concepts:

- (a) Fiscal Policy, need for government spending, area of government spending in India.
- (b) Capital Expenditure, Revenue Expenditure, Plan Expenditure and Non-Plan Expenditure
- (c) Deficits – fiscal, primary and revenue, impact of fiscal deficits on economy, need to control fiscal deficits
- (d) Capital Receipts, Revenue Receipts, Tax and Non-Tax Revenue, Direct and Indirect Taxes, Goods and Service Tax (GST)

2. Understanding Union Budget:

- (a) What is budget?
- (b) Trends in different deficits in budget in India
- (c) Trends of different receipts in budget in India
- (d) Trends of different expenditures in budget in India

SUGGESTED READINGS:

1. Economic Survey, Government of India (latest)
2. The Key to Budget Documents, Budget at a Glance, Macroeconomic Framework Statement, Medium Term Fiscal Policy Statement and Fiscal Policy Strategy Statement available at www.indiabudget.nic.in
3. Uma Kapila (2016), “Fiscal and Budgetary Developments”, in *Indian Economy since Independence*, Academic Foundation, latest edition.
4. Economic and Social Classification of the Budget, available at <http://www.unionbudget.nic.in>

UNIVERSITY OF KALYANI



**CBCS CURRICULUM FOR THREE YEARS UNDER-GRADUATE COURSE
IN
EDUCATION (GENERAL)**

**WITH EFFECT FROM THE ACADEMIC SESSION
2018-19**

INTRODUCTION:

The University Grants Commission (UGC) has taken various measures by means of formulating regulations and guidelines and updating them, in order to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions in India. The various steps that the UGC has initiated are all targeted towards bringing equity, efficiency and excellence in the Higher Education System of country. These steps include introduction of innovation and improvements in curriculum structure and content, the teaching-learning process, the examination and evaluation systems, along with governance and other matters. The introduction of Choice Based Credit System is one such attempt towards improvement and bringing in uniformity of system with diversity of courses across all higher education institutes in the country. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising of core, elective, skill enhancement or ability enhancement courses. The courses shall be evaluated following the grading system, is considered to be better than conventional marks system. This will make it possible for the students to move across institutions within India to begin with and across countries for studying courses of their choice. The uniform grading system shall also prove to be helpful in assessment of the performance of the candidates in the context of employment.

Outline of the Choice Based Credit System being introduced:

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. Ability Enhancement Courses/ Skill Enhancement Courses:

3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

A. TOTAL Number of courses in UG-CBCS (B.A.GENERAL):

Types of course	Core course (CC)	Elective course		Ability Enhancement Course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course (GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	12	6(BSc)/4(BA/B.Com)	2((BA/B.Com)	2	2	24
Credit/course	6	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.A.(GENERAL) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory + Tutorial
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (12 papers)	12x4 = 48	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x2 = 24	12x1 = 12
2.	Elective Courses: (6 papers)		
A.	DSE (6 papers for B.Sc./ 4 papers for B.A. & B.Com.)	6x4 = 24	4x5 = 20
B.	DSE(Pract./ Tutor.)* (6 papers for B.Sc./4 for B.A. & B.Com.)	6x2 = 12	4x1 = 4
C.	GE (Interdisciplinary) (2 papers for B.A. & B.Com.)	--	2x5 = 10
D.	GE (Pract./Tutor.)* (4 papers) (2 papers for B.A. & B.Com.)	--	2x1 = 2
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication / MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (4 papers of 2 credits each)-----	4x2 = 8	4x2 = 8
Total Credit:		120	120

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.A. GENERAL

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC-1,2 (6)	2(1A,2A)	2 (1B,2B)	2 (1C,2C)	2 (1D,2D)			8	48
Language CC - 1,2 (6)	1 (L1-1)	1 (L2-1)	1 (L1-2)	1 (L2-2)			4	24
DSE (6)	-	-	-	-	2(1A,2A)	2 (1B,2B)	4	24
GE (6)					1(GE-1)	1(GE-2)	2	12
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Courses/ Sem.	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

❖ **COURSE CODE & COURSE TITLE:**

A. Core courses (CC)

1. EDU-G-CC-T-1: Philosophical Foundation of Education
2. EDU-G-CC-T-2: Sociological Foundation of Education
3. EDU-G-CC-T-3: Psychological Foundation of Education
4. EDU-G-CC-T-4: Historical foundation of Education

B. Discipline specific elective courses (DSE)

1. EDU-G-DSE-T-1/2(A): Value Education
2. EDU-G-DSE-T-1/2(B): Population Education
3. EDU-G-DSE-T-1/2(C): Peace Education
4. EDU-G-DSE-T-1/2(D): Distance Education
5. EDU-G-DSE-T-3/4(A): Mental Hygiene
6. EDU-G-DSE-T-3/4(B): Comparative Education
7. EDU-G-DSE-T-3/4(C): Guidance & Counseling
8. EDU-G-DSE-T-3/4(D): Great Educators

C. Generic elective courses (GE):

1. EDU-G-GE-T-1(A): Health Education
2. EDU-G-GE-T-1(B): Life Skill Education
3. EDU-G-GE-T-2(A): Pedagogical Knowledge
4. EDU-G-GE-T-2(B): Lifelong Learning and Education

D. Ability enhancement compulsory courses (AECC)

1. AECC-1: Environmental Education
2. AECC-2: English Communication

E. Skill enhancement courses (SEC)

1. EDU-G-SEC-T-1(A): Educational Statistics-I
2. EDU-G-SEC-T-1(B): Educational Statistics-II
3. EDU-G-SEC-T-2(A): Lesson planning
4. EDU-G-SEC-T-2(B): Uses of Teaching Aids
5. EDU-G-SEC-T-3(A): Guidance services
6. EDU-G-SEC-T-3(B): Achievement Test
7. EDU-G-SEC-T-4(A): Life long learning
8. EDU-G-SEC-T-4(B): Yoga Education

Table-3: Semester & Coursewise credit distribution in B.A. (General): (6 Credit: 75 Marks, 2 Credit: 50 Marks)

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-G-CC-T-1	Philosophical foundation of Education	Core (75L+15T)	6(5L+1T)
		Core	6
	L1-1	Core	6
AECC-1	Environmental Education	Ability enhancement compulsory (30L)	2 (2L)
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-G-CC-T-2	Psychological foundation of Education	Core (75L+15T)	6(5L+1T)
		Core	6
	L2-1	Core	6
AECC-2	English communication	Ability enhancement compulsory (30L)	2 (2L)
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-G-CC-T-3	Sociological foundation of Education	Core (75L+15T)	6(5L+1T)
		Core	6
	L1-2	Core	6
EDU-G-SEC-T-1	A. Educational Statistics - I B. Educational Statistics - II	Skill enhancement (30L)	2 (2L)
Total	4 courses	Total	26
SEMESTER-IV			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-G-CC-T-4	Historical foundation of Education	Core (75L+15T)	6(5L+1T)
		Core	6
	L2-2	Core	6
EDU-G-SEC-T-2 (any one)	A. Lesson Planning B. Uses of Teaching Aids	Skill enhancement (30L)	2 (2L)
Total	4 courses	Total	26
SEMESTER-V			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-G-DSE-T-1 EDU-G-DSE-T-2 (any two)	A: Value Education B: Population Education C: Guidance and Counselling D: Distance Education	Discipline specific (75L+15L)	2x6 (2x5L+2x1L)
EDU-G-GE-T-1 (any one)	A: Health Education B: Vocational Education	Generic Elective (75L+15T)	6(5L+1T)
EDU-G-SEC-T-3 (any one)	A. Guidance services B. Achievement Test	Skill enhancement (30L)	2 (2L)
Total	4 courses	Total	24
SEMESTER-VI			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-G-DSE-T-3 EDU-G-DSE-T-4 (any two)	A: Mental hygiene B: Comparative Education C: Peace Education D: Great educators	DSE	6x2=12
EDU-G-GE-T-2 (any one)	A: Women Education B: Life skill Education	Generic Elective (75L+15T)	6(5L+1T)
EDU-G-SEC-T-4 (any one)	A. Life long learning B. Yoga Education	Skill enhancement (30L)	2 (2L)
Total	4 courses	Total	24
Total (All Semesters)	26 courses	Total	120

**CBCS CURRICULUM OF B.A.
IN
EDUCATION (GENERAL)**

B.A. Education (General)
SEMESTER-I
EDU-G-CC-T-1: Philosophical Foundation of Education
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Explain the meaning, nature, scope and aims of education.
- Discuss the meaning and scope of educational philosophy.
- Explain the factors of education and their relationships.
- Explain the concept of Democracy, Socialism and Secularism.
- State the educational philosophies of Swami Vivekananda, Rabindranath Tagore, Rousseau, Dewey.

Unit-I: Concept, Scope and Aim of Education

- a) Meaning, Nature and scope of Education.
- b) Individualistic and socialistic aim.
- c) Delor's commission (UNESCO, 1997)
- d) Meaning and scope of educational Philosophy; Relation between education and philosophy.

Unit-II: Factors of Education: their inter-relationship.

- a) Child: Meaning and characteristics of child centric education system.
- b) Teacher: Qualities and duties of a good teacher. Teacher as a motivator, mentor, facilitator and problem solver.
- c) Curriculum: Meaning and principles of curriculum construction. Co-curricular activities.
- d) School: vision and functions.

Unit-III : School of Philosophy and national values

- a) Western School of Philosophy: Idealism, Naturalism, Pragmatism: special reference to principles, aims of education, curriculum, teaching method, teacher, discipline.
- b) Inculcation of National Value: Democracy, Equality

Unit-IV : Great Educators and their educational philosophy

- a) Swami Vivekananda, Rabindranath Tagore.
- b) Rousseau, Dewey.

Suggested Book:

1. J. C. Aggarwal- Theory and Principles of education
2. J. C. Aggarwal - Philosophical and Sociological bases of Education
3. S. P. Chaube & A. Chaube – Foundations of Education
4. K. K. Shrivastava- Philosophical Foundations of Education
5. A. P. Sharma – Indian and Western Educational Philosophy
6. S. S. Ravi – A Comprehensive Study of Education
7. M. Sharma – Educational Practices of Classical Indian Philosophies
8. S. S. Chandra & R. K. Sharma- Philosophy of Education
9. N. Arora – Educational Philosophy
10. M. K. Goswami- Educational Thinkers: Oriental and Occidental, Thoughts and Essays
11. B. R. Purkait – Great Educators

12. पञ्चम लु - ढरुाशुँ J ढरुनुँ
13. अलु -ओ - ढरुह'ल-लनुँ J सुमाशुँ
14. अकुँ ह-कुँदलु - ढरुनुँ J ढरुलु
15. क-हकुँ वकुँ - ढरु J अनुँ
16. -नुलु कुलु हलु कुँ नुँ- ढरुाशुँ J ढरुलु
17. कुँलु ...कु - ढरुु कुँलु

B.A. Education (General)
SEMESTER-I
: Language 1-1
Core Course; Credit-6. Full Marks-75

COMMON SYLLABUS

B.A. Education (General)
SEMESTER-I
AECC-1: Environmental Education
Ability enhancement compulsory Course; Credit-2. Full Marks-50

COMMON SYLLABUS

B.A. Education (General)
SEMESTER-II
EDU-G-CC-T-2: Psychological Foundation of Education
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Explain the concept, nature, scope and uses of Psychology in education.
- Explain the influence of growth and development in education.
- Describe the meaning and concept of learning, its theories and factors.
- Explain the application of learning theories in classroom situation.
- Discuss the concept and theories of intelligence and creativity.
- Explain the concept and development of personality.

Unit-I: Educational Psychology and Development

- a) Definition, Nature and Scope; Distinction between Psychology and educational Psychology.
- b) Growth and Development: Stages and aspects of development in human life; Physical, Social, Emotional, Cognitive and Language development of Infancy, Childhood and Adolescence period and respective educational programmes.

Unit-II: Learning

- a) Definition and characteristics of Learning; Factors influencing learning
- b) Theories of learning: Classical and Operant conditioning, Trial and Error and Insightful Learning.
- c) Attention & Interest: Factors of Attention and Relation between Attention and Interest.
- d) Memorization: LTM, STM. Principles of economy involved in Memorization; Causes of Forgetting.

Unit-III: Intelligence

- a) Intelligence: Definition; Theories of Intelligence- Spearman, Thurstone, Guilford ; Measurement of Intelligence.

Unit-IV: Personality

- a) Definition , Theories – Types and Trait; Measurement of Personality; Concept of Individual differences in classroom.

Suggested Books:

1. S. K. Mangal- Essentials of Educational Psychology
2. J. C. Aggarwal- Essentials of educational Psychology
3. S. K. Mangal - Advanced Educational Psychology
4. S.S. Chauhan- Advanced Educational Psychology
5. A. Woolfolk -Educational Psychology
6. J. W. Santrock -Educational Psychology

SEMESTER-II
: Language 2-1
Core Course; Credit-6. Full Marks-75

COMMON SYLLABUS

B.A. Education (General)

SEMESTER-II
AECC-2: English Communication
Ability enhancement compulsory Course; Credit-2. Full Marks-50

COMMON SYLLABUS

B.A. Education (General)

SEMESTER-III
EDU-G-CC-T-3: Sociological Foundation of Education
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the meaning, nature and scope of Educational sociology and Relation between education and sociology
- Describe the social factors and their relation to Education.
- Define social groups, socialization and Social Institution and Agencies of Education.
- Explain the Social change and its impact on Education.

Unit-I: Educational Sociology

- a) Meaning, nature and scope of Educational sociology.
- b) Relation between education and sociology.
- c) Concept of Educational sociology and sociology of education.

Unit-II: Social factor and Education

- a) Culture: Concept, role of education in culture, cultural lag.
- b) Meaning of Human Resource Development and its significance in the present society.

Unit-III: Social groups and education

- a) Social groups (Primary, Secondary and Tertiary)
- b) Socialization: Meaning, process and factors of socialization, role of the family and school.
- c) Social Institution and Agencies of Education: (a) Family, (b) School, (c) State, (d) Mass media and (d) Religion

Unit-IV: Social change and Education

- a) Social change: Its definition, characteristics, factors, Constraints and education as an instrument of social change.
- b) Education and Social Mobility.
- c) Education for Socially and Economically backward classes, disadvantage section of Indian society (SC, ST, OBC, Women, Rural)

Suggested Book:

1. J. C. Aggarwal - Philosophical and Sociological bases of Education
2. Y. K. Sharma – Sociological Philosophy of Education
3. Sharma – Sociological Philosophy of Education
4. S. S. Ravi – A Comprehensive Study of Education
5. पञ्चमल्लिक - चरित्रशास्त्रेण चरित्रशास्त्रेण
6. अज्ञानेन ह-संज्ञितं दैवतं - चरित्रशास्त्रेण चरित्रशास्त्रेण
7. च-ह-संज्ञितं इवैकं चरित्रशास्त्रेण - चरित्रशास्त्रेण चरित्रशास्त्रेण
8. -पञ्चमल्लिकं चरित्रशास्त्रेण चरित्रशास्त्रेण चरित्रशास्त्रेण
9. चरित्रशास्त्रेण चरित्रशास्त्रेण चरित्रशास्त्रेण
10. अज्ञानेन चरित्रशास्त्रेण चरित्रशास्त्रेण चरित्रशास्त्रेण
11. चरित्रशास्त्रेण चरित्रशास्त्रेण चरित्रशास्त्रेण
12. चरित्रशास्त्रेण चरित्रशास्त्रेण चरित्रशास्त्रेण
13. चरित्रशास्त्रेण चरित्रशास्त्रेण चरित्रशास्त्रेण

B.A. Education (General)
SEMESTER-III
: Language 1-2
Core Course; Credit-6. Full Marks-75

COMMON SYLLABUS

B.A. Education (General)
SEMESTER-III

EDU-G-SEC-T-1(A): Educational Statistics-I
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Describe the concept of Central tendency and their properties
- Explain the concept of measures of variability and their properties
- Describe the concept of co-relation and their application

Unit-I: Descriptive Statistics

- a) Meaning of Central Tendency- Mean, Median and Mode-their Properties, Calculation and Application.
- b) Measure of Variability- Range, SD and - their Properties, Calculation and Application

Unit-II: Coefficient of correlation

Concept of Correlation – Computation of Co-efficient of Correlation by Rank difference method and Product moment method, Interpretation of Co-efficient of Correlation,

Practical:

Calculate - Mean, Median and Mode; Range, SD ; Co-relation from different frequency distribution.

Suggested Books:

- 1) S. K. Mangal- Statistics in Education and Psychology
- 2) A. K. Singh – Test, Measurement and Research Methods in Behavioural Sciences
- 3) H.E. Garret- Statistics in Education and Psychology
- 4) R. A. Sharma- Mental Measurement and Evaluation
- 5) Y. P. Aggarwal- Statistics Methods Concepts, Application and Computation
- 6) $\rho_{xy} = \frac{r_{xy}}{\sqrt{r_{xx}r_{yy}}}$ - $r_{xy} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$
- 7) $r_{xy} = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{(\sum x^2 - \frac{(\sum x)^2}{n})(\sum y^2 - \frac{(\sum y)^2}{n})}}$
- 8) $r_{xy} = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{(\sum x^2 - \frac{(\sum x)^2}{n})(\sum y^2 - \frac{(\sum y)^2}{n})}}$
- 9) $r_{xy} = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{(\sum x^2 - \frac{(\sum x)^2}{n})(\sum y^2 - \frac{(\sum y)^2}{n})}}$

EDU-G-SEC-T-1(B): Educational Statistics-II
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Discuss the Meaning, characteristics and need of Graphical Representation
- Explain different type of Graphical Representation
- State the principles of Graphical Representation
- Describe the methods of represent Graph
- Explain different types of Graphical Representation
- Discuss the concept of NPC

Unit-I: Concept of Graphical Representation

- a) Meaning, characteristics and need of Graphical Representation
- b) Different types of Graphical Representation (Concept only)
- c) Principles of Graphical Representation
- d) Methods to represents a frequency distribution
- e) Graphical Representation of Data (Concept, Procedure of represent, Merit & Demerit)
 - Bar graph
 - Line graph
 - Histogram
 - Frequency Polygon

Unit-II: Concept of NPC

- a) Concept of Normal Distribution-
- b) Properties and Uses of NPC.
- c) Divergence from Normality- Skewness and Kurtosis

Practical:

Draw Graph of - Bar graph, Line graph, Histogram, Frequency Polygon

Suggested Books:

- 1) S. K. Mangal- Statistics in Education and Psychology
- 2) A. K. Singh – Test, Measurement and Research Methods in Behavirioul Sciences
- 3) H.E. Garret- Statistics in Education and Psychology
- 4) R. A. Sharma- Mental Measurement and Evaluation
- 5) Y. P. Aggarwal- Statistics Methods Concepts, Application and Computation
- 6) $\rho\alpha\alpha\eta\epsilon m \text{ } l;u - j\text{\$}m\acute{E}jue: e\text{\$}\phi a \text{ } J -L\pm nm$
- 7) $-chj\phi np \text{ } fjm \text{ } Hhw -chj\phi np \text{ } dl- \phi nrju \text{ } \phi ljjf \text{ } J \text{ } j\text{\$}m\acute{E}jue$
- 8) $f\text{\$}-Z\acute{N}\frac{3}{4}c\text{\$} BQjk\acute{N} -\phi nrj-r-\phi e j\text{\$}m\acute{E}jue \text{ } J \text{ } \phi e-c\acute{N}ne j$
- 9) $e\text{\$}lim \text{ } Cpmjj- \phi nrju \text{ } j\text{\$}m\acute{E}jue \text{ } \phi ljjf$

EDU-G-CC-T-4: Historical Foundation of Education
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Explain the development of education in India in historical perspectives.
- Discuss the British Indian education system.
- Explain the significant points of selected educational documents and report of ancient, medieval and British India.
- Describe the Constitutional Provision of Education.
- Discuss the contributions of Education Commission in post Independent India.
- Explain the National Policy on Education and National Education System.
- Explain the Functions of Some Major Educational Organization in India.

Unit-I: Education in 19th Century in India

- a) Charter Act of 1813 and its educational significance
- b) Macaulay Minuets- (1835)- its educational significance
- c) Bengal Renaissance- Contribution of Raja Rammohan Roy, Derozio and Vidyasagar.
- d) Wood's Despatch (1854) and its impact on education.
- e) Indian Education Commission (1882-83) and its impact of education.

Unit-II: Education in 20th Century in India (1901-1944)

- a) Educational reformer Lord Curzon
- b) National education movement- Causes, Phases and Importance in Education.
- c) Basic Education- Concept, characteristics, merits and demerits.
- d) Sargent Plan Report (1944)-
Pre-primary education, Primary education, Secondary education, Vocational & Technical education.

Unit-III: Education in Post Independence India

- a) University Education Commission (1948-49)
-Aims and Objective, Rural University Examination System, Teacher and Teaching Education, Vocational Education, Women Education.
- b) Secondary Education Commission (1952-53)
-Structure of Education system, Aims and Objective, Curriculum and Evaluation system and Language Policy
- c) Indian Education Commission (1964-66)
- Structure of Education system, Aims and Objective, Curriculum, Language Policy, Exam System and Teacher Education, Equality in Educational Opportunity.
- d) Asoke Mitra Commission (1991-92)
- Recommendations Regarding Primary and Secondary Education.

Unit-IV: National Policy on Education

- a) National Policy on Education (1986)
-National System of Education, Equality in Education, ECCE, Operation Black Board, Navoday Vidyalaya.
- b) Revised National Policy on Education-1992.

Suggested Books:

1. B. R. Purkait- Milestones of Modern Indian Education
2. J. C. Aggarwal - Landmarks in the History of Modern Indian Education
3. S. S. Ravi – A Comprehensive Study of Education
4. J. P. Banerjee – Education in India: Past, Present and Future
5. S. P. Chaube & A. Chaube – Education in Ancient and Medieval India
6. B. K. Nayak- History Heritage and Development of Indian Education
7. B. N. Dash –History of education in India
8. -N±lcip qjmcjl Hhw fĒnjĳ¹ njÑj- Bd±çel ijlaĒu çnrjl çhLjn
9. Alie -Ojo -Bd±çel ijlaĒu çnrjl Cçaqjp
10. lZçSv -Ojo- Bd±çel ijlaĒu çnrjl lçf-IMj
11. p±±nĒm lju - ij-l-al çnrj J çnrjl ijla;ue
12. p±±çhjm çjnĒ- ijlaĒu çnrjl Cçaqjp
13. içš² i“oZ iš²j-ijlaĒu çnrjl lçf-IMj
14. -SĒjçafĒpjc h-¾cĒjfdĒju- ijlaĒu çnrjl Cçaqjp
15. -SĒjçafĒpjc h-¾cĒjfdĒju- Bd±çel ij-l-al çnrjl çhhaÑe

B.A. Education (General)
SEMESTER-IV
: Language2-2
Core Course; Credit-6. Full Marks-75

COMMON SYLLABUS

**B.A. Education (General)
SEMESTER-IV
EDU-G-SEC-T-2(A): Lesson Planning**

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the meaning and characteristics of Lesson Plan
- Explain the advantages of Lesson Plan
- Classify different Lesson Plans
- Explain the steps of constructing Lesson Plan
- Discuss the principles of Lesson Plan
- Develop Lesson Plan

Unit-I: Concept of Lesson Planning

- a) Definition & Meaning of Lesson Plan
- b) Characteristics of Lesson Plan
- c) Advantages of Lesson Plan

Unit-II: Different aspects of Lesson Plan

- a) Types of Lesson Plan
- b) Steps involved in Lesson Planning
- c) Principles of development of Lesson Plan

Practical:

Development of Lesson Plan (At least 20).

Suggested Books:

1. X. cãmjm jã-MjfidÉju Hhw X. Ecun^l LçhljS - çnrjçh'je e£çã fÜçã J -L±nm
2. X. çeçMm Lçjil cš Hhw X. °QaeÉ jãm - çnrjçh'je çnre fÜçã
3. X. °QaeÉ jãm - pjSfjW çnre fÜçã

Skill Enhancement Course: Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Discuss the meaning and characteristics of Teaching Aids
- Explain the usability of Teaching Aids
- Express the quality and limitation of Teaching Aids
- Discuss the classification of Teaching Aids
- Develop different Teaching Aids

Unit-I: Concept of Teaching Aids

- a) Definition & Meaning of Teaching Aids
- b) Characteristics of Teaching Aids
- c) Utility of Teaching Aids
- d) Limitations of Teaching Aids

Unit-II: Different Types of Teaching Aids

- a) Classification of Teaching Aids (Concept only)
- b) Projected Teaching Aids- OHP, Slide Projection, Film Strip (Concept, principles of construction, uses)
- c) Non-Projected Teaching Aids- Model, Chart, Poster (Concept, principles of construction, uses)

Practical:

Development of Teaching Aids

Suggested Books:

1. X. cæmjm jæ-MjfidÉju Hhw X. Ecun^l LçhljS - çnrjçh'je e£çæ fÜçæ J -L±nm
2. X. çæçMm Lçjil cš Hhw X. °QaeÉ jäm - çnrjçh'je çnre fÜçæ
3. X. °QaeÉ jäm - pjjSfjW çnre fÜçæ

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course objectives:

After end of this course learner will able to-

- Explain the meaning, nature, classify value and its reflection in Indian Constitution.
- Discuss the meaning, objectives and need of value Education
- Describe the role of value education through Curriculum, Co-curricular activities.
- Explain the meaning, advantages and disadvantage of Storytelling, Play-way method and Role plays.

UNIT-I: Meaning and nature of Value

- a) Value: Meaning and Nature
- b) Values enshrined in Indian constitution.
- c) Classification of values proposed by NCERT

UNIT-II: Value Education

- a) Value Education: concept and objective.
- b) Need for value education in India

UNIT-III: Value Education in School

- a) Value Education through Curriculum.
- b) Value Education through Co-Curricular Activities.
- c) Role of teachers to facilitate development of values among the learners.

UNIT-IV: Strategies of value education

- a) Storytelling.
- b) Play-way Method.
- c) Role plays.

Suggested Books:

- 1) Diwahar, R. R., & Aggarwal, M. (Ed). (1984). Peace education. New Delhi: Gandhi Marg.
- 2) Fountain, S. (1999) Peace Education in UNICEF, Working Paper, Education Section, Programme Division, UNICEF, New
- 3) Aggarwal, J.C. (2010). *Education for Values, Environment and Human Rights*. New Delhi: Shipra Publications
- 4) Chadha, S. C. (2008). Education value & value education. Meerut: R.Lall Books Depot
- 5) Chakraborty, Mohit (2003); *Value Education: Changing Perspectives*. New Delhi: Kanishka Publishers. Gupta, N.L. (2000). *Human Values in Education*. New Delhi: Concept Publishing Company.
- 6) Mahakud, L. & Behera, S.K. (2013) (Edit.) Value Education: Dimensions and Approaches, S.B. Enterprise, Kolkata.
- 7) Passi, B. K., & Singh, P. (1999). Value education. Agra: Agra Psychological Corporation.
- 8) Ruhela, S.P. (ed.) (1986). *Human Values and Education*. New Delhi: Sterling Publishers Pvt. Ltd.
- 9) Singh, Y. K. (2009). Value education. New Delhi: APH Publishing Corporation.
- 10) Sharma, Y.K. and Katoch, K.S. (2007) Education for Values, Environment and Human Rights, New Delhi: Deep & Deep Publications Pvt. Ltd.
- 11) Sharma, R. A. (2008). Human value of education. Meerut: R.Lall Books Depot.

EDU-G-DSE-T-1/2(B): Population Education
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to-

- Explain the meaning, concept, scope & objectives of Population Education.
- Discuss the historical development of Population Education.
- Describe the definition, factors, causes and prevention of population growth.
- Explain the Population Education curriculum and policies.

Unit-1: Meaning and Concept of Population Education

- a) Meaning & Concept of Population Education
- b) Scope & objectives of Population Education.

Unit-II: Historical Development of Population Education

- a) Historical development of Population Education and education programme in India.
- b) Some major thrust areas of population education-
 - Family planning
 - Adolescent education.

Unit-III: Population Growth and Problems in India

- a) Definition of population growth.
- b) Factors influencing population growth- fertility, mortality, and migration.
- c) Causes of rapid population growth
- d) Preventive measures for rapid population growth.

Unit-IV: Population Education Curriculum and Policy

- a) Curriculum of Population education at different stages.
- b) Role of population policy in India.
- c) Role of Teacher in making awareness of population explosion.
- d) Community sensitisation programme of early marriage and child labour etc.

Suggested Books:

- 1) Aggarwal, J.C (2002). Population Education. Shipra Publication, 115-A, Vikas Marg, Shakarpur, Delhi-110092.
- 2) Bhardwaj, Ramesh Kumar (2002). Population Education in India. The Associate Publishers 2963/2, Kacha Bazar, Post Box No. 56.
- 3) Ghosh, B.N (1985). Fundamentals of Population Geography. Sterling Publishers Private Limited, New Delhi-11006
- 4) Raju, B. Joseph et al. (2004). Population Education. Sonali Publications, New Delhi-110002.
- 5) Sharma, Yogendra K. (2007). Population Education: Concepts, Principles and Approaches. Kanishka Publishers Distributors, 4697/55-21A Answari Road, Daryaganj, New Delhi-110002
- 6) Sinha, P. N (2000). Population Education and Family Planning. Authors Press, E/35/103, Jawarharpark, Laxmi Nagar, Delhi-110092.

B.A. Education (General)

SEMESTER-V
EDU-G-DSE-T-1/2(C): Guidance and Counseling
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Explain the concept, nature, scope, types & importance of Guidance.
- Discuss the concept, nature, scope, types & importance of Counseling.
- Discuss different tools and techniques used in Guidance & Counseling.
- Identify the characteristics of diverse learner
- Explain the need of Guidance for diverse learner
- Explain the need of counseling for diverse learner

Unit-I: Concept of Guidance

- a) Meaning, Nature, Scope, and Importance of Guidance.
- b) Different Types of Guidance-
 - i) Educational: Meaning, Characteristics, Purpose & Functions.
 - ii) Vocational: Meaning, Characteristics, Purpose & Functions.
 - iii) Personal: Meaning, Characteristics, Purpose & Functions.

Unit-II: Concept of Counseling

- a) Meaning, Nature, Scope, and Importance of Counseling
- b) Types of Counseling-
 - i) Directive: Meaning, Characteristics, Purpose & Functions.
 - ii) Non-directive: Meaning, Characteristics, Purpose & Functions.
 - iii) Eclectic: Meaning, Characteristics, Purpose & Functions.
- c) Steps of Counseling; Characteristics of good Counselor.

Unit-III: Tools and Techniques of Guidance and Counseling

- a) Basic data necessary for Educational Guidance- Pupils abilities, Aptitudes, Interests and Attitudes, Educational Attainments and Personality Traits.
- b) Difference between Guidance, Counseling and Teaching.

Unit-IV: Guidance and Counseling for Diverse Learners

- a) Identification of Gifted, Slow learners, Learner with learning disabilities.
- b) Need of Guidance for diverse learners
- c) Need of Counseling for diverse learner

Suggested readings:

- 1) Sharma, A.R.-Guidance and Counselling.
- 2) Gibson- Guidance and Counselling.
- 3) NCERT- Guidance and Counselling
- 4) Chauhan, S.S.- Principles and Techniques of Guidance

- 5) Guidance and counseling in college and university - S K.Kochar
- 6) Milner, P.- Counselling in Education
- 7) Rao, S. N.-Counselling in Guidance
- 8) -chjçno fjm- çeÑ-cne; J flijnÑ
- 9) X. pããh£l e;N J N;NÑ£ cš- p%øçãçhd;e çeÑ-cne; J flijnÑc;e
- 10) X. i£jQ¾cÊ jãm- çeÑ-cne; J flijnÑc;-el l©f-IM;

SEMESTER-V

EDU-G-DSE-T-1/2(D): Distance Education

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completing of the course the students will be able to-

- Explain the meaning, characteristics, objectives, merits & demerits of distance & open education.
- Discuss the mode and strategies of distance education.
- Describe the relationship among Non-formal, Correspondence, Distance and Open Education.
- Discuss the present status of distance and open education in India.
- Explain the role of multi-media in Distance and Open Education.
- Discuss the problems and remedies of distance and open education in India.

Unit I: Concept of Distance & Open Education

- a) Meaning and definition of Distance Education.
- b) Characteristics and objectives of Distance Education.
- c) Merits and limitations of Distance Education.

Unit II: Strategies of distance education

- a) Mode and strategies of Distance Education.
- b) Relationship among Non-formal, Correspondence, Distance and Open Education.

Unit III: Status of open and distance education in India

- a) Present state of Distance and Open Education in India.
- b) Role of multi-media in Distance and Open Education.

Unit IV: Problems and remedies of distance and open education in India

- a) Salient features of the Indira Gandhi National Open University (IGNOU) and National Open School.
- b) Problems of Distance and Open Education in India.
- c) Measures for strengthening Distance and Open Education in India.

Suggested Books:

- 1) S.S. Ravi – A Comprehensive Study of Education
- 2) R.P. Pathak – Development and Problems of Indian Education
- 3) B.K. Nayak – Modern Trends and Issues in Education of India
- 4) $\text{c}\alpha\text{m}\text{i}\text{m}\text{j}\alpha\text{M}\text{j}\text{i}\text{d}\acute{\text{E}}\text{j}\text{u}$, $\phi\text{h}\text{S}\text{e}\text{p}\text{L}\text{i}\text{l}$, $\text{a}\text{j}\phi\text{le}\text{£}\text{q}\text{i}\text{m}\text{c}\text{i}\text{l}\text{H}\text{h}\text{w}\text{A}\phi\text{i}\phi\text{S}\text{v}\text{L}\text{¥}\text{j}\text{i}\text{l}\text{f}\text{i}\text{m}$ - $\text{i}\text{j}\text{l}\text{a}\text{l}$
 $\phi\text{n}\text{r}\text{i}\text{l}\text{Q}\text{m}\text{j}\text{i}\text{e}\text{O}\text{V}\text{e}\text{j}\text{h}\text{m}\text{£}$
- 5) $\text{a}\text{j}\phi\text{le}\text{£}\text{q}\text{i}\text{m}\text{c}\text{i}\text{l}$, $\phi\text{h}\text{e}\text{j}\text{u}\text{L}\text{Q}\frac{3}{4}\text{c}\text{H}\text{h}\text{w}\text{p}\alpha\alpha\text{n}\text{i}\text{z}$ $^1\text{L}\text{¥}\text{j}\text{i}\text{h}\text{j}\tilde{\text{N}}\text{e}$ - $\phi\text{n}\text{r}\text{i}\text{J}\text{E}\alpha\text{e}\text{u}\text{e}$
- 6) $\text{a}\text{j}\phi\text{le}\text{£}\text{q}\text{i}\text{m}\text{c}\text{i}\text{l}\text{J}\phi\text{h}\text{e}\text{j}\text{u}\text{L}\text{Q}\frac{3}{4}\text{c}$ - $\text{p}\text{j}\text{L}\text{i}\text{m}\text{£}\text{e}\text{i}\text{j}\text{l}\text{a}\text{h}\text{o}\tilde{\text{N}}\text{J}\phi\text{n}\text{r}\text{i}$

SEMESTER-V
EDU-G-GE-T-1(A): Health Education
Generic Elective Course: Credit-6. Full Marks-75

Course Objectives:

After completion of this course the learner will be able to -

- Explain the meaning, definition and significance of health.
- Discuss the meaning and importance of health education.
- Describe the health status, health services and health programme of school children.
- Discuss some common and uncommon diseases in India
- Describe technological health hazards

Unit – I: Concepts of Health

- a) Definition of health and its significance.
- b) Meaning of health education and its importance.

Unit – II: School Health Services

- a) Health Status of school children.
- b) School health service in India.
- c) School health program.

Unit – III : Common and Uncommon Diseases in India :

- a) Common diseases during the previous decade-
 - Cancer.
 - HIV/AIDS
 - Dengue.
 - Reproductive Diseases.
 - Depression.
- b) Uncommon diseases –
 - Autistic.
 - Cerebral Palsied.
 - Thalassemia.

Unit – IV : Technology Related Health Risks :

- a) Identification of the technological health hazards –
 - Smartphone stress.
 - Acne caused by cell phone.
 - Radiation from the cell phone & various types of accidents.
 - Computer causing wrist pain.
 - Back & neck pain.
 - Laptop burns & headaches.
 - Decreased attention span from using Face-Book

Suggested Books :

1. D.T.Kenny, J.G.Carlson, F.J.McGuigan and J.L.Sheppard, Stress and Health – Research and Clinical Applications, Harwood, Academic Publishers, The Netherlands (2000)
2. L. Ramachandran and T.Dharmaliugam, Health Education – A New Approach, Vikas Publishing House Pvt. Ltd. New Delhi (2001)
3. M.C.Gupta and B.K.Mahajan, Text Book of Preventive and social Medicine, Jaypee Brothers, Medical publishers Pvt.Ltd., New Delhi, (2005)
4. S.Mahoney and L.K.Olsen (Eds.), Health Education – Teacher Resource Handbook, Corwin Presee Inc. California, USA, (1993)

5. S.P.Singh, Sex Education – AIDS and Sexuality, Authors Press, Delhi (2001)
6. V.K.Nanda, Health Education, Anmol Publication Pvt. Ltd. New Delhi (1997)
7. X. AçSa cjp - üjÛÛÉ J n|lÆl ønrj

EDU-G-GE-T-1(B) : Vocational Education
Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Discuss the meaning, characteristics & scope of Vocational Education.
- Explain the types, importance & challenges of Vocational Education.
- Difference among Vocational Education, Vocational Training & General Education.
- State the historical background of Vocational Education
- Describe the status of Vocational Education in different Education commission.
- Take measures for vocationalization of different stages of Education.

Unit- I: Concept of Vocational Education

- a) Meaning ,Definition & Characteristics of Vocational Education
- b) Types of Vocational Education
- c) Importance & Challenges of Vocational Education
- d) Difference between Vocational Education, Vocational training & General Education

Unit-II: History of Vocational Education

- a) Vocational Education in Ancient India (Brahmanic period, Buddhist period & Mediaeval period)
- b) Vocational Education in British India
- c) Vocational Education in Independent India

Unit-III: Vocational Education in different Education Commission

- a) Vocational Education in the Education Commission-1952-53
- b) Vocational Education in the Education Commission-1964-66
- c) Vocational Education in the Programme of Action- 1992

Unit-IV: Vocationalization in different Education system

- a) Vocationalization of Secondary Education
- b) Vocationalization of Higher Secondary Education

Suggested Books:

- 1) Rastriya, T. Vocational Education. APH Publishing Corporation. New Delhi.
- 2) N. Harinath & P. A. Reddy. Vocational Education. APH Publishing Corporation. New Delhi.
- 3) V.K.Rao. Vocational Education. APH Publishing Corporation. New Delhi.
- 4) G.Rumble, & J.Oliveira. Vocational Education at a Distance. Routledge publication.
- 5) L. Moran, & G. Rumble. Vocational Education and Training Through Open and Distance Learning. Routledge publication.
- 6) J. Stevenson. Developing Vocational Expertise: Principles and issues in Vocational Education. Routledge publication.

B.A. Education (General)
SEMESTER-V
EDU-G-SEC-T-3(A): Guidance services
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Identify different guidance services
- Discuss the meaning and importance of guidance services
- Organize guidance services in school level

Unit-I: Guidance services:

Meaning, nature, and importance of the following guidance services:

Individual Inventory Services, Testing services, Counseling services, Information service, Placement service, Follow up service

Unit-II: Organizing guidance services at educational institution:

- a) Pre-requisites for organizing guidance services
- b) Organizing guidance services at school and college level
- c) Role of teachers in organizing guidance services.

Suggested Books:

- Anne Anastasi & Susana Urbina – Psychological Testing
- J. C. Aggarwal- Essentials of Educational Psychology
- S. K. Mangal - Advanced Educational Psychology
- S.S. Chauhan- Advanced Educational Psychology
- A. Woolfolk -Educational Psychology
- J. W. Santrock -Educational Psychology

EDU-G-DSE-T-3/4(A): Mental Hygiene
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Discuss the concept, nature, aims and scope of Mental Hygiene
- Discuss the concept, nature, symptoms and causes of mental illness
- Explain the different characteristics of mental disorder
- Discuss the role of parents for preventing Mental health
- Discuss the role of teachers for preventing Mental health

Unit- I: Concept of Mental Hygiene

- a) Definition of Mental Hygiene
- b) Aims of Mental Hygiene
- c) Scope of Mental Hygiene

Unit-II: Concept of Mental Health

- a) Definition of mental health
- b) Symptoms of good mental health
- c) Causes of ill mental health

Unit-III: Classification of Mental disorder (Identification Characteristics, causes and treatment only)

- a) DSM-IV:
 - Axis- I: Depression
 - Axis- II: Obsessive compulsive disorder (OCD)
 - Axis- III: Bipolar mood disorder
 - Axis- IV: Occupational disorder
 - Axis- VI: Truancy
- b) Common Axis:
 - Common Axis-I: Anxiety
 - Common Axis-II: Personality disorder
 - Common Axis-III: Conflict

Unit-IV: Prevention of Mental Hygiene

- a) Role of parents in preserving mental illness of children
- b) Role of Teachers in preserving mental illness of children in the Educational Institution
- c) Relation between Mental Hygiene and Adjustment

Suggested Books:

1. Ghauhan, S.S. – Mental Hygiene – A Science of Adjustment.
2. Mohanty, J. – Abnormal Psychology.
3. Sarason&Sarason – The problem of Maladaptive Behavior
4. Sengupta, M.- Mano swasthaviggan
5. Ghosh, A. – ManashikSwasthaViggan
6. j"¥çl -pe...ç - j-ej: üjÛÛÉçh'je
7. Alle-Ojo - jjeçpL üjÛÛÉçh'je

B.A. Education (General)

SEMESTER-VI
EDU-G-DSE-T-3/4(B): Comparative Education
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the meaning, nature, scope, importance, and methods of Comparative Education.
- Explain the concept of Universalization of Elementary and Secondary Education in UK & USA.
- Compare Indian Education system with USA
- Compare Indian Education system with UK

Unit-I: Meaning, Nature, Scope, and Methods of Comparative Education

- a) Meaning, nature, scope and importance of Comparative Education.
- b) Methods of Comparative Education:
 - i) Philosophical Method
 - ii) Historical Method
 - iii) Sociological Method
 - iv) Psychological Method
 - v) Scientific Method

Unit-II: Factors of Comparative Education:

- a) Natural Factors: Historical, Racial, Linguistic and Social Factors.
- b) Spiritual Factors: Religious and Philosophical Factors.
- c) Secular Factors: Factor of Humanism, Socialism, Nationalism and Democracy.

Unit-III: Universalization of Elementary Education in UK & USA

In relation to Structure, Aims and Objectives, Curriculum, Methodology, Evaluation system and Administration including finance and Comparison with Indian Elementary Education System.

Unit-IV: Universalization of Secondary Education in UK & USA

In relation to Structure, Aims and Objectives, Curriculum, Methodology, Evaluation system and Administration including finance and Comparison with Indian Secondary Education System.

Suggested Books:

1. S. P. Chaube & A. Chaube – Comparative Education
2. R. N. Sharma- Comparative Education
3. Y. K. Sharma- Comparative Education
4. Nikholas Hanse - On Comparative Education
5. -ch£ jª-M;f;dÉ;u- a¥me;j\$M L ¢nrj
6. -j; Bëªp p;j;c- a¥me;j\$M L ¢nrj
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B.A. Education (General)
SEMESTER-VI

EDU-G-DSE-T-3/4 (C): Peace Education
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to:

- Explain the concept, aims, objectives, scope, need and factors of Peace Education.
- Discuss views of Gandhi, Rabindranath Tagore, Aurobinda and Jiddu Krishnamurti regarding Peace Education
- Explain the principles and curriculum of Peace Education
- Discuss the role of education in Peace Education.
- Understand the approaches of Peace Education

UNIT-1: Concept of Peace Education

- Peace Education : Meaning, nature, aims, objectives & scope
- Need of Peace Education.
- Factors of peace education: unemployment, terrorism, religion.

UNIT-2: Key Thinkers of Peace Education

Indian Context:

- Rabindranath Tagore,
- Sri Aurobinda

Global context:

- Montessori
- John Dewey

UNIT-3: Peace Education Programme in School

- Principles of peace education
- Curriculum and Peace Education.
- Quality of a teacher as a peace educator

UNIT-4: Approaches of Peace Education

- Participatory Education
- Co-operative Learning

Reading List

1. Krishnamurti, J. Education and the Significance of Life
2. Kumar, K. Learning from Conflict.
3. Kumar, K. Battle for Peace.
4. NCERT. Ways to Peace
5. UNESCO. Learning the Way of Peace: Teacher's Guide.
6. Diwahar, R. R., & Agarwal, M. (Ed). (1984). Peace education. New Delhi: Gandhi Marg.
7. Fountain, S. (1999) Peace Education in UNICEF, Working Paper, Education Section, Programme Division, UNICEF, New
8. Aggarwal, J.C. (2010). *Education for Values, Environment and Human Rights*. New Delhi: Shipra Publications

9. Chadha, S. C. (2008). Education value & value education. Meerut: R.Lall Books Depot
10. Chakrabarti, Mohit (2003); *Value Education: Changing Perspectives*. New Delhi: Kanishka Publishers.
11. Gupta, N.L. (2000). *Human Values in Education*. New Delhi: Concept Publishing Company.
12. Mahakud, L. & Behera, S.K. (2013) (Edit.) *Value Education: Dimensions and Approaches*, S.B. Enterprise, Kolkata.
13. Passi, B. K., & Singh, P. (1999). *Value education*. Agra: Agra Psychological corporation.
14. Ruhela, S.P. (ed.) (1986). *Human Values and Education*. New Delhi: Sterling Publishers Pvt. Ltd.
15. Singh, Y. K. (2009). *Value education*. New Delhi: APH Publishing Corporation.
16. Sharma, Y.K. and Katoch, K.S. (2007) *Education for Values, Environment and Human Rights*, New Delhi: Deep & Deep Publications Pvt. Ltd.
17. Sharma, R. A. (2008). *Human value of education*. Meerut: R.Lall Books Depot.
18. Shukla, R. P. (2004). *Value education and human rights*. New Delhi: Sarup and sons.
19. Subramanian, K. (1990). *Value Education*. Madurai: Ravana Publication.
20. Venkataiah, (2009). *Value education*. New Delhi: APH Publishing Corporation

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to-

- Discuss the philosophies of great thinker of the east and west
- Explain the educational ideas of great thinker of the east and west
- Explain some experiments on education of eastern and western philosophers and thinkers
- Discuss the ideas of contemporary thinkers on education of eastern and western philosophers and thinkers

Unit – I: Indian Educators:

Contribution of following great educators with special reference to Educational Philosophy, aims of education, Curriculum, Method of Teaching, Role of teacher & Relevance in Present day context.

- Sarvapalli Radhakrishnan.
- Shri Aurobinda.

Unit - II: Western Educators:

Contribution of following great educators with special reference to Educational Philosophy, Aims of education, Curriculum, Method of Teaching Role of teacher & Relevance in Present day context.

- Bertrand Russel
- Madam Maria Montessori

Unit - III: Modern Thinkers on Education in India

- a) Abul Kalam Azad
- b) Annie Besant
- c) A.P.J. Abdul Kalam

Unit- IV: Some Experiments of Great Educators on Education:

- a) Viswabharati and Rabindranath Tagore
- b) Basic education and Gandhiji
- c) Kindergarten and Froebel
- d) Laboratory school and John Dewey

SUGGESTED READING:

- 1) Aggarwal, J.C – Theory and Principles of education Philosophical and Sociological Bases of education
- 2) Mukherjee, K.K. – Some great educators of the world.
- 3) Purkait, B.R. – Great educators
- 4) Mukherjee, K.K. – Principles of education.

- 5) Banerjee, A –Philosophy and principles of education
- 6) Ravi,s-A comprehensive study of Education
- 7) Sushil Ray –ShikshaTatta
- 8) ArunGhosh –Shikshatatta&ShikshaDarshan.
- 9) BihuranjanGuha –ShikshayaPathikrit.
- 10) GourdasHalder&Prasanta Sharma –ShikshaTatta&ShikshaNiti.
- 11) A.K.Pal –SikshadarshnerRuparekha
- 12) AQÑe j h³¼c j f i d É j u - ç nr j c n Ñ e J ç nr j e £ ç a
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Generic Elective Course; Credit-6. Full Marks-75

Course objectives:

After completing of the course, the student will be able to

- Explain the concept & Needs of women education.
- Discuss the differences between Women Education and Women studies.
- Describe the contribution of Missionaries, British Govt and Indian thinkers.
- Explain the recommendations of various commissions and Committees on women's education.
- Examine the present status of Women's Education.

Unit I: Women Education.

- a) Concept & Need of Women Education
- b) Women Education and Women Studies-distinction

Unit II: Contribution of great scholar in the field of Education

- a) Contribution of missionaries.
- b) Role of British Govt.
- c) Contribution of the following Indian thinkers:
 - Raja Ram Mohan Roy
 - IswarChandraVidyasagar.
 - Nibedita.

Unit III: Commission and committees on Women's Education.

- a) University Education commission(1948)
- b) Secondary Education commission (1952-53)
- c) Education Commission (1964-66).
- d) Durgabai Deshmukh Committee
- e) Honsraj Mehta Committee

Unit IV: Present status of Women Education in India.

- a) Gender issues in Education and its causes.
- b) Measures required towards gender equity in Education.

Suggested Readings

- Singh, U.K. (2001), Women Education, New Delhi, Common wealth publishers.
- Gupta, M, (2003), Women and Educational Development, New Delhi, Sarup and Sons.
- Mishra, R.N. (2003), Women and Educational Development, New Delhi, DiscoveryPublishing.
- Sharma, B.M (Ed.) (2005), Women and Education, New Delhi, CommonwealthPublishers.
- Rao, M.K. (2005), Employment of Women in India, New Delhi, Discovery Publishing House.
- Tapan, N. (2000), Need for women Empowerment, Jaipur and New Delhi RawatPublication.

EDU-G-GE-T-2(B) : Life Skill Education
Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Describe the meaning of life skill education, its nature and scope.
- Describe effective communication, its functions, model and barriers.
- Explain interpersonal relationship, its definition and factors affecting relationships.
- Explain meaning, nature, stages of creative and critical thinking.
- Describe the concept of problem solving, its steps and factors influencing problem solving.
- Discuss the concept of coping with emotions its characteristics, types and coping strategies.
- Discuss the concept of coping with stress, stressors, sources of stress and coping strategies.

Unit 1: Introduction to life skill education

- a) Life Skills: Concept, core life skills and their applications.
- b) Life Skill education: concept, nature and scope, Distinction between life skill education and sex education.

Unit 2: Social Skills and Negotiation Skills

- a) Empathy - Sympathy, Empathy and Altruism
- b) Interpersonal Relationship - Definition, Factors affecting Relationships

Unit 3: Thinking Skills and Problem solving ability

- a) Thinking: Concept, Nature and Types of Thinking, Concept Formation, Reasoning
- b) Creative and Critical Thinking: Definition, Nature, Stages

Unit 4: Strategies for life skill Education

- a) Coping with Emotions: Definition, Characteristics, Types, Coping Strategies
- b) Coping with Stress: Definition, Stressors, Sources of Stress, Coping Strategies

Suggested reading:

1. Dahama O.P., Bhatnagar O.P, (2005). *Education and Communication for Development*, (2nd Edn.), Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Debra McGregor, (2007). *Developing Thinking; Developing Learning - A guide to thinking skills in education*, Open University Press, New York, USA
3. Duffy Grover Karen, Atwater Eastwood, (2008). (8th Edn.), *Psychology for Living- Adjustment, Growth and Behaviour Today*, Pearson Education Inc, New Delhi.
4. Mangal S.K., (2008). *An Introduction to Psychology*, Sterling Publishers Pvt. Ltd., New Delhi.
5. Nair .V. Rajasenan, (2010). *Life Skills, Personality and Leadership*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
6. Nair. A. Radhakrishnan et al., (2010). *Life Skills Assessment Scale*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
7. Stella Cottrell, (2005). *Critical Thinking Skills: Developing Effective Analysis and Argument*, Palgrave Macmillan Ltd., New York.

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Explain the concept, characteristics, aims, nature, scope and need of Life Long Education
- Explain the different teaching methods of Life Long Learning
- Describe the different recommendations of different education commission on Life Long Learning.

Unit-I: Concept of Life Long Learning

- c) Meaning and definition of Life Long Learning and Adult Education
- d) Characteristics of Life Long Learning
- e) Aims of Life Long Learning
- f) Need or Importance of Life Long Learning.
- g) Different teaching methods for Life Long Learning

Unit-II: Recommendations of different commission on Life Long learning

- d) National Literacy Mission (NLM) – (1988)
- e) National Adult Education Program
- f) Problems & Prospects of Life Long Learning.

Suggested books:

- Ravi, S.S.- A Comprehensive Study of Education
- Mukhopadhyaya, D.; Sarkar, B.; Halder, T.; & Pal, A.K. – Varater Shikshar Chalaman Ghatanabali
- Mukhopadhyaya, D.; Halder, T. & Chanda, B.- Contemporary India and Education.
- Aggarwal, J.C.- Landmarks in the History of Modern Indian Education.
- Jarvis, P. Adult Education and Lifelong Learning.
- Knowles, M.S. The Modern Practice of Adult Education.
- Mayo, P.- Learning with Adults.
- Murriam, S.B. & Bierema, L.L. Adult Learning: Linking Theory and Practice.
- Murriam, S.B. & Grace, A.P. The Jossey-Bass Reader on Contemporary Issues in Adult Education.

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Explain the meaning, nature, aims and role of teacher of Yoga education
- Discuss different types of Yoga
- Express the guidelines of Yoga education
- Discuss the significance of Yoga Education
- Explain the historical background of Yoga Education
- Discuss the relationship among Yoga, Sankhya Philosophy and Bhagwat Gita
- Describe the need of Yoga for healthy life style

Unit-I: Concept of Yoga Education

- a) Meaning and definition, and nature of Yoga Education
- b) Types and aims of Yoga Education
- c) Role of teachers in implementing Yoga Education

Unit-II: Yoga and Health

- a) Need of Yoga for good health
- b) Yogic concept of healthy life style
- c) Yoga for reduction of stress

Practical: Practical Asanas and Pranayam

Suggested Readings:

- Swami Shivananda Yoga Asanas : Divine Life Society.
- JhaVinay Kant (2015), Patanjalis Yoga Sutras.
- NCERT -Yoga Syllabus
- Raja Yoga-Vivekananda Swami-Adyar Publication, Madras
- NCTE-Yoga Education.
- NCTE- Yoga Education – Master of Education Programme.
- Bhakta, B.B.-VaratiyaShiksha R Ruparekha.

UNIVERSITY OF KALYANI



**CBCS CURRICULUM FOR THREE YEARS UNDER-GRADUATE COURSE
IN
EDUCATION (HONOURS)**

**WITH EFFECT FROM THE ACADEMIC SESSION
2018-19**

INTRODUCTION:

The University Grants Commission (UGC) has taken various measures by means of formulating regulations and guidelines and updating them, in order to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions in India. The various steps that the UGC has initiated are all targeted towards bringing equity, efficiency and excellence in the Higher Education System of country. These steps include introduction of innovation and improvements in curriculum structure and content, the teaching-learning process, the examination and evaluation systems, along with governance and other matters. The introduction of Choice Based Credit System is one such attempt towards improvement and bringing in uniformity of system with diversity of courses across all higher education institutes in the country. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising of core, elective, skill enhancement or ability enhancement courses. The courses shall be evaluated following the grading system, is considered to be better than conventional marks system. This will make it possible for the students to move across institutions within India to begin with and across countries for studying courses of their choice. The uniform grading system shall also prove to be helpful in assessment of the performance of the candidates in the context of employment.

Outline of the Choice Based Credit System being introduced:

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. Ability Enhancement Courses/ Skill Enhancement Courses:

3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

A. TOTAL Number of courses in UG-CBCS (B.A. Hons.):

Types of course	Core course (CC)	Elective course		Ability enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course (GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

TABLE-1: DETAILS OF COURSES & CREDIT OF B.A.(HONOURS) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory + Tutorial
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (14 papers)	14x4 = 56	14x5 = 70
1.B.	Core Course (Practical/Tutorial)*(14 papers)	14x2 = 28	14x1 = 14
2.	Elective Courses: (8 papers)		
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x4 = 16	4x5 = 20
2.B.	DSE (Practical / Tutorial)* (4 papers)	4x2 = 8	4x1 = 4
2.C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x4 = 16	4x5 = 20
2.D.	GE (Practical / Tutorial)* (4 papers)	4x2 = 8	4x1 = 4
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
Total Credit:		140	140

TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.A.(HONOURS)

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1			--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

❖ **COURSE CODE & COURSE TITLE:**

A. Core courses (CC)

1. EDU-H-CC-T-1: Philosophical Foundation of Education-1
2. EDU-H-CC-T-2: Sociological Foundation of Education
3. EDU-H-CC-T-3: Psychological Foundation of Education
4. EDU-H-CC-T-4: History of Education in Colonial India
5. EDU-H-CC-T-5: Educational Evaluation & Statistics
6. EDU-H-CC-T-6: Philosophical Foundation of Education-II
7. EDU-H-CC-T-7: Inclusive Education
8. EDU-H-CC-T-8: History of Education in Post-Independence India
9. EDU-H-CC-T-9: Psychology of Instruction
10. EDU-H-CC-T-10: Contemporary issues in Education
11. EDU-H-CC-T-11: Educational Management
12. EDU-H-CC-T-12: Educational Technology
13. EDU-H-CC-T-13: Curriculum Studies
14. EDU-H-CC-T-14: Educational Research

B. Discipline specific elective courses (DSE)

1. EDU-H-DSE-T-1/2(A): Value Education
2. EDU-H-DSE-T-1/2(B): Population Education
3. EDU-H-DSE-T-1/2(C): Peace Education
4. EDU-H-DSE-T-1/2(D): Distance Education
5. EDU-H-DSE-T-1/2(E): History of Education in Ancient and Medieval India
6. EDU-H-DSE-T-3/4(A): Mental Hygiene
7. EDU-H-DSE-T-3/4(B): Comparative Education
8. EDU-H-DSE-T-3/4(C): Guidance & Counseling
9. EDU-H-DSE-T-3/4(D): Great Educators
10. EDU-H-DSE-3/4(E): Dissertation

C. Generic elective courses (GE):

1. EDU-H-GE-T-1(A): Health Education
2. EDU-H-GE-T-1(B): Life Skill Education
3. EDU-H-GE-T-2(A): Pedagogical Knowledge
4. EDU-H-GE-T-2(B): Lifelong Learning and Education
5. EDU-H-GE-T-3(A): Women Education
6. EDU-H-GE-T-3(B): Yoga Education
7. EDU-H-GE-T-4(A): Vocational Education
8. EDU-H-GE-T-4(B): ICT in Education

D. Ability enhancement compulsory courses (AECC)

1. AECC-1: Environmental Education
2. AECC-2: English Communication

E. Skill enhancement courses (SEC)

1. EDU-H-SEC-T-1(A): Statistical Analysis-I
2. EDU-H-SEC-T-1(B): Statistical Analysis-II
3. EDU-H-SEC-T-2(A): Computer Application
4. EDU-H-SEC-T-2(B): Uses of Teaching Aids

**Table-3: Semester & Course wise credit distribution in B.A. (Hons.) Education
(6 Credit=75 Marks & 2 Credit=50 Marks)**

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-H-CC-T-1	Philosophical foundation of Education-1	Core (75L+15T)	6(5L+1T)
EDU-H-CC-T-2	Sociological foundation of Education	Core (75L+15T)	6(5L+1T)
EDU-H-GE-T-1 (any one)	A. Health Education B. Life skill Education	Generic Elective (75L+15T)	6(5L+1T)
AECC-1	Environmental Education	Ability enhancement compulsory (30L)	2 (2L)
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-H-CC-T-3	Psychological foundation of Education	Core (75L+15T)	6(5L+1T)
EDU-H-CC-T-4	History of Education in colonial India	Core (75L+15T)	6(5L+1T)
EDU-H-GE-T-2 (any one)	A. Pedagogical knowledge B. Life long learning and Education	Generic Elective (75L+15T)	6(5L+1T)
AECC-2	English communication	Ability enhancement compulsory (30L)	2 (2L)
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-H-CC-T-5	Educational Evaluation & Statistics	Core (75L+15T)	6(5L+1T)
EDU-H-CC-T-6	Philosophical foundation of Education-II	Core (75L+15T)	6(5L+1T)
EDU-H-CC-T-7	Inclusive Education	Core (75L+15T)	6(5L+1T)
EDU-H-GE-T-3	A: Women Education B: Yoga Education	Generic Elective (75L+15T)	6(5L+1T)
EDU-H-SEC-T-1	A. Statistical Analysis - I B. Statistical Analysis - II	Skill enhancement (30L)	2 (2L)
Total	5 courses	Total	26
SEMESTER-IV			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-H-CC-T-8	History of Education in Post-independence India	Core	6(5L+1T)
EDU-H-CC-T-9	Psychology of Instruction	Core	6(5L+1T)

EDU-H-CC-T-10	Contemporary issues in Education	Core	6(5L+1T)
EDU-H-GE-T-4	A: Vocational Education	Generic Elective (75L+15T)	6(5L+1T)
	B: ICT in Education		
EDU-H-SEC-T-2	A. Computer Application	Skill enhancement (30L)	2 (2L)
	B. Uses of Teaching Aids		
Total	5 courses	Total	26
SEMESTER-V			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-H-CC-T-11	Educational Management	Core (75L+15T)	6(5L+1T)
EDU-H-CC-T-12	Educational Technology	Core (75L+15T)	6(5L+1T)
EDU-H-DSE-T-1	A: Value Education	Discipline specific (75L+15L)	2x6 (2x5L+2x1L)
EDU-H-DSE-T-2	B: Population Education		
(any two)	C: Peace Education		
	D: Distance Education		
	E: History of Education in Ancient and Medieval India		
Total	4 courses	Total	24
SEMESTER-VI			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
EDU-H-CC-T-13	Curriculum Studies	Core (75L+15T)	6(5L+1T)
EDU-H-CC-T-14	Educational Research	Core (75L+15T)	6(5L+1T)
EDU-H-DSE-T-3	A: Mental hygiene	Discipline specific (75L+15L)	2x6 (2x5L+2x1L)
EDU-H-DSE-T-4	B: Comparative Education		
(any two)	C: Guidance and Counselling		
	D: Great educators		
	E: Dissertation		
Total	4 courses	Total	24
Total (All semesters)	26 courses	Total	140

CBCS CURRICULUM OF B.A. IN EDUCATION (HONOURS)

B.A. Education (Honours)
SEMESTER-I
EDU-H-CC-T-1: Philosophical Foundation of Education-1
Core Course; Credit-6; Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the meaning, nature, scope and aims of education.
- Discuss the meaning and scope of educational philosophy.
- Explain the factors of education and their relationships.
- Describe the knowledge, reality and value of different Indian schools of philosophy namely Sankhya, Yoga and Buddhism.
- Discuss the educational view of different Western schools of philosophy namely Idealism, Naturalism, Pragmatism.
- Explain about the Philosophy of Indian Great Educators like - Swami Vivekananda, Rabindranath Tagore, Mahatma Gandhi
- Explain about the Philosophy of Western Great Educators like - Rousseau, Dewey, Froebel.

Unit-I: Concept, Scope and Aim of Education

- a) Meaning, Nature and Scope of Education.
- b) Individualistic and socialistic aim.
- c) Report of Delor's commission (UNESCO, 1996)
- d) Meaning and scope of educational Philosophy; Relation between education and philosophy.

Unit-II: Factors of Education:

- a) Child: Meaning and characteristics of child centric education system.
- b) Teacher: Qualities and duties of a good teacher. Teacher as a motivator, mentor, facilitator and problem solver.
- c) Curriculum: Meaning and Types. Co-curricular activities.
- d) School: vision and functions.

Unit-III: Schools of Philosophy and National Values

- a) Indian schools of Philosophy: Sankhya, Yoga, Buddhism; in terms of knowledge, reality and value.
- b) Western School of Philosophy: Idealism, Naturalism, Pragmatism: special reference to principles, aims of education, curriculum, teaching method, teacher, discipline.

Unit-IV: Great Educators and their educational philosophy

- a) Indian: Swami Vivekananda, Rabindranath Tagore, Mahatma Gandhi.
- b) Western: Rousseau, Dewey, Froebel.

Suggested Books:

1. J. C. Aggarwal- Theory and Principles of Education
2. J. C. Aggarwal - Philosophical and Sociological Bases of Education
3. S. P. Chaube & A. Chaube – Foundations of Education
4. K. K. Shrivastava- Philosophical Foundations of Education
5. S. S. Ravi – A Comprehensive Study of Education
6. M. Sharma – Educational Practices of Classical Indian Philosophies
7. S. S. Chandra & R. K. Sharma- Philosophy of Education
8. M. K. Goswami- Educational Thinkers: Oriental and Occidental, Thoughts and Essays.

9. पञ्चमल्लि - चर्याशा J चर्याचने
10. अने ह-चर्यादेषु - चर्याचने J चर्याेषा
11. च-हचर्यावेषु - चर्या J चने
12. चर्या"े ... - चर्यावेषु
13. अने -ओ- चर्या च-ए-ने J जशा
14. -नचर्या चर्या J चर्या"े - चर्याशा J चर्याेषा
15. नचर्या चने J चर्या"े
16. चर्या"े ... - चर्यावेषु
17. -हचर्या, -चर्या ... - चर्या चने J चर्यावेषु-चर्या अने

B.A. Education (Honours)
SEMESTER-I
EDU-H-CC-T-2: Sociological Foundation of Education
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to-

- Discuss the meaning, nature and scope of Educational sociology and Relation between Education and Sociology.
- Describe the Social factor and their relation to Education.
- Define social groups, socialization and Social Institution and Agencies of Education.
- Explain the Social change and its impact on Education.

Unit-I: Educational Sociology

- a) Meaning, nature and scope of Educational sociology.
- b) Relation between education and sociology.
- c) Concept of Educational sociology and sociology of education.

Unit-II: Social factors, issues and Education

- a) Culture: Concept, role of education in culture, cultural lag.
- b) Meaning of Human Resource Development and its significance in the present society.
- c) Social issues: unemployment, poverty, education of socially and economically backward classes, disadvantage section of Indian society (SC, ST and OBC).

Unit-III: Social groups and Education

- a) Social groups- meaning and types (Primary, Secondary and Tertiary)
- b) Socialization: Meaning, process and factors of socialization, role of the family and school.
- c) Social Institutions and Agencies of Education: (i) Family, (ii) School, (iii) State, (iv) Mass media and (v) Religion

Unit-IV: Social change and Education

- a) Social change: definition, characteristics, factors, constraints and education as an instrument of social change.
- b) Social change in India (Privatization and Globalization)
- c) Education and social stratification: Definition and characteristics
- d) Education and Social Mobility

Suggested Books:

1. Y. K. Sharma – Sociological Philosophy of Education
2. S. S. Ravi – A Comprehensive Study of Education
3. J. C. Aggarwal - Philosophical and Sociological Bases of Education
4. पारंपरिक शिक्षा - चन्द्रिका चन्द्रिका
5. आधुनिक शिक्षा - चन्द्रिका चन्द्रिका
6. शिक्षा-समाज-संघर्ष - चन्द्रिका चन्द्रिका
7. शिक्षा-समाज-संघर्ष - चन्द्रिका चन्द्रिका
8. शिक्षा-समाज-संघर्ष - चन्द्रिका चन्द्रिका
9. शिक्षा-समाज-संघर्ष - चन्द्रिका चन्द्रिका
10. शिक्षा-समाज-संघर्ष - चन्द्रिका चन्द्रिका
11. शिक्षा-समाज-संघर्ष - चन्द्रिका चन्द्रिका
12. शिक्षा-समाज-संघर्ष - चन्द्रिका चन्द्रिका

B.A. Education (Honours)
SEMESTER-I
EDU-H-GE-T-1(A): Health Education
Generic Elective Course: Credit-6. Full Marks-75

Course Objectives:

After completion of this course the learner will be able to -

- Explain the meaning, definition and significance of health.
- Discuss the meaning and importance of health education.
- Describe the health status, health services and health programme of school children.
- Discuss some common and uncommon diseases in India
- Describe technological health hazards

Unit – I: Concepts of Health

- a) Definition of health and its significance.
- b) Meaning of health education and its importance.

Unit – II: School Health Services

- a) Health Status of school children.
- b) School health service in India.
- c) School health program.

Unit – III : Common and Uncommon Diseases in India :

- a) Common diseases during the previous decade-
 - Cancer.
 - HIV/AIDS
 - Dengue.
 - Reproductive Diseases.
 - Depression.
- b) Uncommon diseases –
 - Autistic.
 - Cerebral Palsy.
 - Thalassemia.

Unit – IV: Technology Related Health Risks :

- a) Identification of the technological health hazards –
 - Smartphone stress.
 - Acne caused by cell phone.
 - Radiation from the cell phone & various types of accidents.
 - Computer causing wrist pain.
 - Back & neck pain.
 - Laptop burns & headaches.
 - Decreased attention span from using Face-Book

Suggested Books :

- D.T.Kenny, J.G.Carlson, F.J.McGuigan and J.L.Sheppard, Stress and Health – Research and Clinical Applications, Harwood, Academic Publishers, The Netherlands (2000)

- L. Ramachandran and T. Dharmalingam, Health Education – A New Approach, Vikas Publishing House Pvt. Ltd. New Delhi (2001)
- M.C. Gupta and B.K. Mahajan, Text Book of Preventive and Social Medicine, Jaypee Brothers, Medical Publishers Pvt. Ltd., New Delhi, (2005)
- S. Mahoney and L.K. Olsen (Eds.), Health Education – Teacher Resource Handbook, Corwin Press Inc. California, USA, (1993)
- S.P. Singh, Sex Education – AIDS and Sexuality, Authors Press, Delhi (2001)
- V.K. Nanda, Health Education, Anmol Publication Pvt. Ltd. New Delhi (1997)
- X. AøSa cjp - üjÛÉ J n|l ønrj

B.A. Education (Honours)
SEMESTER-I
EDU-H-GE-T-1(B): Life Skill Education
Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Describe the meaning of life skill education, its nature and scope.
- Describe effective communication, its functions, model and barriers.
- Explain interpersonal relationship, its definition and factors affecting relationships.
- Explain meaning, nature, stages of creative and critical thinking.
- Describe the concept of problem solving, its steps and factors influencing problem solving.
- Discuss the concept of coping with emotions its characteristics, types and coping strategies.
- Discuss the concept of coping with stress, stressors, sources of stress and coping strategies.

Unit 1: Introduction to life skill education

- a) Life Skills: Concept, core life skills and their applications.
- b) Life Skill education: concept, nature and scope, Distinction between life skill education and sex education.

Unit 2: Social Skills and Negotiation Skills

- a) Empathy - Sympathy, Empathy and Altruism
- b) Interpersonal Relationship - Definition, Factors affecting Relationships

Unit 3: Thinking Skills and Problem solving ability

- a) Thinking: Concept, Nature and Types of Thinking, Concept Formation, Reasoning
- b) Creative and Critical Thinking: Definition, Nature, Stages

Unit 4: Strategies for life skill Education

- a) Coping with Emotions: Definition, Characteristics, Types, Coping Strategies
- b) Coping with Stress: Definition, Stressors, Sources of Stress, Coping Strategies

Suggested reading:

1. Dahama O.P., Bhatnagar O.P, (2005). *Education and Communication for Development*, (2nd Edn.), Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Debra McGregor, (2007). *Developing Thinking; Developing Learning - A guide to thinking skills in education*, Open University Press, New York, USA
3. Duffy Grover Karen, Atwater Eastwood, (2008). (8th Edn.), *Psychology for Living- Adjustment, Growth and Behaviour Today*, Pearson Education Inc, New Delhi.
4. Mangal S.K., (2008). *An Introduction to Psychology*, Sterling Publishers Pvt. Ltd., New Delhi.
5. Nair .V. Rajasenan, (2010). *Life Skills, Personality and Leadership*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
6. Nair. A. Radhakrishnan et al., (2010). *Life Skills Assessment Scale*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
7. Stella Cottrell, (2005). *Critical Thinking Skills: Developing Effective Analysis and Argument*, Palgrave Macmillan Ltd., New York.

B.A. Education (Honours)
SEMESTER-I
AECC-1: Environmental Education
Ability Enhancement Compulsory Course; Credit-2. Full Marks-50

COMMON SYLLABUS

B.A. Education (Honours)
SEMESTER-II
EDU-H-CC-T-3: Psychological Foundation of Education
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of this course the learners will be able to -

- Discuss the concept, nature, scope and uses of Psychology in education.
- Explain the influence of growth and development in education.
- Describe the meaning and concept of learning, its theories and factors.
- Explain the application of learning theories in classroom situation.
- Discuss the concept and theories of intelligence and creativity.
- Explain the concept and development of personality.

Unit-I: Educational Psychology and Development

- a) Concept, Nature and Scope; Distinction between Psychology and Educational Psychology.
- b) Growth and Development: Stages and aspects of development in human life; Physical, Social, Emotional, Cognitive and Language development of Infancy, Childhood and Adolescence period and respective educational programmes.
- c) Piaget's theory of Cognitive Development.

Unit-II: Learning

- a) Definition and characteristics of Learning; Factors influencing learning
- b) Theories of learning and their implications: Classical and Operant conditioning, Trial and Error, Insightful Learning
- c) Transfer of Learning: Concept & Types.
- d) Motivation: Types, factors and Role of Motivation in learning
- e) Memorization: Definition, factors, LTM, STM. Forgetting- meaning and causes

Unit-III: Intelligence & Creativity

- a) Intelligence: Definition; Theories of Intelligence and their implications- Spearman, Thurstone, Guilford and Gardner; Measurement of Intelligence- verbal and non-verbal
- b) Creativity: meaning, nature, factors, and nurturing.

Unit-IV: Personality

- a) Definition; Heredity & Environment as determinants of Personality.
- b) Type and Trait theory, Psychoanalytical theory
- c) Measurement of Personality- projective test
- d) Individual differences –meaning and implications.

Suggested Books:

1. S. K. Mangal- Essentials of Educational Psychology
2. J. C. Aggarwal- Essentials of Educational Psychology

3. S. K. Mangal - Advanced Educational Psychology
4. S.S. Chauhan- Advanced Educational Psychology
5. A. Woolfolk -Educational Psychology
6. J. W. Santrock -Educational Psychology
7. E. B. Hurlock -Child Development
8. L. E. Berk - Child Development
9. B. N. Dash & N. Dash –A Test Book of Educational Psychology
10. பரமஹம்சம் - கல்வி-பிழைப்பியல்
11. அலிசு - கல்வி - கல்வி-பிழைப்பியல்
12. ஃபீல்ட் - கல்வி-பிழைப்பியல்
13. சீசெபி - கல்வி-பிழைப்பியல்
14. லீஃபர் - கல்வி-பிழைப்பியல்
15. ஃபீல்ட் - கல்வி-பிழைப்பியல்
16. சுலி - கல்வி-பிழைப்பியல்
17. ஃபீல்ட் - கல்வி-பிழைப்பியல்
18. சீசெபி - கல்வி-பிழைப்பியல்

B.A. Education (Honours)
SEMESTER-II
EDU-H-CC-T-4: History of Education in Colonial India
Core Course; Credit-6. Full Marks-75

Course Objective:

After completion of this course the learners will be able to:

- Discuss the development of education in Colonial India in historical perspectives.
- Elaborate the contributions of Education Commission in post independent India.
- Describe the Educational Policy in Colonial India.
- Discuss Bengal Renaissance and its influence on Indian Education
- Describe National Education Movement and its impacts on Education.
- State different educational reform under colonial rule.
- Explain the nature of basic education.
- Discuss the impact of the colonial rule on the development of Indian Education.

Unit: I: Education in 19th Century in India

- Charter Act of 1813
- Oriental –Occidental Controversy
- Macaulay’s Minute
- Bentinck’s Declaration
- Wood’s Despatch: Context, Recommendations, Criticism and Educational Significance
- Indian Education Commission: Background, Composition of the Commission, Criticism and Educational Significance

Unit: II: Bengal Renaissance and Its Influence on Education

- Concept Bengal Renaissance
- Causes of Bengal Renaissance
- Characteristics of Bengal Renaissance
- Contribution of Raja Rammohan Roy, Derozio and Vidyasagar in Education.
- Impact of Bengal Renaissance on Education,

Unit: III: Educational policy of Lord Curzon and National Education Movement

- Simla Conference 1901
- The Indian Universities Commission 1902
- The Indian Universities Act 1904
- Govt. of India’s Resolution on Indian Educational Policy 1904
- Curzon contribution in Indian Education

National Education Movement

- Characteristics, of National Education Movement,

- Causes of National Education Movement,
- Objective of National Education Movement
- Different Phases of National Education Movement
- Causes of Failure of the Movement
- Influence of the National Education Movement on Future Development of Indian Education

Unit: IV: Commission in between 1st and 2nd world war

The Calcutta University Commission (Sadlar Commission) 1917-1919

- Context
- Recommendation
- Criticism
- Results

Basic Education:

- Concepts
- Characteristics
- Merits & Demerits

The post-war plan of educational development (Sargent Plan) 1944

- Context
- Objective
- Recommendations
- Criticism
- Results

Suggested Readings:

1. B. R. Purkait- Milestones of Modern Indian Education
2. J. C. Aggarwal - Landmarks in the History of Modern Indian Education
3. Nurulla & Naik- A Students History in India
4. S. S. Ravi – A Comprehensive Study of Education
5. J. P. Banerjee – Education in India: Past, Present and Future
6. S.N. Mukerjee- Modern Indian Education
7. B. K. Nayak- History Heritage and Development of Indian Education
8. B. N. Dash –History of Education in India
9. -SÉjçá fËpjc h-¾cÉjfdÉju - BdæçeL ijl-a çnrj çhhÑae
10. X. çcm£f L¥jil WjL¥l J -nM qjçjcæm qL - BdæçeL ijl-al çnrjl djlj
11. içš²i"oe iš²j - ijla£u çnrjl lçf-IMj
12. leçSv -Ojo - BdæçeL ijl-a çnrjl çhLjn
13. leçSv -Ojo - kæ-N kæ-N ijl-al çnrj: fËjQ£e, jdÉ, BdæçeL kæN

B.A. Education (Honours)
SEMESTER-II
EDU-H-GE-T-2(A): Pedagogical Knowledge
Generic Elective Course; Credit-6. Full Marks-75

Course objectives:

After completion of this course the learners will be able to -

- State the meaning, definition, need and scope of Pedagogy
- Explain the difference between Pedagogy & Andragogy
- Describe the aims and objectives of different discipline such as- Language, Social Science, Science & Mathematics.
- Discuss different Pedagogical approaches
- Describe the Concept and method of Microteaching.
- Explain the Concept and method of Constructivist Approach.

Unit-I: Meaning and Nature of Pedagogy

- a) Meaning, definition, characteristics & need of Pedagogy.
- b) Scope of Pedagogy.
- c) Difference between Pedagogy & Andragogy

Unit-II: Aims & Objectives of following discipline at secondary level

- a) Language
- b) Social Science
- c) Science
- d) Mathematics

Unit-III: Pedagogical Approaches

- a) Lecture Method
- b) Heuristic Method
- c) Project Method
- d) Demonstration Method
- e) Laboratory Method
- f) Collaborative Method

Unit-IV: Trends in Pedagogy

- a) Microteaching
- b) Constructivist Approach.

Suggested books:

1. Dr. S. K. Bhata and Dr .soniajindal - A text book of curriculum .

2. Rampal Sing and Dharmendra Kumar --Pedagogy of school subject economics.

3. Sashiprobha Sharma ---Teacher education: principles, theories and practices.

4.J.C .Aggarwal - Essentials of Educational Technology.

5. jmu L¥jil -pe- çnrj fËkαçš²çh'e

6. çhSe plLil- çnMe J çnre

7. X. çamjm ja-MifjdÉju J X. Ecun^l LçhljS- çnrjçh'je e£çafÜçã J -L±nm

8. X. çamjm ja-MifjdÉju J pev L¥jil -Oio- çnrj çe-cÑnejl jeÚ'sÄ

9. pççn£m lju- çnre J çnrj fËp%o

10. -L±çnL Q-fjdÉju- çnrj fËkαçš²çhcÉj

11. nÉjjifËp;c QVÉl;S-çnrj fËkαçš²

B.A. Education (Honours)
SEMESTER-II
EDU-H-GE-T-2(B): Lifelong Learning and Education
Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Explain the concept, characteristics, aims, nature, scope and need of Life Long Education
- Describe the different dimensions of Life Long Learning
- Explain the different teaching methods of Life Long Learning
- Explain the curriculum construction of Life Long Learning
- Discuss the Historical background of Life Long Learning
- Describe the different recommendations of different education commission on Life Long Learning.

Unit-I: Concept of Life Long Learning

- a) Meaning and definition of Life Long Learning and Adult Education
- b) Characteristics of Life Long Learning
- c) Aims of Life Long Learning
- d) Need or Importance of Life Long Learning.

Unit-II: Approaches of Life Long Learning

- a) Dimensions of Life Long Learning
- b) Different teaching methods for Life Long Learning

Unit-III: Historical Background of Life Long Learning

- a) Life Long Learning in Pre-Independence India
 - ✓ Life Long Learning in Ancient India
 - ✓ Life Long Learning in Medieval India
 - ✓ Life Long Learning in British India
- b) Life Long Learning in Post-Independence India. (Historical description from Independence to last twelve fifth year plan)

Unit-IV: Recommendations of different commission on Life Long learning

- a) National Literacy Mission (NLM) – (1988)
- b) National Adult Education Program
- c) Problems & Prospects of Life Long Learning.

Suggested books:

- Ravi,S.S.- A Comprehensive Study of Education

- Mukhopadhyaya, D.; Sarkar, B.; Halder, T.; & Pal, A.K. –
VaraterShiksharChalamanGhatanabali
- Mukhopadhyaya, D.; Halder, T. & Chanda, B.- Contemporary India and Education.
- Aggarwal, J.C.- Landmarks in the History of Modern Indian Education.
- Jarvis, P. Adult Education and Lifelong Learning.
- Knowles, M.S. The Modern Practice of Adult Education.
- Mayo, P.- Learning with Adults.
- Murriam, S.B. & Bierema, L.L. Adult Learning: Linking Theory and Practice.
- Murriam, S.B. & Grace, A.P. The Jossey-Bass Reader on Contemporary Issues in Adult Education.

B.A. Education (Honours)
SEMESTER-II
AECC-2: English Communication
Ability Enhancement Compulsory Course; Credit-2. Full Marks-50

COMMON SYLLABUS

B.A. Education (Honours)
SEMESTER-III
EDU-H-CC-T-5: Educational Evaluation & Statistics
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the concepts, scope and need of measurement and evaluation
- Explain the relation between Evaluation & Measurement and scale of Measurement
- Describe basic concept of Statistics
- Organize and tabulate data
- Explain different types of measuring scales and their uses in education
- Describe different types of Tools and Techniques in the field of Education.
- Elaborate the concept and methods of validity, reliability and norms and their importance in educational measurement.
- Explain different type of Evaluation process

Unit-I: Measurement and Evaluation in Education

- a) Concept, Scope and Need of Evaluation; Relation between Evaluation and Measurement.
- b) Scales of Measurement- Nominal, Ordinal, Interval and Ratio.

Unit-II: Educational Statistics

- a) Concept, Scope and Need of Educational Statistics
- b) Concept of raw data, score, frequency distribution, range, variable.
- c) Organization and Tabulation of Data- Frequency distribution table

Unit-III: Tools and Techniques of Evaluation

- a) Tools:
 - Tests- Essay type and Objective type; Short answer type and Oral type.
 - Personality Test- Rorschach Ink Blot Test
 - Interest Test- Kuder Richardson Test
- b) Techniques:

Observation, CRC, Interview, Questionnaire and Inquiry.
- c) Characteristics of a good test:
 - Reliability- Concept, Characteristics, Causes of low Reliability, Determination of Reliability, Various types.
 - Validity- Concept Causes of low Validity, Types, Determination.
 - Objectivity- Concept, Characteristics, Types of Objective Test & Essay type test, advantages and disadvantages.
 - Norms- Concept, Types and their uses.

Unit-IV: Evaluation Process

- a) Evaluation Process: Concept, Types (Formative and Summative)
- b) Concept of Norm-Referenced Test and Criterion Referenced Test.
- c) Concept of Gradation and Credit system.

Suggested Books:

1. S. K. Mangal- Statistics in Education and Psychology
2. A. K. Singh – Test, Measurement and Research Methods in Behavioural Sciences
3. H.E. Garret- Statistics in Education and Psychology
4. R. A. Sharma- Mental Measurement and Evaluation
5. Y. P. Aggarwal- Statistics Methods Concepts, Application and Computation
6. পরিসংখ্যান বিজ্ঞান - জিস্ট্রিউ: এফএ জি -এলএম
7. -চিওপ ফিম Hhw -চিওপ দি- ওরু ফল্জি জি জিস্ট্রিউ
8. ফস-জিওকই BQjkÑ -ওরু-র-ও জিস্ট্রিউ জি ওে-সইনে
9. এলিম Cpmij- ওরু জিস্ট্রিউ ফল্জি
10. আলি -ওিও- জি-ই'ই'ইএল ফল্জি জি ফল্জিউ

B.A. Education (Honours)
SEMESTER-III
EDU-H-CC-T-7: Inclusive Education
Core Course; Credit-6. Full Marks-75

Course Objectives-

After completion the course the learners will be able to:

- Discuss the Concept, nature, need of Inclusive Education.
- Describe the theories of Inclusive Education.
- Explain the development of competencies for Inclusive Education.
- Discuss the practices of Inclusive Education
- Describe the Infrastructural facilities for an ideal Inclusive School.
- Discuss the Role of teacher in Inclusive Classroom setting

Unit I: Inclusive Education concept and Nature

- a) Concept and principles of Inclusion.
- b) Need of Inclusive education.
- c) PWD Act (1994)

Unit II: Competencies development for Inclusive Education.

- a) Theories of Inclusive Education
- b) Development of Attitude, Positive Behaviour & social skill for Inclusion.

Unit III: Inclusive Education and its Practices.

- a) Differentiating Instruction.
 - Peer Tutoring
 - Co-operative learning
 - Inclusive lesson planning.
- b) Inclusive Instructional Strategies at school level.
 - Remedial Help.
 - Team Teaching.
 - Circles of Friends.

Unit -IV: Inclusive School

- a) Infrastructural facilities for an ideal Inclusive School.
- b) Teachers Role in Inclusive Classroom

Suggested Readings:

1. Loreman, Deppeler and Harvey- Inclusive Education, Allen and Unwin Australia.
2. Corbett Jenny – Supporting Inclusive Education, RoutledgeFalmer, 2001.
3. Felicity Armstrong and Michele Moore- Action Research for Inclusive Education, RoutledgeFalmer, 2004.
4. Mike Adams and Sally Brown – Towards Inclusive Learning in Higher Education, Routledge, 2006.
5. Peter Mittler- Working towards Inclusive Education, David Fulton Publishers, 2000
6. Nind, Sheehy and Simms, Inclusive Education – Learners and Learning Context, David Fulton Pub. 17) Integrated and Inclusive Education, Premavathy and Mittal, R C I, 2006.
7. Advani, Lal. and Chadha, Anupriya (2003). You and Your Special Child, New Delhi: UBS Publishers' Distributors Pvt. Ltd.
8. Sharma, Kaushal and Mahapatra (2007). Emerging Trends in Inclusive Education', Delhi, IVY Pub.
9. Renuka, P. and Bai, Suneetha, G. Inclusive of Exceptional Children in The Mainstream Schools and teacher education: Global Trends in Teacher education.
10. X. EçjÑ Qœ²haÑ£- çh-no Qjçqcj pçfæ çnö J Aç¹Ñi" çš²jæmL çnrj
11. X. -chhËa -chejb J Bçno L¥jil -chejb- hÉjçæç²djÑ£ çnö J a|l çnrj

B.A. Education (Honours)
SEMESTER-III
EDU-H-GE-T-3(A): Women Education
Generic Elective Course; Credit-6. Full Marks-75

Course objectives:

After completing of the course, the student will be able to

- Explain the concept & Needs of women education.
- Discuss the differences between Women Education and Women studies.
- Describe the contribution of Missionaries, British Govt and Indian thinkers.
- Explain the recommendations of various commissions and Committees on women's education.
- Examine the present status of Women's Education.

Unit I: Women Education.

- a) Concept & Need of Women Education
- b) Women Education and Women Studies-distinction

Unit II: Contribution of great scholar in the field of Education

- a) Contribution of missionaries.
- b) Role of British Govt.
- c) Contribution of the following Indian thinkers:
 - Raja Ram Mohan Roy
 - IswarChandraVidyasagar.
 - Nibedita.

Unit III: Commission and committees on Women's Education.

- a) University Education commission(1948)
- b) Secondary Education commission (1952-53)
- c) Education Commission (1964-66).
- d) Durgabai Deshmukh Committee
- e) Honsraj Mehta Committee

Unit IV: Present status of Women Education in India.

- a) Gender issues in Education and its causes.
- b) Measures required towards gender equity in Education.

Suggested Readings

- Singh, U.K. (2001), Women Education, New Delhi, Common wealth publishers.
- Gupta, M, (2003), Women and Educational Development, New Delhi, Sarup and Sons.
- Mishra, R.N. (2003), Women and Educational Development, New Delhi, DiscoveryPublishing.
- Sharma, B.M (Ed.) (2005), Women and Education, New Delhi, CommonwealthPublishers.
- Rao, M.K. (2005), Employment of Women in India, New Delhi, Discovery Publishing House.
- Tapan, N. (2000), Need for women Empowerment, Jaipur and New Delhi RawatPublication.

B.A. Education (Honours)
SEMESTER-III
EDU-H-GE-T-3(B): Yoga Education
Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Explain the meaning, nature, aims and role of teacher of Yoga education
- Discuss different types of Yoga
- Express the guidelines of Yoga education
- Discuss the significance of Yoga Education
- Explain the historical background of Yoga Education
- Discuss the relationship among Yoga, Sankhya Philosophy and Bhagwat Gita
- Describe the need of Yoga for healthy life style

Unit-I: Concept of Yoga Education

- a) Meaning and definition of Yoga Education
- b) Nature & Characteristics of Yoga Education
- c) Aims of Yoga Education
- d) Role of teachers in implementing Yoga Education

Unit-II: Different Approaches of Yoga Education

- a) Types of Yoga Education
- b) General guidelines for performing Yoga Education
- c) Significance to Yogic texts in the context of schools of Yoga.

Unit-III: Historical Background of Yoga Education

- a) Historical background of Yoga Education
- b) Yoga Philosophy and Yoga Education
- c) Sankhya Philosophy and Yoga Education
- d) Yoga as reflected in Bhagwat Gita

Unit-IV: Yoga and Health

- a) Concept of health and health related Problems
- b) Need of Yoga for good health
- c) Yogic concept of healthy life style
- d) Yoga for reduction of stress

Suggested Readings:

- Swami Shivananda Yoga Asanas : Divine Life Society.
- Jha Vinay Kant (2015), Patanjalis Yoga Sutras.
- NCERT -Yoga Syllabus
- Raja Yoga-Vivekananda Swami-Adyar Publication, Madras
- NCTE-Yoga Education.
- NCTE- Yoga Education – Master of Education Programme.
- Bhakta, B.B.-Varatiya Shiksha R Ruparekha.

B.A. Education (Honours)
SEMESTER-III
EDU-H-SEC-T-1(A): Statistical Analysis-I
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Explain the concept of central tendency, variability and their properties
- Discuss the concept of Percentile and Percentile Rank and its application.
- Describe the concept of co-relation and their application
- Explain the concept of Parametric and Non-Parametric Test
- Apply the knowledge and calculate different statistical values

Unit-I: Descriptive Statistics

- a) Meaning of Central Tendency- Mean, Median and Mode-their Properties, Calculation and Application.
- b) Measure of Variability- Range, AD, SD and QD- their Properties, Calculation and Application)
- c) Percentile and Percentile Rank- Definition, Calculation, Application, Graphical Determination.

Unit-II: Relationship and Inferential Statistics

- a) Concept of Correlation – Computation of Co-efficient of Correlation by Rank difference method and Product moment method, Interpretation of Co-efficient of Correlation,
- b) Parametric and Non-Parametric Test- (only Concept and Uses).

Practical:

Calculate - Mean, Median and Mode; Range, AD, SD & QD; PP, PR; Co-relation; Standard score & Z score from different frequency distribution.

Suggested Books:

- 1) S. K. Mangal- Statistics in Education and Psychology
- 2) A. K. Singh – Test, Measurement and Research Methods in Behavioural Sciences
- 3) H.E. Garret- Statistics in Education and Psychology
- 4) R. A. Sharma- Mental Measurement and Evaluation
- 5) Y. P. Aggarwal- Statistics Methods Concepts, Application and Computation
- 6) ρ σ λ μ ν - \int $\sin^2 x$ dx $= \frac{x}{2} - \frac{\sin 2x}{4}$
- 7) $\frac{d}{dx} \log_e x = \frac{1}{x}$ $\frac{d}{dx} \log_e x^2 = \frac{2}{x}$ $\frac{d}{dx} \log_e x^3 = \frac{3}{x}$
- 8) $\log_e a^x = x \log_e a$ $\log_e a^m \cdot \log_e a^n = \log_e a^{m+n}$ $\log_e \frac{a^m}{a^n} = \log_e a^m - \log_e a^n$
- 9) $e^{\log_e x} = x$ $\log_e e^x = x$ $\log_e e = 1$ $\log_e 1 = 0$

SEMESTER-III
EDU-H-SEC-T-1(B): Statistical Analysis-II
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the meaning, characteristics and need of Graphical Representation
- Explain different type of graphical representation
- State the principles of graphical representation
- Describe the methods of represent graph
- Explain different types of graphical representation
- Discuss the concept of NPC

Unit-I: Concept of Graphical Representation

- a) Meaning, characteristics and need of Graphical Representation
- b) Different types of Graphical Representation (Concept only)
- c) Principles of Graphical Representation
- d) Methods to represents a frequency distribution
- e) Graphical Representation of Data (Concept, Procedure of represent, Merit & Demerit)
 - Pie diagram, Bar graph, Line graph, Histogram, Frequency Polygon, Ogive

Unit-II: Concept of NPC

- a) Concept of Normal Distribution
- b) Properties and Uses of NPC.
- c) Divergence from Normality- Skewness and Kurtosis

Practical:

Draw graphs - Pie diagram, Bar graph, Line graph, Histogram, Frequency Polygon, Ogive.

Suggested Books:

- 1) S. K. Mangal- Statistics in Education and Psychology
- 2) A. K. Singh – Test, Measurement and Research Methods in Behavioural Sciences
- 3) H.E. Garret- Statistics in Education and Psychology
- 4) R. A. Sharma- Mental Measurement and Evaluation
- 5) Y. P. Aggarwal- Statistics Methods Concepts, Application and Computation
- 6) $\rho_{\text{correlation}}$ $\rho_{\text{regression}}$ ρ_{partial} ρ_{multiple}
- 7) χ^2 test F test t test U test M test R test
- 8) BQ JK r c e J c N e j
- 9) e S l m C p m j c r j u j S m E j u e f c l j f

B.A. Education (Honours)

SEMESTER-IV

EDU-H-CC-T-8: History of Education in Post-Independence India Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Describe the Preamble, various articles and act on education in Indian Constitution.
- Explain the recommendations and educational importance of various Education Commission in post Independent India
- Discuss the functions of some educational bodies in West Bengal
- Discuss the National Policy on Education in different time.

Unit-I: Education and Constitution

- a) Preamble and various Articles on Education in Indian Constitution
- b) RTE Act-2009
- c) Development of Education under Plan (Last two plans)

Unit-II: Education Commission in post Independent India

- a) University Education Commission (1948-49)
- b) Secondary Education Commission (1952-53)
- c) Indian Education Commission (1964-66)
- d) AsokeMitra Commission (1991-92)

Unit-III: Some Educational Bodies in West Bengal (Function only)

- a) SCERT, b) DIET.

Unit-IV: National Policies on Education

- a) National Policy on Education (1968)
- b) National Policy on Education (1986)
- c) Programme of Action (POA)- 1992
 - i) Ramamurti Committee (1990-91)
 - ii) Janardhan Reddy Committee (1992)

Suggested Books:

1. B. R. Purkait- Milestones of Modern Indian Education
2. J. C. Aggarwal - Landmarks in the History of Modern Indian Education
3. S. S. Ravi – A Comprehensive Study of Education
4. J. P. Banerjee – Education in India: Past, Present and Future
5. S. P. Chaube & A. Chaube – Education in Ancient and Medieval India
6. B. K. Nayak- History Heritage and Development of Indian Education
7. B. N. Dash –History of Education in India
8. -N±lcjppqimcjlHhwfĒnjĳ¹ njÑĳ- Bd±œeLiĳla£u çnrĳl çhLĳn
9. Alle -Oĳo -Bd±œeLiĳla£u çnrĳlCœaqĳp
10. lZçSv -Oĳo- k±-Nk±-Niĳl-al çnrĳ
11. p±±n£mlĳu - ĳl-al çnrĳ J çnrĳlĳlaĳue
12. p±±çhĳm çjnĒ- ĳla£u çnrĳlCœaqĳp
13. ĳçš² ĳoZ ĳš²-ĳla£u çnrĳllçf-IMĳ
14. -SĒĳçafĒpĳc h-¾cĒĳfĳdĒĳu- ĳla£u çnrĳlCœaqĳp

B.A. Education (Honours)

SEMESTER-IV
EDU-H-CC-T-9: Psychology of Instruction
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the concept, factors, and principles of teaching.
- Explain the Flander's Interactional analysis
- Explain the characteristics of a good teacher.
- Discuss the nature of classroom teaching, traditional teaching, and constructivist teaching.
- Explain the concept and implications of Micro-teaching
- Discuss different types of teaching methods.

Unit-I: Teaching

- a) Science of Teaching- Relation between teaching and learning;
- b) Factors affecting teaching process, Input and Output variables;
- c) Maxims of teaching; Fundamentals of teaching.

Unit-II: Teacher Behavior

- a) Observation of classroom behavior: Flander's Interactional analysis.
- b) Characteristics of a good teacher.

Unit-III: Teacher and Classroom Teaching

- a) Nature of classroom teaching.
- b) Difference between traditional and constructivist teaching;
- c) Micro-teaching- meaning , nature, merits and demerits

Unit-IV: Teaching Methods

Meaning, nature, merits and demerits- Lecture, Demonstration, Project, Problem Solving, and, Story-telling.

Suggested Books:

- 1) S. K. Mangal- Essentials of Educational Psychology
- 2) J. C. Aggarwal- Essentials of Educational Psychology
- 3) S. K. Mangal - Advanced Educational Psychology
- 4) S.S. Chauhan- Advanced Educational Psychology
- 5) A. Woolfolk -Educational Psychology
- 6) J. W. Santrock -Educational Psychology
- 7) B. N. Dash & N. Dash –A Test Book of Educational Psychology
- 8) पाठनमाला - मनो विज्ञान
- 9) अज्ञान - मनो विज्ञान
- 10) ज्ञान लक्ष्मी - मनो विज्ञान
- 11) -लक्ष्मी - मनो विज्ञान
- 12) नवीन मनो विज्ञान

B.A. Education (Honours)

SEMESTER-IV

EDU-H-CC-T-10: Contemporary issues in Education Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Explain constitutional provisions with special reference to RTE Act, DPEP, SSA-SSM of Universalization of Elementary Education.
- Describe the meaning, aims & objectives, significance of Universalization of Secondary Education and Role of RMSA.
- Explain the concept, role of Higher Education and Knowledge Commission and RUSA.
- Discuss modern issues in Indian Education like- Peace Education, Sustainable development, Inclusive Education, Open & Distance learning, Equality & Equity in Education, Women Education.

Unit-I: Universalization of Elementary Education

Universalization of Elementary Education- Meaning, Constitutional Provision with special reference to RTE Act; Aims and Objectives, Importance, Role of DPEP; SSA-SSM, Problems.

Unit-II: Universalization of Secondary Education

Meaning, aims & objectives, significance; Role of RMSA, Problems.

Unit-III: Higher Education and RUSA

- a) Role of Higher Education
- b) Knowledge Commission & Higher Education
- c) Higher Education and RUSA
- d) Problems of Higher Education in India

Unit-IV: Issues in Education

- a) Peace Education: Meaning, aims & objectives, need.
- b) Education for Sustainable Development: Meaning, aims & objectives, Role of education in Sustainable Development.
- c) Inclusive Education: Meaning, Need & Govt, programme.
- d) Open & Distance Learning System: Meaning, Characteristics and need.
- e) Equality and Equity in Education: Meaning, importance, causes of inequality, Role of education to remove inequality in education.
- f) Women Education: Importance, problems.

Suggested Books:

1. S. S. Ravi – A Comprehensive Study of Education
2. J. C. Aggarwal- Theory and Principles of Education
3. R. P. Pathak – Development and Problems of Indian Education
4. B. K. Nayak- Modern Trends and Issues in Education of India
5. $\text{c}\alpha\text{m}\text{i}\text{m}\ \text{j}\alpha\text{-M}\text{i}\text{f}\text{i}\text{d}\text{E}\text{j}\text{u},\ \text{c}\text{h}\text{S}\text{e}\ \text{p}\text{L}\text{i}\text{l},\ \text{a}\text{j}\text{c}\text{h}\text{e}\text{L}\ \text{q}\text{i}\text{m}\text{c}\text{i}\text{l}\ \text{H}\text{h}\text{w}\ \text{A}\text{c}\text{i}\text{c}\text{S}\text{v}\ \text{L}\text{N}\text{j}\text{i}\text{l}\ \text{f}\text{i}\text{m}-\ \text{i}\text{j}\text{l}-\text{a}\text{l}\ \text{c}\text{h}\text{r}\text{i}\text{l}\ \text{Q}\text{m}\text{j}\text{i}\text{e}\ \text{O}\text{V}\text{e}\text{j}\text{h}\text{m}\text{L}$
6. $\text{a}\text{j}\text{c}\text{h}\text{e}\text{L}\ \text{q}\text{i}\text{m}\text{c}\text{i}\text{l},\ \text{c}\text{h}\text{e}\text{j}\text{u}\text{L}\ \text{Q}\text{3}\text{4}\text{c}\ \text{H}\text{h}\text{w}\ \text{p}\alpha\alpha\text{n}\text{i}\text{c}\text{1}\ \text{L}\text{N}\text{j}\text{i}\text{l}\ \text{h}\text{j}\text{N}\text{e}-\ \text{c}\text{h}\text{r}\text{i}\ \text{J}\ \text{E}\alpha\text{ue}$
7. $\text{a}\text{j}\text{c}\text{h}\text{e}\text{L}\ \text{q}\text{i}\text{m}\text{c}\text{i}\text{l}\ \text{J}\ \text{c}\text{h}\text{e}\text{j}\text{u}\text{L}\ \text{Q}\text{3}\text{4}\text{c}-\ \text{p}\text{j}\text{L}\text{i}\text{m}\text{L}\text{e}\ \text{i}\text{j}\text{l}\text{a}\text{h}\text{o}\text{N}\ \text{J}\ \text{c}\text{h}\text{r}\text{i}$

B.A. Education (Honours)
SEMESTER-IV
EDU-H-GE-T-4(A): Vocational Education
Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Discuss the meaning, characteristics & scope of Vocational Education.
- Explain the types, importance & challenges of Vocational Education.
- Difference among Vocational Education, Vocational Training & General Education.
- State the historical background of Vocational Education
- Describe the status of Vocational Education in different Education commission.
- Take measures for vocationalization of different stages of Education.

Unit- I: Concept of Vocational Education

- a) Meaning ,Definition & Characteristics of Vocational Education
- b) Types of Vocational Education
- c) Importance & Challenges of Vocational Education
- d) Difference between Vocational Education, Vocational training & General Education

Unit-II: History of Vocational Education

- a) Vocational Education in Ancient India (Brahmanic period, Buddhist period & Mediaeval period)
- b) Vocational Education in British India
- c) Vocational Education in Independent India

Unit-III: Vocational Education in different Education Commission

- a) Vocational Education in the Education Commission-1952-53
- b) Vocational Education in the Education Commission-1964-66
- c) Vocational Education in the Programme of Action- 1992

Unit-IV: Vocationalization in different Education system

- a) Vocationalization of Secondary Education
- b) Vocationalization of Higher Secondary Education

Suggested Books:

- 1) Rastriya, T. Vocational Education. APH Publishing Corporation. New Delhi.
- 2) N. Harinath & P. A. Reddy. Vocational Education. APH Publishing Corporation. New Delhi.
- 3) V.K.Rao. Vocational Education. APH Publishing Corporation. New Delhi.
- 4) G.Rumble, & J.Oliveira. Vocational Education at a Distance. Routledge publication.
- 5) L. Moran, & G. Rumble. Vocational Education and Training Through Open and Distance Learning. Routledge publication.
- 6) J. Stevenson. Developing Vocational Expertise: Principles and issues in Vocational Education. Routledge publication.

B.A. Education (Honours)
SEMESTER-IV
EDU-H-GE-T-4(B): ICT in Education
Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Explain the basic concepts of Computer
- Discuss the concept and different functions of Hardware approach of Computer.
- Discuss the concept and different functions of Software approach of Computer.
- Explain the concept and different functions of MS-WINDOWS.
- Explain of applications of different software.
- Describe the concept, functions and programme of INTERNET.

UNIT - I: Fundamental of Hardware

Computer definition, main units, characteristics, generation, classification, hardware and software concept and classification, input and output devices, CPU, Memory – RAM, ROM, Register, Cache memory, FDD, HDD, CD, DVD, Pen Drive.

Unit-II: Fundamentals of Software

Instruction, Program, Software, Types of Software, Package, Type of packages, Programming Languages, Classification of Programming Languages, Generations of Programming Languages, Advantages and Disadvantages of various programming languages, Examples of various types of programming languages.

UNIT – III: MS – WINDOWS

Bootting, steps of bootting, types of bootting, Windows Elements, desktop, icon, tool, recycle bin, menu, file manager, control panel, print manager, clip board, paint, notepad and other accessories of windows.

UNIT – IV: Internet

Internet: meaning, history, requirements (Software and Hardware), downloading required information from the internet, process it and save it as per our requirements., HTML, ISP and surfing web sites. Electronic Mail: meaning, requirement, features, various parts of an E-Mail ID, composing a mail, sending a mail, receiving a mail, opening, saving and managing mail.

Suggested Reading

- a) Fundamentals of Computers by [V. Rajaraman, Prentice Hall India Pvt., Limited](#)
- b) Windows 10 Bible by Wiley Publication
- c) Microsoft Excel Functions & Formulas by BPB Publication
- d) Microsoft Office Complete Reference by Tata McGraw Hill Publication

B.A. Education (Honours)
SEMESTER-IV
EDU-H-SEC-T-2(A): Computer Application
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Explain the beginning, basic editing, templates by using MS word
- Work with Graph, Pictures. Tables by using MS word
- Work with Desktop Publishing, Mail Merge by using MS word
- Discuss about the Proofing, Printing, Publishing, Comparing, Merging and Protecting Documents by using MS word
- Activate Power Point, uses of Themes and Layouts
- Insert Text, WordArt, Graphics, Animations, sounds
- Apply Edit, save, print and publish by using MS Power Point

Unit-I: MS word - features and uses

- a) Beginning to use Microsoft word
- b) Basic Editing
- c) Templates
- d) Tables
- e) Desktop Publishing
- f) Proofing, Printing and Publishing
- g) Comparing, Merging and Protecting Documents

Unit-II: MS Power Point- features, animation and uses

- a) Activating Power Point
- b) Using Themes and Layouts
- c) Inserting Text and Using WordArt
- d) Inserting Graphics
- e) Working with Animations
- f) Sounds
- g) Editing, Saving, Printing and Publishing Tools

Practical:

1. Creating different texts, tables, etc. using MS_word.
2. Creating a slideshow for taking a class of any standard

Suggested Books:

- 1) Fundamentals of Computers by [V. Rajaraman](#), [Prentice Hall India Pvt., Limited](#)
- 2) Windows 10 Bible by Wiley Publication
- 3) Microsoft Excel Functions & Formulas by BPB Publication
- 4) Microsoft Office Complete Reference by Tata McGraw Hill Publication

B.A. Education (Honours)
SEMESTER-IV
EDU-H-SEC-T-2(B): Uses of Teaching Aids
Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Discuss the meaning and characteristics of Teaching Aids
- Explain the usability of Teaching Aids
- Express the quality and limitation of Teaching Aids
- Discuss the classification of Teaching Aids
- Develop different Teaching Aids

Unit-I: Concept of Teaching Aids

- a) Definition & Meaning of Teaching Aids
- b) Characteristics of Teaching Aids
- c) Utility of Teaching Aids
- d) Limitations of Teaching Aids

Unit-II: Different Types of Teaching Aids

- a) Classification of Teaching Aids (Concept only)
- b) Projected Teaching Aids- OHP, Slide Projection, Film Strip (Concept, principles of construction, uses)
- c) Non-Projected Teaching Aids- Model, Chart, Poster (Concept, principles of construction, uses)

Practical:

Development of Teaching Aids

Suggested Books:

1. X. cæmjm jæ-MjfidÉju Hhw X. Ecun^l LçhljS - çnrjçh'je e£çæ fÜçæ J -L±nm
2. X. çæçMm L¥jil cš Hhw X. °QaeÉ jäm - çnrjçh'je çnre fÜçæ
3. X. °QaeÉ jäm - pjjSfjW çnre fÜçæ

B.A. Education (Honours)
SEMESTER-V
EDU-H-CC-T-11: Educational Management
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion the course the learners will be able to:

- Explain the Meaning, Nature, Scope, Function and Needs and types of Educational management.
- Explain the meaning and function of Educational Administration.
- Explain the meaning, purpose of supervision and distinguish between supervision and inspection.
- Illustrate educational planning and types of educational planning.
- Discuss the functions of some selected administrative bodies.

Unit-I: Concept of Educational Management

- a) Educational Management: Meaning, Nature, Scope, Function and Needs.
- b) Types of Educational Management: Centralization, Decentralization, Autocratic, Democratic and Laissez-fair.

Unit-II: Educational Administration and Supervision

- a) Educational Administration: meaning and function.
- b) Supervision: meaning, purpose; difference between Supervision and Inspection.
- c) Factors affecting managerial behavior of teachers: Personal, Social, Cultural, Political and Institutional.

Unit-III: Educational Planning

- a) Educational Planning: Meaning, Needs and Significance.
- b) Types of Educational Planning; Strategies and Steps in Educational Planning.
- c) Brief outline of the last Five Year Plan in Primary and Secondary Education.

Unit-IV: Functions of Various Administrative Bodies

- a) UGC, b) NAAC, c) NCERT, d) NCTE.

Suggested Books:

1. J. C. Aggarwal- Educational Administration, Management and Supervision
2. J. Mohanty- Educational Administration, Supervision and School Management
3. I. S. Sindhu- Educational Administration and Management
4. H. M. Qureshi - Educational Administration, Management and Supervision
5. C. C. Mahajan - Educational Administration, Supervision and School Management
6. A. K. Chakrabarti - Educational Administration, Management and Supervision
7. -N. S. Chakrabarti - Educational Administration, Management and Supervision
8. A. K. Chakrabarti - Educational Administration, Management and Supervision
9. P. S. Chakrabarti - Educational Administration, Management and Supervision

B.A. Education (Honours)
SEMESTER-V
EDU-H-CC-T-12: Educational Technology
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the concept, nature and scope of educational technology.
- Explain the role of communication & multimedia approach in the field of Education.
- Discuss the role Seminar, Panel Discussion. Team teaching in the field of education.
- Describe the role of technology in modern teaching-learning process.

Unit-I: Educational Technology

- a) Meaning, Nature, Need and Scope of Educational Technology
- b) Technology in Education and Technology of Education
- c) Approaches of ET: Hardware, Software, and System

Unit-II: Classroom Communication and Media used

- a) Meaning, Nature, Types, and Components of Communication
- b) Barriers of classroom communication and strategies of overcoming barriers in communication
- c) Media used in education: Audio (Radio), Visual (Projector), Audio-visual (TV)- merits and demerits

Unit-III: Instructional Technology

- a) Mass Instructional Technology- Seminar, Discussion, Panel Discussion. Team teaching
- b) Personalized Instructional Techniques- Programmed Instruction- meaning, principles, types, merits and demerits
- c) Computers and its role in educational instruction

Unit-IV: Phases, Levels, and Models of Teaching

- a) Phases of Teaching: Pre-active, Inter-active & Post-active.
- b) Levels of Teaching: Memory, Understanding, Reflective.
- c) Models of Teaching: Concept, Components, Families, Glaser's Basic Teaching Model, Bruner's Concept Attainment Model.

Suggested Books:

1. K. Sampath- Introduction to Educational Technology
2. R. P. Pathak- New Dimensions of Educational Technology
3. U. Rao – Educational Technology
4. K. L. Kumar- Educational Technology
5. J. Mohanty- Educational Technology
6. J.C. Aggarwal - Educational Technology
7. S.S. Dahiya - Educational Technology
8. jmu L%jil -pe- çnrj fËkαçš²çh'je
9. -L±çnL Q-fjdÉju- çnrj fËkαçš²çhcÉj
10. nÉjjifËp;c QVÉl;S-çnrj fËkαçš²

B.A. Education (Honours)
SEMESTER-V
EDU-H-DSE-T-1/2(A): Value Education

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course objectives:

After end of this course learner will able to-

- Explain the meaning, nature, classify value and its reflection in Indian Constitution.
- Discuss the meaning, objectives and need of value Education
- Describe the role of value education through Curriculum, Co-curricular activities.
- Explain the meaning, advantages and disadvantage of Storytelling, Play-way method and Role plays.

UNIT-I: Meaning and nature of Value

- a) Value: Meaning and Nature
- b) Values enshrined in Indian constitution.
- c) Classification of values proposed by NCERT

UNIT-II: Value Education

- a) Value Education: concept and objective.
- b) Need for value education in India

UNIT-III: Value Education in School

- a) Value Education through Curriculum.
- b) Value Education through Co-Curricular Activities.
- c) Role of teachers to facilitate development of values among the learners.

UNIT-IV: Strategies of value education

- a) Storytelling.
- b) Play-way Method.
- c) Role plays.

Suggested Books:

- 1) Diwahaar, R. R., & Aggarwal, M. (Ed). (1984). Peace education. New Delhi: Gandhi Marg.
- 2) Fountain, S. (1999) Peace Education in UNICEF, Working Paper, Education Section, Programme Division, UNICEF, New
- 3) Aggarwal, J.C. (2010). *Education for Values, Environment and Human Rights*. New Delhi: Shipra Publications
- 4) Chadha, S. C. (2008). Education value & value education. Meerut: R.Lall Books Depot
- 5) Chakraborty, Mohit (2003); *Value Education: Changing Perspectives*. New Delhi: Kanishka Publishers. Gupta, N.L. (2000). *Human Values in Education*. New Delhi: Concept Publishing Company.
- 6) Mahakud, L. & Behera, S.K. (2013) (Edit.) Value Education: Dimensions and Approaches, S.B. Enterprise, Kolkata.
- 7) Passi, B. K., & Singh, P. (1999). Value education. Agra: Agra Psychological Corporation.

- 8) Ruhela, S.P. (ed.) (1986). *Human Values and Education*. New Delhi: Sterling Publishers Pvt. Ltd.
- 9) Singh, Y. K. (2009). *Value education*. New Delhi: APH Publishing Corporation.
- 10) Sharma, Y.K. and Katoch, K.S. (2007) *Education for Values, Environment and Human Rights*, New Delhi: Deep & Deep Publications Pvt. Ltd.
- 11) Sharma, R. A. (2008). *Human value of education*. Meerut: R.Lall Books Depot.

B.A. Education (Honours)
SEMESTER-V
EDU-H-DSE-T-1/2(B): Population Education
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to-

- Explain the meaning, concept, scope & objectives of Population Education.
- Discuss the historical development of Population Education.
- Describe the definition, factors, causes and prevention of population growth.
- Explain the Population Education curriculum and policies.

Unit-1: Meaning and Concept of Population Education

- a) Meaning & Concept of Population Education
- b) Scope & objectives of Population Education.

Unit-II: Historical Development of Population Education

- a) Historical development of Population Education and education programme in India.
- b) Some major thrust areas of population education-
 - Family planning
 - Adolescent education.

Unit-III: Population Growth and Problems in India

- a) Definition of population growth.
- b) Factors influencing population growth- fertility, mortality, and migration.
- c) Causes of rapid population growth
- d) Preventive measures for rapid population growth.

Unit-IV: Population Education Curriculum and Policy

- a) Curriculum of Population education at different stages.
- b) Role of population policy in India.
- c) Role of Teacher in making awareness of population explosion.
- d) Community sensitisation programme of early marriage and child labour etc.

Suggested Books:

- 1) Aggarwal, J.C (2002).Population Education.Shipra Publication, 115-A, VikasMarg, Shakarpur, Delhi-110092.
- 2) Bhardwaj, Ramesh Kumar(2002). Population Education in India. The Associate Publishers 2963/2, Kacha Bazar, Post Box No. 56.
- 3) Ghosh, B.N(1985). Fundamentals of Population Geography. Sterling Publishers Private Limited, New Delhi-11006
- 4) Raju, B. Joseph et al. (2004). Population Education.Sonali Publications, New Delhi-110002.
- 5) Sharma, Yogendra K. (2007). Population Education: Concepts, Principles and Approaches. Kanishka Publishers Distributors, 4697/55-21A Answari Road, Daryaganj, New Delhi-110002
- 6) Sinha, P. N (2000).Population Education and Family Planning. Authors Press, E/35/103, Jawarharpark, Laxmi Nagar, Delhi-110092.

**B.A. Education (Honours)
SEMESTER-V**

EDU-H-DSE-T-1/2(C): Peace Education

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to:

- Explain the concept, aims, objectives, scope, need and factors of Peace Education.
- Discuss views of Gandhi, Rabindranath Tagore, Aurobinda and Jiddu Krishnamurti regarding Peace Education
- Explain the principles and curriculum of Peace Education
- Discuss the role of education in Peace Education.
- Understand the approaches of Peace Education

UNIT-1: Concept of Peace Education

- Peace Education : Meaning, nature, aims, objectives & scope
- Need of Peace Education.
- Factors of peace education: unemployment, terrorism, religion.

UNIT-2: Key Thinkers of Peace Education

Indian Context:

- Rabindranath Tagore,
- Sri Aurobinda

Global context:

- Montessori
- John Dewey

UNIT-3: Peace Education Programme in School

- Principles of peace education
- Curriculum and Peace Education.
- Quality of a teacher as a peace educator

UNIT-4: Approaches of Peace Education

- Participatory Education
- Co-operative Learning

Reading List

1. Krishnamurti, J. Education and the Significance of Life
2. Kumar, K. Learning from Conflict.
3. Kumar, K. Battle for Peace.
4. NCERT. Ways to Peace
5. UNESCO. Learning the Way of Peace: Teacher's Guide.
6. Diwahaar, R. R., & Agarwal, M. (Ed). (1984). Peace education. New Delhi: Gandhi Marg.
7. Fountain, S. (1999) Peace Education in UNICEF, Working Paper, Education Section, Programme Division, UNICEF, New

8. Aggarwal, J.C. (2010). *Education for Values, Environment and Human Rights*. New Delhi: Shipra Publications
9. Chadha, S. C. (2008). *Education value & value education*. Meerut: R.Lall Books Depot
10. Chakrabarti, Mohit (2003); *Value Education: Changing Perspectives*. New Delhi: Kanishka Publishers.
11. Gupta, N.L. (2000). *Human Values in Education*. New Delhi: Concept Publishing Company.
12. Mahakud, L. & Behera, S.K. (2013) (Edit.) *Value Education: Dimensions and Approaches*, S.B. Enterprise, Kolkata.
13. Passi, B. K., & Singh, P. (1999). *Value education*. Agra: Agra Psychological corporation.
14. Ruhela, S.P. (ed.) (1986). *Human Values and Education*. New Delhi: Sterling Publishers Pvt. Ltd.
15. Singh, Y. K. (2009). *Value education*. New Delhi: APH Publishing Corporation.
16. Sharma, Y.K. and Katoch, K.S. (2007) *Education for Values, Environment and Human Rights*, New Delhi: Deep & Deep Publications Pvt. Ltd.
17. Sharma, R. A. (2008). *Human value of education*. Meerut: R.Lall Books Depot.
18. Shukla, R. P. (2004). *Value education and human rights*. New Delhi: Sarup and sons.
19. Subramanian, K. (1990). *Value Education*. Madurai: Ravana Publication.
20. Venkataiah, (2009). *Value education*. New Delhi: APH Publishing Corporation

B.A. Education (Honours)
SEMESTER-V
EDU-H-DSE-T-1/2(D): Distance Education
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completing of the course the students will be able to-

- Explain the meaning, characteristics, objectives, merits & demerits of distance & open education.
- Discuss the mode and strategies of distance education.
- Describe the relationship among Non-formal, Correspondence, Distance and Open Education.
- Discuss the present status of distance and open education in India.
- Explain the role of multi-media in Distance and Open Education.
- Discuss the problems and remedies of distance and open education in India.

Unit I: Concept of Distance & Open Education

- a) Meaning and definition of Distance Education.
- b) Characteristics and objectives of Distance Education.
- c) Merits and limitations of Distance Education.

Unit II: Strategies of distance education

- a) Mode and strategies of Distance Education.
- b) Relationship among Non-formal, Correspondence, Distance and Open Education.

Unit III: Status of open and distance education in India

- a) Present state of Distance and Open Education in India.
- b) Role of multi-media in Distance and Open Education.

Unit IV: Problems and remedies of distance and open education in India

- a) Salient features of the Indira Gandhi National Open University (IGNOU) and National Open School.
- b) Problems of Distance and Open Education in India.
- c) Measures for strengthening Distance and Open Education in India.

Suggested Books:

- 1) S.S. Ravi – A Comprehensive Study of Education
- 2) R.P. Pathak – Development and Problems of Indian Education
- 3) B.K. Nayak – Modern Trends and Issues in Education of India
- 4) $\text{c}\alpha\text{m}\text{i}\text{m}\text{j}\alpha\text{M}\text{i}\text{f}\text{i}\text{d}\acute{\text{E}}\text{i}\text{u}, \text{ }\phi\text{h}\text{S}\text{e}\text{p}\text{L}\text{i}\text{l}, \text{ a}\text{i}\phi\text{le}\text{£} \text{ q}\text{i}\text{m}\text{c}\text{i}\text{l}\text{H}\text{h}\text{w}\text{A}\phi\text{i}\phi\text{S}\text{v}\text{L}\text{¥}\text{j}\text{i}\text{l}\text{f}\text{i}\text{m}- \text{ i}\text{j}\text{l}\text{a}\text{l}$
 $\phi\text{n}\text{r}\text{i}\text{l}\text{Q}\text{m}\text{j}\text{i}\text{e}\text{O}\text{V}\text{e}\text{j}\text{h}\text{m}\text{£}$
- 5) $\text{a}\text{i}\phi\text{le}\text{£} \text{ q}\text{i}\text{m}\text{c}\text{i}\text{l}, \text{ }\phi\text{h}\text{e}\text{i}\text{u}\text{L} \text{ Q}^{\frac{3}{4}}\text{c} \text{ H}\text{h}\text{w} \text{ p}\alpha\alpha\text{n}\text{i}\zeta^1 \text{ L}\text{¥}\text{j}\text{i}\text{l}\text{h}\text{j}\tilde{\text{N}}\text{e} - \phi\text{n}\text{r}\text{i} \text{ J} \text{ E}\alpha\text{e}\text{u}\text{e}$
- 6) $\text{a}\text{i}\phi\text{le}\text{£} \text{ q}\text{i}\text{m}\text{c}\text{i}\text{l} \text{ J} \text{ }\phi\text{h}\text{e}\text{i}\text{u}\text{L} \text{ Q}^{\frac{3}{4}}\text{c} - \text{ p}\text{j}\text{L}\text{i}\text{m}\text{£}\text{e}\text{i}\text{j}\text{l}\text{a}\text{h}\text{o}\tilde{\text{N}} \text{ J} \text{ }\phi\text{n}\text{r}\text{i}$

B.A. Education (Honours)
SEMESTER-V
EDU-H-DSE-T-1/2(E): History of Education in Ancient and Medieval India
Discipline Specific Elective Course; Credit-6. Full Marks-75

COURSE OBJECTIVES :

After end of this course the learners will able to:

- Discuss the features, aims, objectives, curriculum, teaching methods, student teacher relationship and evaluation system of Brahmanic system of Education
- Explain the education system of different educational institutions of Brahmanic system of education.
- Discuss the features, aims, objectives, curriculum, teaching methods, student teacher relationship and evaluation system of Buddhistic system of Education
- Explain the education system of different educational institutions of Buddhistic system of Education
- Compare between Brahmanic and Buddhistic system of Education
- Discuss the features, aims, objectives, curriculum, teaching methods, student teacher relationship and evaluation system of Islamic system of Education
- Discuss the educational contribution of Akbar, Aurangzeb.
- Explain the women and vocational education in Ancient and Medieval India.

Unit 1: Brahmanic System of Education:

- a) Salient features
- b) Aims and objectives, Curriculum, Methods of Teaching, Teacher Taught relation and Evaluation System.
- c) Centre of Learning: Takshasila and Nabadwip

Unit 2: Buddhistic System of Education:

- a) Salient features
- b) Aims and objectives, Curriculum, Methods of Teaching, Teacher- Taught relation and Evaluation System.
- c) Centre of Learning: Nalanda and Vikramasila
- d) Comparison between Brahmanic System of Education and Buddhistic System of Education.

Unit 3: Medieval System of Education:

- a) General characteristics
- b) Aims and objectives, Curriculum, Methods of Teaching, Teacher Taught relation and Evaluation System.
- c) Contribution of Akbar and Aurangzeb
- d) Centre of Learning: Fatepur Sikri and Delhi

Unit 4: Women and Vocational education in Ancient and Medieval India:

- a) Women's Education in Ancient and India
- b) Women's Education in Medieval India
- c) Vocational Education in Ancient and India
- d) Vocational Education in Medieval and India

Suggested Readings:

- S.M.Jafar --Some Cultural Aspects of Medieval India ,
- B.R. Purkait -- Milestone in Ancient and Medieval Indian Education. Central Book Agency. Kolkata.
- A.S.Altekar -- Education in Ancient India.
- E.E.Keay --India Education in ancient times.
- J. C. Aggarwal - Landmarks in the History of Modern Indian Education
- S. S. Ravi – A Comprehensive Study of Education
- J. P. Banerjee – Education in India: Past, Present and Future
- S. P. Chaube & A. Chaube – Education in Ancient and Medieval India
- B. K. Nayak- History Heritage and Development of Indian Education
- B. N. Dash –History of Education in India
- Dr. Harisadhan Goswami- Bharatiya Shikhar Itihas (Bengali Version)
- -SÉjç a fĒpjc h-¼cÉjfdÉju - Bdæçel ijl-a çnrj çhhÑæ
- X. çcm£f L¥jil WjL¥l J -nM qjçjcæm qL - Bdæçel ijl-al çnrjl djlj
- içš²i"oe iš²j - ijlæLu çnrjl lçf-IMj
- leçSv -Ojo - Bdæçel ijl-a çnrjl çhLjn
- leçSv -Ojo - kæ-N kæ-N ijl-al çnrj: fĒjQ£e, jdÉ, Bdæçel kæN

SEMESTER-VI
EDU-H-CC-T-13: Curriculum Studies
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to -

- Illustrate the meaning, nature, scope, determinants and functions of Curriculum.
- Discuss the types and bases of curriculum.
- Explain the concept of curriculum framework and NCF-2005.
- Discuss the basis of curriculum construction, evaluation and innovation.
- Describe the definition and types of curriculum theories

Unit-I: Introduction of Curriculum

- a) Meaning, Nature, Scope and functions of Curriculum
- b) Determinants of Curriculum
- c) Difference and Relation between Curriculum and Syllabus.
- d) Different Types of Curriculum
- e) Co-curricular Activities
- f) Bases of Curriculum: Philosophical, Sociological & Psychological.

Unit-II: Concept of Curriculum Framework

- a) Curriculum Framework: Meaning
- b) NCF-2005
- c) Principles of curriculum construction

Unit-III: Curriculum Evaluation

- a) Meaning & importance of curriculum evaluation
- b) Formative and summative evaluation of curriculum: concept & difference between them.

Unit-IV: Curriculum Theories

- a) Definition
- b) Types (only concept)
- c) Technical & Non-Technical Model (One theory from each category)

Suggested Books:

1. N. Bhalla- Curriculum Development
2. M. Talla- Curriculum Development: Perspectives, Principles
3. P. H. Taylor & C. M. An Introduction to Curriculum Studies
4. chÉ¾4c¥ iVÊjQ;kÑÉ-fjWœ²j QQÑj J j\$smÉjue
5. çjçql QVÊjfdÉju- fjWœ²j QQÑj
6. fËZh L¥jil Qœ²haÑ£-fjWœ²j e£ça J çejÑje

SEMESTER-VI
EDU-H-CC-T-14: Educational Research
Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Define and explain the meaning, and nature of research.
- Define and explain the meaning and nature of Educational research.
- Identify sources of data for Research.
- Describe the types of Research.
- Describe the meaning of Research problem, Review of Related Literature.
- Explain the concept of Hypothesis, Variables, and Research data.
- Analyze the Qualitative and Quantitative data.
- Acquaint with the process of collecting data.

Unit-I: Research-meaning and nature:

- Meaning and nature of research
- Sources of knowledge (Authority, Tradition, Personal Experience, Deduction, Induction.)
- Need of research in Education

Unit-II: Educational Research- meaning, nature and types

- Meaning, nature & scope of Educational Research
- Types of research: Basic, Applied & Action Research; Longitudinal and Cross Sectional Research. Historical, Descriptive and Experimental research (meaning only)
- Importance of Educational Research.

Unit-III: Basic Ideas of Research

- Characteristics of a good research problem
- Review of related Literature – purpose
- Variable – dependent and independent
- Research Hypothesis – meaning, nature and types
- Population, Sample and sampling technique- meaning

Unit-IV: Research Data:

- Qualitative and Quantitative data
- Tool of data collection- characteristics, merits and demerits of questionnaire and interview
- Descriptive and Inferential statistics (meaning only)
- Steps of testing hypotheses

Suggested Books:

1. L. Koul – Methodology of Educational Research
2. S. K. Mangal- Statistics in Education and Psychology
3. A. K. Singh – Test, Measurement and Research Methods in Behavioral Sciences
4. J.W.Best & J.V.Kahn – Research in Education
5. J.W.Creswell – Educational Research
6. -chjϕnpfjm- N-hoZj fÜϕa J ljϕnϕh'j-el -L±nm
7. -jjxmϕvg¥llqjje, nJLaBm£ MjeHhwüfeL¥jlcjp- N-hoZj fÜϕa J fϕlpwMÉje
8. SjϕLl -qj-pe- ϕnrj\$mlN-hoZj

EDU-H-DSE-T-3/4(A): Mental Hygiene

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Discuss the concept, nature, aims and scope of Mental Hygiene
- Discuss the concept, nature, symptoms and causes of mental illness
- Explain the different characteristics of mental disorder
- Discuss the role of parents for preventing Mental health
- Discuss the role of teachers for preventing Mental health

Unit- I: Concept of Mental Hygiene

- a) Definition of Mental Hygiene
- b) Aims of Mental Hygiene
- c) Scope of Mental Hygiene

Unit-II: Concept of Mental Health

- a) Definition of mental health
- b) Symptoms of good mental health
- c) Causes of ill mental health

Unit-III: Classification of Mental disorder (Identification Characteristics, causes and treatment only)

- a) DSM-IV:
 - Axis- I: Depression
 - Axis- II: Obsessive compulsive disorder (OCD)
 - Axis- III: Bipolar mood disorder
 - Axis- IV: Occupational disorder
 - Axis- VI: Truancy
- b) Common Axis:
 - Common Axis-I: Anxiety
 - Common Axis-II: Personality disorder
 - Common Axis-III: Conflict

Unit-IV: Prevention of Mental Hygiene

- a) Role of parents in preserving mental illness of children
- b) Role of Teachers in preserving mental illness of children in the Educational Institution
- c) Relation between Mental Hygiene and Adjustment

Suggested Books:

1. Ghauhan, S.S. – Mental Hygiene – A Science of Adjustment.
2. Mohanty, J. – Abnormal Psychology.
3. Sarason&Sarason – The problem of Maladaptive Behavior
4. Sengupta, M.- Mano swasthaviggan
5. Ghosh, A. – ManashikSwasthaViggan
6. j"¥çl -pe...ç - j-ej: üjÛÛÉçh'je
7. Alle-Ojo - jjeçpL üjÛÛÉçh'je

B.A. Education (Honours)

SEMESTER-VI

EDU-H-DSE-T-3/4(B): Comparative Education Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the meaning, nature, scope, importance, and methods of Comparative Education.
- Explain the concept of Universalization of Elementary and Secondary Education in UK & USA.
- Compare Indian Education system with USA
- Compare Indian Education system with UK

Unit-I: Meaning, Nature, Scope, and Methods of Comparative Education

- a) Meaning, nature, scope and importance of Comparative Education.
- b) Methods of Comparative Education:
 - i) Philosophical Method
 - ii) Historical Method
 - iii) Sociological Method
 - iv) Psychological Method
 - v) Scientific Method

Unit-II: Factors of Comparative Education:

- a) Natural Factors: Historical, Racial, Linguistic and Social Factors.
- b) Spiritual Factors: Religious and Philosophical Factors.
- c) Secular Factors: Factor of Humanism, Socialism, Nationalism and Democracy.

Unit-III: Universalization of Elementary Education in UK & USA

In relation to Structure, Aims and Objectives, Curriculum, Methodology, Evaluation system and Administration including finance and Comparison with Indian Elementary Education System.

Unit-IV: Universalization of Secondary Education in UK & USA

In relation to Structure, Aims and Objectives, Curriculum, Methodology, Evaluation system and Administration including finance and Comparison with Indian Secondary Education System.

Suggested Books:

1. S. P. Chaube & A. Chaube – Comparative Education
2. R. N. Sharma- Comparative Education
3. Y. K. Sharma- Comparative Education
4. Nikhola Hanse - On Comparative Education
5. -ch£ jª-Mjf;dÉju- a¥mejj\$ML çnrj
6. -jj; Bëãp pjjc- a¥mejj\$ML çnrj
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B.A. Education (Honours)
SEMESTER-VI
EDU-H-DSE-T-3/4 (C): Guidance & Counselling
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Explain the concept, nature, scope, types & importance of Guidance.
- Discuss the concept, nature, scope, types & importance of Counselling.
- Discuss different tools and techniques used in Guidance & Counselling.
- Identify the characteristics of diverse learner
- Explain the need of Guidance for diverse learner
- Explain the need of counselling for diverse learner

Unit-I: Concept of Guidance

- e) Meaning, Nature, Scope, and Importance of Guidance.
- f) Different Types of Guidance-
 - i) Educational: Meaning, Characteristics, Purpose & Functions.
 - ii) Vocational: Meaning, Characteristics, Purpose & Functions.
 - iii) Personal: Meaning, Characteristics, Purpose & Functions.

Unit-II: Concept of Counselling

- a) Meaning, Nature, Scope, and Importance of Counselling
- b) Types of Counselling-
 - i) Directive: Meaning, Characteristics, Purpose & Functions.
 - ii) Non-directive: Meaning, Characteristics, Purpose & Functions.
 - iii) Eclectic: Meaning, Characteristics, Purpose & Functions.
- c) Steps of Counselling; Characteristics of good Counsellor.

Unit-III: Tools and Techniques of Guidance and Counselling

- b) Basic data necessary for Educational Guidance- Pupils abilities, Aptitudes, Interests and Attitudes, Educational Attainments and Personality Traits.
- c) Difference between Guidance, Counselling and Teaching.

Unit-IV: Guidance and Counselling for Diverse Learners

- d) Identification of Gifted, Slow learners, Learner with learning disabilities.
- e) Need of Guidance for diverse learners
- f) Need of Counselling for diverse learner

Suggested readings:

- 1) Sharma, A.R.-Guidance and Counselling.
- 2) Gibson- Guidance and Counselling.

- 3) NCERT- Guidance and Counselling
- 4) Chauhan, S.S.- Principles and Techniques of Guidance
- 5) Guidance and counseling in college and university - S K.Kochar
- 6) Milner, P.- Counselling in Education
- 7) Rao, S. N.-Counselling in Guidance
- 8) -ch;çno f;im- çẽÑ-cne; J fl;jnÑ
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B.A. Education (Honours)
SEMESTER-VI
EDU-H-DSE-T-3/4(D): Great Educators
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to-

- Discuss the philosophies of great thinker of the east and west
- Explain the educational ideas of great thinker of the east and west
- Explain some experiments on education of eastern and western philosophers and thinkers
- Discuss the ideas of contemporary thinkers on education of eastern and western philosophers and thinkers

Unit – I: Indian Educators:

Contribution of following great educators with special reference to Educational Philosophy, aims of education, Curriculum, Method of Teaching, Role of teacher & Relevance in Present day context.

- Sarvapalli Radhakrishnan.
- Shri Aurobinda.

Unit - II: Western Educators:

Contribution of following great educators with special reference to Educational Philosophy, Aims of education, Curriculum, Method of Teaching Role of teacher & Relevance in Present day context.

- Bertrand Russel
- Madam Maria Montessori

Unit - III: Modern Thinkers on Education in India

- a) Abul Kalam Azad
- b) Annie Besant
- c) A.P.J. Abdul Kalam

Unit- IV: Some Experiments of Great Educators on Education:

- a) Viswabharati and Rabindranath Tagore
- b) Basic education and Gandhiji
- c) Kindergarten and Froebel
- d) Laboratory school and John Dewey

SUGGESTED READING:

- 1) Aggarwal, J.C – Theory and Principles of education Philosophical and Sociological Bases of education
- 2) Mukherjee, K.K. – Some great educators of the world.
- 3) Purkait, B.R. – Great educators
- 4) Mukherjee, K.K. – Principles of education.
- 5) Banerjee, A – Philosophy and principles of education
- 6) Ravi, S – A comprehensive study of Education
- 7) Sushil Ray – Shiksha Tatta
- 8) Arun Ghosh – Shiksha Tatta & Shiksha Darshan.
- 9) Bihuranjan Guha – Shikshaya Pathikrit.
- 10) Gourdas Halder & Prasanta Sharma – Shiksha Tatta & Shiksha Niti.
- 11) A.K. Pal – Sikshadarshner Ruparekha
- 12) A. K. Pal – Shikshadarshner Ruparekha
- 13) Sushil Ray – Shiksha Tatta
- 14) Arun Ghosh – Shiksha Tatta & Shiksha Darshan

B.A. Education (Honours)
SEMESTER-VI
EDU-H-DSE-T-3/4(E): Dissertation
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course objectives:

After completion of the course the learners will be able to:

- apply the knowledge gained through different courses in practical field.
- solve problems related to his course of study.
- document, calculate, analyse and interpret data.
- deduce findings from different studies
- write and report in standard academic formats.

Guidelines:

- The students undertaking this course shall be allotted a supervisor/mentor/guide at the beginning of the semester.
- The student shall select a topic for dissertation from any field of Education taking help from the supervisor/mentor/guide.
- The work completed within the stipulated time and written in standard academic format shall be submitted at the end of the semester.
- The work shall be evaluated on the basis of the written document submitted by the student and a *viva-voce* conducted on the same.

Suggested Readings:

1. L. Koul – Methodology of Educational Research
2. S. K. Mangal- Statistics in Education and Psychology
3. A. K. Singh – Test, Measurement and Research Methods in Behavioral Sciences
4. J.W.Best & J.V.Kahn – Research in Education
5. J.W.Creswell – Educational Research
6. -ch;çnpf;im- N-hoZ; fÜça J l;çnçh'j-el -L±nm
7. -j;xm±vg¥llqj;e, nJLaBm£ M;eHhwüfeL¥j;lc;ip- N-hoZ; fÜça J fçlpwMÉ;e
8. S;çLl -q;pe- çnr;ij§mLN-hoZ;

UG-CBCS Syllabus
Subject: ENGLISH (Honours)

This document contains following sections:

- A. Total number of course**
- a. Table 1: Credit wise distribution
 - b. Table-2: Semester wise distribution
 - c. Table-3: Course & semester wise distribution

- B. Semester-wise detail content of UG-CBCS syllabus**

A. TOTAL Number of courses in UG-CBCS (B.A. GENERAL):

Types of course	Core course (CC)	Elective course		Ability Enhancement Course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course(AECC)	Skill Enhancement course (SEC)	
No. of course	12	6(BSc)/4(BA/B.Com)	2((BA/B.Com)	2	4	24
Credit/course	6	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.A./ B.SC./ B.COM.(GENERAL) UNDER CBCS

S. No.	Particulars of Course	Credit Point
1.	Core Course: 14 Papers	Theory + Tutorial
I.A.	Core Course: Theory (12 papers)	12x5 = 60
I.B.	Core Course (Practical/Tutorial)*(12 papers)	12x1 = 12
2.	Elective Courses: (6 papers)	
A.	DSE (6 papers for B.Sc./ 4 papers for B.A. & B.Com.)	4x5 = 20
B.	DSE (Pract./ Tutor.)* (6 papers for B.Sc./4 for B.A. &B.Com.)	4x1 = 4
C.	GE (Interdisciplinary) (2 papers for B.A. & B.Com.)	2x5 = 10
D.	GE (Pract./Tutor.)* (4 papers) (2 papers for B.A. & B.Com.)	2x1 = 2
3. Ability Enhancement Courses		
A.	AECC(2 papers of 2 credits each) ENVS, English Communication / MIL	2x2 = 4
B.	Skill Enhancement Course(SEC) (4 papers of 2 credits each)	4x2 = 8
Total Credit:		120

TABLE-2:SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.A./B.COM. GENERAL

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC-1,2 (6)	2(1A,2A)	2 1B,2B)	2 (1C,2C)	2 (1D,2D)			8	48
Language CC - 1,2 (6)	1 (L ₁ -1)	1 (L ₂ -1)	1 (L ₁ -2)	1 (L ₂ -2)			4	24
DSE (6)	-	-	-	-	2(1A,2A)	2 (1B,2B)	4	24
GE (6)					1(GE-1)	1(GE-2)	2	12
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Courses/ Sem.	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN B.A.GENERAL)
(6 Credit: 75 Marks)

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
		Core (Language 1)	6
ENGH-G-CC-T-1	British Poetry and Drama: 17 th and 18 th Centuries	Core	6
		Core	6
ENGH-G-AECC-T-1	English Communication (L1)	AECC	2
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
ENGH-G-LCC-T-1	Indian Writing in English	Core (Language 2)	6
ENGH-G-CC-T-2	British Literature: 18 th Century	Core	6
		Core	6
ENGH-G-AECC-T-1	English Communication (L2)	AECC	2
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
		Core (Language 1)	6
ENGH-G-CC-T-3	British Romantic Literature	Core	6
		Core	6
ENGH-G-SEC-T-1	English Language Teaching	SEC	2
Total	4 courses	Total	20
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
ENGH-G-LCC-T-2	Literature of the British Isles	Core (Language 2)	6
ENGH-G-CC-T-4	British Literature: 19 th Century	Core	6
		Core	6
ENGH-G-SEC-T-2	Soft Skills	SEC	2
Total	4 courses	Total	20
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
ENGH-G-DSE-T-1	Modern Indian Writing in English Translation	DSE	6
		DSE	6
ENGH-G-GE-T-1	Academic Writing and Composition	GE	6
ENGH-G-SEC-T-3	Business Communication	SEC	2
Total	4 courses	Total	20
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
ENGH-G-DSE-T-2	Partition Literature	DSE	6
		DSE	6
ENGH-G-GE-T-2	Contemporary India: Women and Empowerment	GE	6
ENGH-G-SEC-T-4	Technical Writing	SEC	2
Total	4 courses	Total	20
Total (All semesters)	24 courses	Total	120

❖ **COURSE CODE & COURSE TITLE:**

❖ *Each paper of any course denoted by-(2-4 letters Subject Code--Honours/General (H/G)--Course Type (CC/GE/DSE)-(Theory/Tutorial/Practical)-Number of course. Ex.-Chemistry-CHEM-H-CC-T-1)*

A. Language Compulsory courses (LCC)

1. ENGH-G-LCC-T-1: Indian Writing in English
2. ENGH-G-LCC-T-2: Literature of the British Isles

B. Core Courses (CC)

1. ENGH-G-CC-T-1: British Poetry and Drama: 17th and 18th Centuries
2. ENGH-G-CC-T-2: British Literature: 18th Century
3. ENGH-G-CC-T-3: British Romantic Literature
4. ENGH-G-CC-T-4: British Literature: 19th Century

C. Generic Discipline specific elective courses (DSE)

1. ENGH-G-DSE-T-1: Modern Indian Writing in English Translation
2. ENGH-G-DSE-T-2: Partition Literature

D. Generic elective courses (GE):

1. ENGH-G-GE-T-1: Academic Writing and Composition
2. ENGH-G-GE-T-2: Contemporary India: Women and Empowerment

D. Ability enhancement compulsory courses (AECC)

1. ENGH-G-AECC-T-1: English Communication (L1/L2)

E. Skill enhancement courses (SEC)

1. ENGH-G-SEC-T-1: English Language Teaching
2. ENGH-G-SEC-T-2: Soft Skills
3. ENGH-G-SEC-T-3: Business Communication
4. ENGH-G-SEC-T-4: Technical Writing

**B.A. ENGLISH (General)
SEMESTER-I**

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-CC-T-1	British Poetry and Drama: 17 th and 18 th Centuries	Core	6	60+15

Texts:

1. John Milton. *Paradise Lost*. Bk. I
2. John Webster. *The Duchess of Malfi*.
3. Aphra Behn. *The Rover*.
4. Alexander Pope. *The Rape of the Lock*. (Books I and II)

B.A. ENGLISH (General)
SEMESTER-I

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-AECC-T-1	English Communication (L1)	AECC	2	50

Objective:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

The present course hopes to address some of these aspects through an interactive mode of teaching-learning process and by focusing on various dimensions of communication skills. Some of these are : Language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note-taking etc.

While, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. It is hoped that after studying this course, students will find a difference in their personal and professional interactions. The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

1. Introduction: Theory of Communication, Types and modes of Communication

2. Language of Communication: Verbal and Non-verbal (Spoken and Written), Personal, Social and Business, Barriers and Strategies, Intra-personal, Inter-personal and Group communication

3. Speaking Skills: Monologue, Dialogue, Group Discussion, Effective Communication/ Mis- Communication, Interview, Public Speech

4. Reading and Understanding Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation (from Indian language to English and vice-versa) Literary/Knowledge Texts

5. Writing Skills

Documenting, Report Writing, Making notes, Letter writing

Readings:

1. *Fluency in English - Part II*, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.

B.A. ENGLISH (General)
SEMESTER-II

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-LCC-T-1	Indian Writing in English	Core (Language 2)	6	60+15=75

Texts:

1. R.K. Narayan. "Selvi"
2. H.L.V. Derozio. "The Orphan Girl"
3. Toru Dutt. "Our Casuarina Tree"
4. Kamala Das. "Introduction"
5. Jayanta Mahapatra. "Dawn at Puri"
6. Nirad C Chaudhuri. "My Birthplace"
7. Rabindranath Tagore. *The Post Office*

B.A. ENGLISH (General)
SEMESTER-II

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-CC-T-2	British Literature: 18 th Century	Core	6	60+15=75

Texts

1. William Congreve. *The Way of the World*.
2. Jonathan Swift. *Gulliver's Travels* (Books I & II)
3. Samuel Johnson. "London".
4. Thomas Gray. "Elegy Written in a Country Churchyard".
5. Eliza Heywood. *Fantomina*.

B.A. ENGLISH (General)
SEMESTER-II

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-AECC-T-1	English Communication (L2)	AECC	2	50

Objective:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

The present course hopes to address some of these aspects through an interactive mode of teaching-learning process and by focusing on various dimensions of communication skills. Some of these are : Language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note-taking etc.

While, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. It is hoped that after studying this course, students will find a difference in their personal and professional interactions. The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

1. Introduction: Theory of Communication, Types and modes of Communication

2. Language of Communication: Verbal and Non-verbal (Spoken and Written), Personal, Social and Business, Barriers and Strategies, Intra-personal, Inter-personal and Group communication

3. Speaking Skills: Monologue, Dialogue, Group Discussion, Effective Communication/ Mis- Communication, Interview, Public Speech

4. Reading and Understanding Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation (from Indian language to English and vice-versa) Literary/Knowledge Texts

5. Writing Skills

Documenting, Report Writing, Making notes, Letter writing

Readings:

1. *Fluency in English - Part II*, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.

B.A. ENGLISH (General)
SEMESTER-III

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-CC-T-3	British Romantic Literature	Core	6	60+15=75

Texts

1. William Blake. "The Lamb", "The Chimney Sweeper", "The Tyger", the Introduction to *The Songs of Innocence*.
2. Robert Burns. "A Bard's Epitaph" and "Scots Wha Hae"
3. William Wordsworth. "Tintern Abbey"
4. Samuel Taylor Coleridge. "Kubla Khan", "Dejection: An Ode"
5. George Gordon Byron. Canto IV. Verses 178-86. *Childe Harold's Pilgrimage. II*. 1594-1674.
6. Percy Bysshe Shelley. "Ode to the West Wind"
7. John Keats. "Ode to a Nightingale", "Bright Star" and "To Autumn"
8. Mary Shelley. *Frankenstein*

B.A. ENGLISH (General)
SEMESTER-III

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-SEC-T-1	English Language Teaching	SEC	2	50

Any four of the following topics

1. Knowing the Learner
2. Structures of English Language
3. Methods of teaching English Language and Literature
4. Materials for Language Teaching
5. Assessing Language Skills
6. Using Technology in Language Teaching

Suggested Readings

1. Penny Ur, *A Course in Language Teaching: Practice and Theory*. CUP, 1996.
2. Marianne Celce-Murcia, Donna M. Brinton, and Marguerite Ann Snow, *Teaching English as a Second or Foreign Language*. Cengage Learning, 4th ed, 2014.
3. Adrian Doff, *Teach English: A Training Course For Teachers*. Cambridge UP, 1988.
4. *Business English*. Pearson, 2008.
5. Diane Larsen-Freeman. *Techniques and Principles in Language Teaching*. OUP, 1986.
6. Patsy M. Lightbown and Nina Spada. *How Languages are Learned*. 4th ed. OUP, 2013.
7. Geetha Nagaraj. *English Language Teaching: Approaches, Methods, Techniques*. Orient Blackswan, 2010.
8. Jack C Richards and Theodore S Richards. *Approaches and Methods in Language Teaching*. CUP, 2001.

**B.A. ENGLISH (General)
SEMESTER-IV**

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-CC-T-4	British Literature: 19 th Century	Core	6	60+15=75

Texts:

1. Charlotte Brontë. *Jane Eyre*. 1847. 3rd ed. Norton Critical Edition. 2016.
2. Charles Dickens. *Hard Times*. 1854. 4th ed. Norton Critical Edition. 2015.
3. Thomas Hardy. *Tess of the d'Urbervilles*. 1891-92. 3rd ed. Norton Critical Edition. 1991.
4. Alfred Tennyson. "Ulysses"
5. Robert Browning. "My Last Duchess"
6. Christina Rossetti. 1st Stanza. "The Goblin Market". 1862. //1-31.

**B.A. ENGLISH (General)
SEMESTER-IV**

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-SEC-T-2	Soft Skills	SEC	2	50

Topics and skills to be learnt

1. Teamwork
2. Emotional Intelligence
3. Adaptability
4. Leadership
5. Problem solving

B.A. ENGLISH (General)
SEMESTER-V

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-DSE-T-1	Modern Indian Writing in English Translation	DSE	6	60+15=75

Texts:

1. Premchand. "The Shroud". *New Penguin Book of Classic Urdu Stories*. Ed. M. Assaduddin. Penguin, 2006.
2. Ismat Chughtai. "The Quilt". *Lifting the Veil: Selected Writings of Ismat Chughtai*. Tr. M. Assaduddin. Penguin, 2009.
3. Gurdial Singh. "A Season of No Return". *Earthy Tones*. Tr. Rana Nayar. Fiction House, 2002.
4. Fakir Mohan Senapati. "Rebati". *Oriya Stories*. Ed. Vidya Das. Tr. Kishori Charan Das. Srishti, 2000.
5. G.M.Muktibodh. "The Void" (Tr. Vinay Dharwadker) and "So Very Far" (tr. Vishnu Khare and Adil Jussawala). *Oxford Anthology of Modern Indian Poetry*. OUP, 2000.
6. Amrita Pritam. "I Say unto Waris Shah" (Tr. N.S.Tasneem). *Modern Indian Literature: An Anthology. Plays and Prose*. Vol.3.Ed. K. M. George. SahityaAkademi, 1992.
7. Thangjam Ibopishak Singh. "Dali, Hussain, or Odour of Dream, Clours of Wind" and "The Land of the Half-Humans". Tr. Robin S. Ngangom. *The Anthology of Contemporary Poetry from the Northeast*. NEHU, 2003.
8. Rabindranath Tagore. *Red Oleanders* OR Dharamveer Bharati. *Andha Yug*. Tr. Alok Bhalla. OUP, 2009.
9. G. KalyanRao. *Untouchable Spring*. Tr. Alladi Uma and M. Sridhar. Orient Blackswan, 2010.

B.A. ENGLISH (General)
SEMESTER-V

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-GE-T-1	Academic Writing and Composition	GE	6	60+15=75

Academic Writing and Composition (Any four)

1. Introduction to the Writing Process
2. Introduction to the Conventions of Academic Writing
3. Writing in one's own words: Summarizing and Paraphrasing
4. Critical Thinking: Syntheses, Analyses, and Evaluation
5. Structuring an Argument: Introduction, Interjection, and Conclusion
6. Citing Resources; Editing, Book and Media Review

B.A. ENGLISH (General)
SEMESTER-V

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-SEC-T-3	Business Communication	SEC	2	50

Any four of the following

1. Introduction to the essentials of Business Communication: Theory and Practice

2. Citing references, and using bibliographical and research tools
3. Writing a project report
4. Writing reports on fieldwork/ visits to industries, business concerns etc./ business negotiations
5. Summarizing annual report of companies
6. Writing minutes of meetings
7. E-correspondence
8. Spoken English for business communication (viva for internal assessment)
9. Making oral presentations (viva for internal assessment)

B.A. ENGLISH (General)

SEMESTER-VI

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-DSE-T-2	Partition Literature	DSE	6	60+15=75

Texts:

1. Intizar Husain, Basti. Tr. Frances W. Pritchett. New Delhi: Rupa, 1995.
2. Amitav Ghosh. *The Shadow Lines*.
3.
 - a) Dibyendu Palit, 'Alam's Own House', tr. Sarika Chaudhuri, *Bengal Partition Stories: An Unclosed Chapter*, ed. Basabi Fraser. London: Anthem Press, 2008. pp. 453–72.
 - b) ManikBandyopadhyay, 'The Final Solution', tr. Rani Ray, *Mapmaking: Partition Stories from Two Bengals*, ed. Debjani Sengupta. New Delhi: Srishti, 2003. pp. 23–39.
 - c) Sa'adat Hasan Manto, "Toba Tek Singh", in *Black Margins: Manto*, tr. M. Asaduddin. New Delhi: Katha, 2003. pp. 212–20.
 - d) Lalithambika Antharajanam. "A Leaf in the Storm". Tr. K. Narayana Chandran, in *Stories about the Partition of India*. Ed. AlokBhalla. New Delhi: Manohar, 2012. pp. 137–45.
4. a) Faiz Ahmad Faiz. "For Your Lanes, My Country" in *In English: Faiz Ahmad Faiz, A Renowned Urdu Poet*. Tr. and ed. Riz Rahim. California: Xlibris, 2008. p. 138.
 b) Gulzar. "Toba Tek Singh". Tr. Anisur Rahman, in *Translating Partition*. Ed. Tarun Saint et. al. New Delhi: Katha, 2001. p. x.

B.A. ENGLISH (General)

SEMESTER-VI

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-GE-T-2	Contemporary India: Women and Empowerment		2	50

1. Social Construction of Gender (Masculinity and Femininity) and Patriarchy
2. History of Women's Movements in India (Pre-independence, post-independence)Women, Nationalism, Partition, Women and Political Participation
3. Women and Law, Women and the Indian Constitution, Personal Laws (Customary practices on inheritance and Marriage), (Supplemented by workshop on legal awareness)
4. Women and Environment: State interventions, domestic violence, female foeticide, sexual harassment
5. Female Voices: *Rokeya Shekhawat Hossein. Sultana's Dream*.

6. Dalit Discourse: Sharmila Rege. "Dalit Feminist Standpoint". *Gender and Caste*. Ed. A. Rao. Kali for Women, 2003.

B.A. ENGLISH (General)
SEMESTER-VI

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-G-SEC-T-4	Technical Writing	SEC	2	50

1. Communication: Language and communication, differences between speech and writing, distinct features of speech, distinct features of writing
2. Writing skills: Selection of topic, thesis statement, developing the thesis, introductory, transitional and concluding paragraphs. Linguistic unity, coherence and cohesion, descriptive, narrative, expository and argumentative writing.
3. Technical writing: scientific and technical subjects; formal and informal writings; formal writings; formal writings/ reports, handbooks, manuals, letters, memorandum, notices, agenda, minute, common errors to be avoided

UG-CBCS Syllabus
Subject: ENGLISH (Honours)

This document contains following sections:

- A. Total number of course
- a. Table 1: Credit wise distribution
 - b. Table-2: Semester wise distribution
 - c. Table-3: Course & semester wise distribution
- B. Semester-wise detail content of UG-CBCS syllabus

A. TOTAL Number of courses in UG-CBCS (B.A. English Honours.):

Types of course	Core course (CC)	Elective course		Ability enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course (GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

TABLE-1: DETAILS OF COURSES & CREDIT OF B.A. (English Honours) UNDER CBCS

S. No.	Particulars of Course	Credit Point
I.	Core Courses: 14 Papers	Theory + Tutorial
I.A.	Core Course: Theory (14 papers)	14x5 = 70
I.B.	Core Course (Tutorial)*(14 papers)	14x1 = 14
2.	Elective Courses: 8 papers	
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x5 = 20
2.B.	DSE (Tutorial)* (4 papers)	4x1 =4
2C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x5 = 20
2.D.	GE (Tutorial)* (4 papers)	4x1 =4
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4
Total Credit:		140

TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.A.HONS

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1			--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

COURSE CODE & COURSE TITLE:

- ❖ *Each paper of any course denoted by-(2-4 letters Subject Code--Honours/General (H/G)--Course Type (CC/GE/DSE)-(Theory/Tutorial/Practical)-Number of course.*

A. Core courses (CC)

1. ENGH-H-CC-T-1: Indian Classical Literature
2. ENGH-H-CC-T-2: European Classical Literature
3. ENGH-H-CC-T-3: Indian Writing in English
4. ENGH-H-CC-T-4: British Poetry and Drama: 14th – 17th Centuries
5. ENGH-H-CC-T-5: American Literature
6. ENGH-H-CC-T-6: Popular Literature
7. ENGH-H-CC-T-7: British Poetry and Drama: 17th and 18th Centuries
8. ENGH-H-CC-T-8: British Literature: 18th Century
9. ENGH-H-CC-T-9: British Romantic Literature
10. ENGH-H-CC-T-10: British Literature: 19th Century
11. ENGH-H-CC-T-11: Women's Writing
12. ENGH-H-CC-T-12: British Literature: The Early 20th Century
13. ENGH-H-CC-T-13: Modern European Drama
14. ENGH-H-CC-T-14: Postcolonial Literatures

B. Discipline specific elective courses (DSE)

1. ENGH-H-DSE-T-1: Modern Indian Writing in English Translation
2. ENGH-H-DSE-T-2: British Literature: Post World War II
3. ENGH-H-DSE-T-3: Literary Criticism
4. ENGH-H-DSE-T-4: Literary Theory
5. ENGH-H-DSE-T-5: Partition Literature
6. ENGH-H-DSE-T-6: Research Methodology

C. Generic elective courses (GE):

1. ENGH-H-GE-T-1: Academic Writing and Composition
2. ENGH-H-GE-T-2: Text and Performance
3. ENGH-H-GE-T-3: Language and Linguistics
4. ENGH-H-GE-T-4: Contemporary India: Women and Empowerment

D. Ability enhancement compulsory courses (AECC)

1. ENGH-H-AECC-T-1: English Communication

E. Skill enhancement courses (SEC)

1. ENGH-H-SEC-T-1: English Language Teaching
1. ENGH-H-SEC-T-2: Soft Skills

TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN IN B.A. (Hons.)
(6 Credits: 75 Marks; 2 Credits: 25 Marks)

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
ENGH-H-CC-T-1	Indian Classical Literature	Core	6
ENGH-H-CC-T-2	European Classical Literature	Core	6
ENGH-H-GE-T-1	Academic Writing and Composition	GE	6
ENGH-H-AECC-T-1	English Communication (L1/L2)	AECC	2
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
ENGH-H-CC-T-3	Indian Writing in English	Core	6
ENGH-H-CC-T-4	British Poetry and Drama: 14 th – 17 th Centuries	Core	6
ENGH-H-GE-T-2	Text and Performance	GE	6
ENGH-H-AECC-T-1	English Communication (L1/L2)	AECC	2
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
ENGH-H-CC-T-5	American Literature	Core	6
ENGH-H-CC-T-6	Popular Literature	Core	6
ENGH-H-CC-T-7	British Poetry and Drama: 17 th and 18 th Centuries	Core	6
ENGH-H-GE-T-3	Language and Linguistics	GE	6
ENGH-H-SEC-T-1	English Language Teaching	SEC	2
Total	5 courses	Total	26
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
ENGH-H-CC-T-8	British Literature: 18 th Century	Core	6
ENGH-H-CC-T-9	British Romantic Literature	Core	6
ENGH-H-CC-T-10	British Literature: 19 th Century	Core	6
ENGH-H-GE-T-4	Contemporary India: Women and Empowerment	GE	6
ENGH-H-SEC-T-2	Soft Skills	SEC	2
Total	5 courses	Total	26
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
ENGH-H-CC-T-11	Women's Writing	Core	6
ENGH-H-CC-T-12	British Literature: The Early 20 th Century	Core	6
ENGH-H-DSE-T-1	Modern Indian Writing in English Translation	DSE (Any two)	6x2=12
ENGH-H-DSE-T-2	British Literature: Post World War II		
ENGH-H-DSE-T-3	Literary Criticism		
Total	4 courses	Total	24
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
ENGH-H-CC-T-13	Modern European Drama	Core	6
ENGH-H-CC-T-14	Postcolonial Literatures	Core	6
ENGH-H-DSE-T-4	Literary Theory	DSE (Any two)	6x2=12
ENGH-H-DSE-T-5	Partition Literature		
ENGH-H-DSE-T-6	Research Methodology		
Total	4 courses	Total	24
Total (All semesters)	26 courses	Total	140

B.A. ENGLISH (Honours)
SEMESTER-I

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-1	Indian Classical Literature	Core	6	60+15=75

Texts

1. Kalidasa. *Abhijnana Shakuntalam*. Tr. Chandra Rajan, in *Kalidasa: The Loom of Time*. New Delhi: Penguin, 1989.
2. Vyasa. “The Dicing” and “The Sequel to Dicing”, “The Book of the Assembly Hall”, “The Temptation of Karna”, Book V. “The Book of Effort” in *The Mahabharata*. Tr. And ed. J.A.B. van Buitenen. Chicago: Brill, 1975. pp.106-69.
3. Sudraka. *Mrcchakatika*. Tr. M.M.Ramachandra Kale. New Delhi: Motilal Banarsidas, 1962.
4. IlangoAdigal. “The Book of Banci”, in *Cilappatikaram. The Tale of an Anklet*. Bk.3.Tr. R. Parthasarathy. New Delhi: Penguin, 2004.

Suggested topics for class presentations

1. The Indian epic tradition: themes and recensions
2. Classical Indian drama: theory and practice
3. *Alamkara* and *rasa*
4. *Dharma* and the heroic tradition

Readings

1. Bharata. Chapter 6. “Sentiments”. *Natyashastra*. Tr. ManmohanGhosh, vol I. 2nd Ed. Calcutta: Asiatic Society, 1967. pp. 100-18.
2. Iravati Karve. “Draupadi”. In *Yuganta: The End of An Epoch*. Hyderabad: Disha: 1991. pp. 79-105.
3. J.A.B. van Buitenen. “Dharma and Moksha”. In Roy W. Perrett ed. *Indian Philosophy*, vol. V, *Theory of Value: A Collection of Readings*. New York: Garland, 2000. pp. 33-40.
4. Vinay Dharwadkar. “Orientalism and the Study of Indian Literature”. In *Orientalism and the Postcolonial Predicament: Perspectives on South Asia*. Ed. Carol A. Breckenridge and Peter van der Veer. New Delhi: OUP, 1994.pp. 158-95.

B.A. ENGLISH (Honours)
SEMESTER-I

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-2	European Classical Literature	Core	6	60+15=75

Texts

1. Homer. Books I and II. *The Iliad*. Tr. E. V. Rieu. Harmondsworth: Penguin, 1985.
2. Sophocles. "Oedipus the King". Tr. Robert Fagles in *Sophocles: The Three Theban Plays*. Harmondsworth: Penguin, 1984.
3. Plautus. *Pot of Gold*. Tr. E.F.Watling. Harmondsworth: Penguin, 1965.
4. Ovid. Selections from *Metamorphoses*. "Bacchus" (Bk.III), "Pyramus and Thisbe" (Bk.IV), "Philomela" (Bk. VI). Tr. Mary M. Innes. Harmondsworth: Penguin, 1975.
5. Horace. "Epistle I". Bk. I. *The Satires of Horace and Persius*. Tr. Niall Rudd. Penguin, 2005.

Suggested topics for class presentations

1. Epic
2. Comedy and tragedy in Classical drama
3. The Athenian city state
4. Catharsis and mimesis
5. Canons of Rhetoric
6. Literary cultures in Augustan Rome

Readings

1. Aristotle. Chapters 6-17, 23, 24 and 26. *Poetics*. Tr. with an introduction and notes by Malcolm Heath. London: Penguin, 1996.
2. Plato. Bk. X. *The Republic*. Tr. Desmond Lee. London: Penguin, 2007.
3. Horace. "Ars Poetica". *Horace: Satires, Epistles and Ars Poetica*. Tr. H. Rushton Fairclough. Cambridge, MA: Harvard UP, 2005. pp. 451-73.

GE I (Any one)**B.A. ENGLISH (Honours)****SEMESTER-I**

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-GE-T-1	Academic Writing and Composition	GE	6	60+15=75

Academic Writing and Composition (Any four)

1. Introduction to the Writing Process
2. Introduction to the Conventions of Academic Writing
3. Writing in one's own words: Summarizing and Paraphrasing
4. Critical Thinking: Syntheses, Analyses, and Evaluation
5. Structuring an Argument: Introduction, Interjection, and Conclusion
6. Citing Resources; Editing, Book and Media Review

Suggested Readings

1. Liz Hamp-Lyons and Ben Heasley, *Study writing: A Course in Writing Skills for Academic Purposes* (Cambridge: CUP, 2006).
2. Renu Gupta, *A Course in Academic Writing* (New Delhi: Orient BlackSwan, 2010).
3. IlonaLeki, *Academic Writing: Exploring Processes and Strategies* (New York: CUP, 2nd ed, 1998).
4. Gerald Graff and Cathy Birkenstein, *They Say/I Say: The Moves That Matter in Academic Writing* (New York: Norton, 2009).
5. Pramod K Nayar, Marilyn Anderson and Madhuchhanda Sen. *Critical Thinking, Academic Writing and Presentation Skills*. Pearson, 2009.
6. Mark Cholij. *Towards Academic English*. OUP, 2006.

B.A. ENGLISH (Honours)
SEMESTER-I
B.A. ENGLISH (Honours)
SEMESTER-I

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-AECC-T-1	English Communication (L1/L2)	AECC	2	50

Objective:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

The present course hopes to address some of these aspects through an interactive mode of teaching-learning process and by focusing on various dimensions of communication skills. Some of these are : Language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note-taking etc.

While, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. It is hoped that after studying this course, students will find a difference in their personal and professional interactions. The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

1. Introduction: Theory of Communication, Types and modes of Communication

2. Language of Communication:

Verbal and Non-verbal

(Spoken and Written)

Personal, Social and Business

Barriers and Strategies

Intra-personal, Inter-personal and

Group communication

3. Speaking Skills:

Monologue

Dialogue

Group Discussion

Effective Communication/ Mis-Communication

Interview

Public Speech

4. Reading and Understanding

Close Reading

Comprehension

Summary Paraphrasing

Analysis and Interpretation

Translation(from Indian language to English and vice-versa)

Literary/Knowledge

Texts

5. Writing Skills

Documenting

Report Writing

Making notes

Letter writing

Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.

2. *Business English*, Pearson, 2008.

3. *Language, Literature and Creativity*, Orient Blackswan, 2013.

B.A. ENGLISH (Honours)
SEMESTER-II

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-3	Indian Writing in English	Core	6	60+15=75

Texts

1. Girish Karnad. *Hayavadana. Three Plays*. New Delhi: OUP, 1997.
2. Anita Desai. *In Custody*.
3. Amitav Ghosh. "The Ghosts of Mrs. Gandhi". *The New Yorker*. 17 Jul 1995.
4. Salman Rushdie. "The Free Radio"
5. Shashi Deshpande. "The Intrusion"
6. Kamala Das. "Introduction"
7. Robin S. Ngangom. "The Strange Affair of Robin S. Ngangom", "A Poem for Mother"
8. Nissim Ezekiel. "Enterprise"
9. Toru Dutt. "Our Casurina Tree"
10. Arun Kolatkar. "The Bus"
11. Jayanta Mahapatra. "Dawn at Puri"

Suggested topics for class presentations

1. Indian English in postcolonial context
2. Themes and contexts of Indian English novel
3. Aesthetics of Indian English poetry

Readings

1. Raja Rao. "Foreword". *Kanthapura*. New Delhi: OUP, 1989. pp. v-vi.
2. Salman Rushdie. "Commonwealth Literature Does Not Exist". *Imaginary Homelands*. London: Granta, 1991. pp. 61-70.
3. Meenakshi Mukherjee. "Divided by a Common Language". *The Perishable Empire*. New Delhi: OUP, 2000. pp. 61-70.
4. Bruce King. "Introduction". *Modern Indian Poetry in English*. 2nded. New Delhi: OUP, 2005. pp. 1-10.

B.A. ENGLISH (Honours)
SEMESTER-II

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-4	British Poetry and Drama: 14 th – 17 th Centuries	Core	6	60+15=75

Texts

1. Geoffrey Chaucer. “Wife of Bath”. *The Prologue to the Canterbury Tales*. Ed. Neville Coghill.
2. Edmund Spenser. Sonnet LXXV. “One day I wrote her name...” *Amoretti*.
3. John Donne. “The Sunne Rising” and “Valediction Forbidding Mourning”
4. Francis Bacon. “Of Empire”
5. Christopher Marlowe. *Doctor Faustus*
6. William Shakespeare. *Twelfth Night*
7. William Shakespeare. *Macbeth*

Suggested topics for class presentations

1. Renaissance Humanism
2. The stage, the Court and the City
3. Religious and political thought of the period
4. Ideas of love and marriage
5. The writer in society

Readings

1. Pico della Mirandola. Excerpts from the *Oration on the Divinity of Man*. *The Portable Renaissance Reader*. Ed. James Bruce Ross and Mary martin McLaughlin. New York: Penguin Books, 1953. pp. 476-9.
2. John Calvin. “Predestination and Free Will”. *The Portable Renaissance Reader*. Ed. James Bruce Ross and Mary martin McLaughlin. New York: Penguin Books, 1953. pp.704-11.
3. Baldassare Castiglione. “Longing for Beauty” and “Invocation of Love”, “Love and Beauty”. Bk.IV. *The Courtier*. Tr. George Bull. Harmondsworth: Penguin, rpt. 1983. pp. 324-8, 330-5.
4. Philip Sidney. *An Apology for Poetry*. Ed. Forrest G. Robinson. Indianapolis: Bobbs-Merrill, 1970. pp.13-18.

B.A. ENGLISH (Honours)
SEMESTER-II

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-GE-T-2	Text and Performance	GE	6	60+15=75

1. Introduction

1. Introduction to theories of performance
2. Historical overview of Western and Indian theatre
3. Forms and Periods: Classical, Contemporary, Stylized, Naturalist

Topics for Student Presentations:

- a. Perspectives on theatre and performance
- b. Historical development of theatrical forms
- c. Folk traditions

2. Theatrical Forms and Practices

1. Types of theatre, semiotics of performative spaces, e.g. proscenium 'in the round', amphitheatre, open-air, etc.
2. Voice, speech: body movement, gestures and techniques (traditional and contemporary), floor exercises: improvisation/characterization

Topics for Student Presentations:

- a. On the different types of performative space in practice
- b. Poetry reading, elocution, expressive gestures, and choreographed movement

3. Theories of Drama

1. Theories and demonstrations of acting: Stanislavsky, Brecht
2. Bharata

Topics for Student Presentations:

Acting short solo/ group performances followed by discussion and analysis with application of theoretical perspectives

4. Theatrical Production

1. Direction, production, stage props, costume, lighting, backstage support.
2. Recording/archiving performance/case study of production/performance/impact of media on performance processes.

Topics for Student Presentations:

All aspects of production and performance; recording, archiving, interviewing performers and data collection.

B.A. ENGLISH (Honours)
SEMESTER-II

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-AECC-T-1	English Communication (L1/L2)	AECC	2	50

Objective:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

The present course hopes to address some of these aspects through an interactive mode of teaching-learning process and by focusing on various dimensions of communication skills. Some of these are : Language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note-taking etc.

While, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. It is hoped that after studying this course, students will find a difference in their personal and professional interactions. The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

1. Introduction: Theory of Communication, Types and modes of Communication

2. Language of Communication:

Verbal and Non-verbal

(Spoken and Written)

Personal, Social and Business

Barriers and Strategies

Intra-personal, Inter-personal and

Group communication

3. Speaking Skills:

Monologue

Dialogue

Group Discussion

Effective Communication/ Mis-Communication

Interview

Public Speech

4. Reading and Understanding

Close Reading

Comprehension

Summary Paraphrasing

Analysis and Interpretation

Translation(from Indian language to English and vice-versa)

Literary/Knowledge

Texts

5. Writing Skills

Documenting

Report Writing

Making notes

Letter writing

Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.

2. *Business English*, Pearson, 2008.

3. *Language, Literature and Creativity*, Orient Blackswan, 2013.

B.A. ENGLISH (Honours)
SEMESTER-III

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-5	American Literature	Core	6	60+15=75

Texts

1. Tennessee Williams. *The Glass Menagerie*.
2. Toni Morrison. *Beloved*.
3. Edgar Allan Poe. "The Purloined Letter".
4. William Faulkner. "Dry September"
5. Anne Bradstreet. "The prologue"
6. Walt Whitman. "Passage to India" (ll. 1-68). *Leaves of Grass*.
7. Adriene Rich. "Power"
8. Allen Ginsberg. "An Eastern Ballad". *Beat Poets*. Ed. Carmela Ciuraru. New York: Alfred A. Knopf, 2002.
9. Abraham Lincoln. "Gettysburg Address"
10. Martin Luther King. "I have a Dream"

Suggested topics for class presentations

1. The American Dream
2. Social Realism and the American novel
3. Folklore and the American novel
4. Black women's writing
5. Questions of form in American poetry
6. Civil Rights Movement

Readings

1. Hector St John Crevecoeur. "What is an American". (Letter III) in *Letters from an American Farmer*. Harmondsworth: Penguin, 1982. pp. 66-105.
2. Frederick Douglass. Chapters 1-7. *A Narrative of the Life of Frederick Douglass*. Harmondsworth: Penguin, 1982. pp.47-87.
3. Henry David Thoreau. "Battle of the Ants". Excerpt from "Brute Neighbors" Ch.12. *Walden*. Norton Critical Edition.
4. Ralph Waldo Emerson. "Self Reliance". *The Selected Writings of Ralph Waldo Emerson*. Ed. with a biographical introduction by Brooks Atkinson. New York: Modern Library, 1964.
5. Toni Morrison. "Romancing the Shadow". *Playing in the Dark: Whiteness and Literary Imagination*. London: Picador, 1993. pp. 29-39.
6. K. Sen and A. Sengupta. "Modernist Drama" *A Short History of American Literature*. New Delhi: Orient Blackswan. pp.160-174.

B.A. ENGLISH (Honours)
SEMESTER-III

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-6	Popular Literature	Core	6	60+15=75

Texts

2. Lewis Carroll. *Through the Looking Glass*.
3. Agatha Christie. *The Murder of Roger Ackroyd*.
4. Shyam Selvadurai. *Funny Boy*.
5. Durgabai Vyam and Shubhash Vyam. *Bhimayana: Experiences of Untouchability./ Autobiographical Notes on Ambedkar* (for visually challenged students)

Suggested topics for class presentations

1. Coming of age
2. The canonical and the popular
3. Caste, gender and identity
4. Ethics and education in children's literature
5. Sense and nonsense
6. The graphic novel

Readings

1. Chelva Kanaganayakam. "Dancing in the Air: Reading Contemporary Sri Lankan Literature". rpt. Malashri Lal, Alamgir Hashmi and Victor J Ramraj eds. *Post Independence Voices in South Asian Writings*. Delhi: Doaba Publications, 2001. pp.51-65.
2. Sumathi Ramaswamy. "Introduction". *Beyond Appearances? Visual Practices and Ideologies in Modern India*. New Delhi: Sage, 2003. pp. xii-xxix.
3. Leslie Fiedler. "Towards a Definition of Popular Literature". *Super Culture: American Popular Culture and Europe*. Ed. C.W.E. Bigsby. Bowling Green: Ohio UP, 1975. pp. 29-38.
4. Felicity Hughes. "Children's Literature: Theory and Practice". *English Literary History*. Vol.45. 1978. pp. 542-61.

B.A. ENGLISH (Honours)
SEMESTER-III

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-7	British Poetry and Drama: 17 th and 18 th Centuries	Core	6	60+15=75

Texts:

1. John Milton. *Paradise Lost*. Bk. I
2. John Webster. *The Duchess of Malfi*.
3. Aphra Behn. *The Rover*.
4. Alexander Pope. *The Rape of the Lock*. (Books I and II)

Suggested topics for class presentations

1. Religious and secular thought in the 17th century
2. The Stage, the state and the market
3. The mock-epic and Satire
4. Women in the 17th century
5. The Comedy of Manners

Readings

1. "Genesis", Ch.1-4 and "The Gospel According to St. Luke", Ch.1-7. [King James Version]
2. Niccolo Machiavelli. Chapters 15, 16, 18 and 25. *The Prince*. Ed. and tr. Robert M. Adams. New York: Norton & Co, 1992.
3. Thomas Hobbes. Chapters 8, 11 and 13. *The Leviathan*. New York: Norton & Co, 2006.
4. John Dryden. "A discourse Concerning the Origin and Progress of Satire". *The Norton Anthology of English Literature*. V.1. 9thedn. Ed. Stephen Greenblatt. New York: Norton, 2012. pp. 1767-8.

B.A. ENGLISH (Honours)
SEMESTER-III

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-GE-T-3	Language and Linguistics	GE	6	60+15=75

1. **Language:** language and communication; language varieties: standard and non-standard language; language change.

Mesthrie, Rajend and Rakesh M Bhatt. *World Englishes: The study of New Linguistic Varieties*. Cambridge UP, 2008.

2. **Phonetics and Phonology:** Introduction to English vowel and consonant sounds, Stress and phonemic transcription of connected speech, Syllabic structure and consonant cluster.

T. Balasubramanian. *A textbook of English Phonetics for Indian Students*. 2nd ed. Trinity, 2013.

J. D.O'Connor. *Better English Pronunciation*. CUP, 2000.

Peter Roach. *English Phonetics and Phonology: A Practical Course*. CUP, 2000.

3. **Syntax and Semantics:** Categories and Constituents, Phrase Structure, Maxims of conversations.

Akmajian, A., R. A. Demers and R, M Harnish. Chapters 5 and 6. *Linguistics: An Introduction to Language and Communication*. 2nd ed. MIT Press, 1984. Indian edition, Prentice Hall, 1991.

Board of editors. *Linguistics: An Introduction*. Hyderabad: Orient Blackswan, 2015.

F.R.Palmer. *Grammar*. Penguin, 1983.

George Yule. *The Study of Language*. CUP, 2016.

David Crystal. *English as A Global Language*. 2nd ed. CUP, 2003.

Victoria Fromkin, Robert Rodman, Nina Hyams. Chapters 3, 6 and 7. *An Introduction to Language*. 11th ed. Wadsworth, 2018.

4. **Rhetoric and Prosody:** Identification and explanation of the figures of speech, Scansion and identification of the metrical pattern of a poem, or an excerpt from a poem.

Bose and Sterling. *Elements of English Rhetoric and Prosody*.

B.A. ENGLISH (Honours)
SEMESTER-III

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-SEC-T-1	English Language Teaching	SEC	2	50

Any four of the following topics

1. Knowing the Learner
2. Structures of English Language
3. Methods of teaching English Language and Literature
4. Materials for Language Teaching
5. Assessing Language Skills
6. Using Technology in Language Teaching

Suggested Readings

1. Penny Ur, *A Course in Language Teaching: Practice and Theory*. CUP, 1996.
2. Marianne Celce-Murcia, Donna M. Brinton, and Marguerite Ann Snow, *Teaching English as a Second or Foreign Language*. Cengage Learning, 4th ed, 2014.
3. Adrian Doff, *Teach English: A Training Course For Teachers*. Cambridge UP, 1988.
4. *Business English*. Pearson, 2008.
5. Diane Larsen-Freeman. *Techniques and Principles in Language Teaching*. OUP, 1986.
6. Patsy M. Lightbown and Nina Spada *How Languages are Learned*. 4th ed. OUP, 2013.
7. Geetha Nagaraj. *English Language Teaching: Approaches, Methods, Techniques*. Orient Blackswan, 2010.
8. Jack C Richards and Theodore S Richards. *Approaches and Methods in Language Teaching*. CUP, 2001.

B.A. ENGLISH (Honours)
SEMESTER-IV

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-8	British Literature: 18 th Century	Core	6	60+15=75

Texts

1. William Congreve. *The Way of the World*.
2. Jonathan Swift. *Gulliver's Travels* (Books I & II)
3. Samuel Johnson. "London".
4. Thomas Gray. "Elegy Written in a Country Churchyard".
5. Eliza Heywood. *Fantomina*.

Suggested topics for class presentations

1. The Enlightenment and Neoclassicism
2. Restoration Comedy
3. The Country and the City
4. The novel and the periodical press

Readings

1. Jeremy Collier. *A Short View of the Immorality and Profaneness of the English Stage*. London: Routledge, 1996.
2. Daniel Defoe. "The Complete English Tradesman" (Letter XXII), "The Great Law of Subordination Considered" (Letter IV) and "The Complete English Gentleman" in *Literature and Social Order in Eighteenth-century England*. Ed. Stephen Copley. London: Croom Helm, 1984.
3. Samuel Johnson. (i) Essay 156 in *The Rambler* in *Selected Writings: Samuel Johnson*. Ed. Peter Martin. Cambridge, MA: Harvard UP, 2009. pp. 194-7; (ii) *Rasselas*. Ch.10. (iii) "Pope's Intellectual Character: Pope and Dryden Compared", from the *Life of Pope* in *The Norton Anthology of English Literature*, vol.1, ed. Stephen Greenblatt. 8th Ed. New York: Norton, 2006. pp.2693-94, 2774-77.

B.A. ENGLISH (Honours)
SEMESTER-IV

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-9	British Romantic Literature	Core	6	60+15=75

Texts

1. William Blake. "The Lamb", "The Chimney Sweeper", "The Tyger", the Introduction to *The Songs of Innocence*.
2. Robert Burns. "A Bard's Epitaph" and "Scots Wha Hae"
3. William Wordsworth. "Tintern Abbey"
4. Samuel Taylor Coleridge. "Kubla Khan", "Dejection: An Ode"
5. George Gordon Byron. Canto IV. Verses 178-86. *Childe Harold's Pilgrimage. II*. 1594-1674.
6. Percy Bysshe Shelley. "Ode to the West Wind"
7. John Keats. "Ode to a Nightingale", "Bright Star", "To Autumn"
8. Mary Shelley. *Frankenstein*.

Suggested Topics for class presentations

1. Reason and imagination
2. Conceptions of nature
3. Literature and revolution
4. The Gothic
5. The Romantic lyric

Readings

1. William Wordsworth. "Preface" to *Lyrical Ballads* (1802 ed.). *The Norton Anthology of Theory and Criticism*. Eds. William Cain et al. 2001. pp. 648-67.
2. John Keats. Letter to George and Thomas Keats, 21 December 1817. Letter to Richard Woodhouse, 27 October 1818. *Complete Poems and Selected Letters of John Keats*. Ed. Edward Hirsch. Modern Library, 2001.
3. Jean-Jacques Rousseau. "Preface" to *Emile or On Education*. Tr. Allan Bloom. Harmondsworth: Penguin, 1991.
4. Samuel Taylor Coleridge. Chap XIII. *Biographia Literaria*. Ed. George Watson. London: Everyman, 1993. pp. 161-6.

B.A. ENGLISH (Honours)
SEMESTER-IV

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-10	British Literature: 19 th Century	Core	6	60+15=75

Texts

1. Charlotte Brontë. *Jane Eyre*. 1847. 3rd ed. Norton Critical Edition. 2016.
2. Charles Dickens. *Hard Times*. 1854. 4th ed. Norton Critical Edition. 2015.
3. Thomas Hardy. *Tess of the d'Urbervilles*. 1891-92. 3rd ed. Norton Critical Edition. 1991.
4. Alfred Tennyson. "Ulysses"
5. Robert Browning. "My Last Duchess"
6. Christina Rossetti. 1st Stanza. "The Goblin Market". 1862. ll.1-31.

Suggested Topics for class presentations

1. Utilitarianism
2. Nineteenth-century novel
3. Marriage and sexuality
4. The writer and society
5. Faith and doubt
6. Dramatic monologue

Readings

1. Karl Marx. "The Essence of the Materialist Conception of History: Being and Social Consciousness." Sec. IV, Part I. *German Ideology*. 1845.
2. Charles Darwin. "Natural Selection and Sexual Selection" selection from *The Descent of Man*. *Norton Anthology of English Literature*. 8th Ed. Vol.2. Ed. Stephen Greenblatt. New York: Norton, 2006.
3. John Stuart Mill. Selections from Ch. 1 of *The Subjection of Women*. *Norton Anthology of English Literature*. 8th Ed. Vol.2. Ed. Stephen Greenblatt. New York: Norton, 2006.

B.A. ENGLISH (Honours)
SEMESTER-IV

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-GE-T-4	Contemporary India: Women and Empowerment	GE	6	60+15=75

1. Social Construction of Gender (Masculinity and Femininity) and Patriarchy
2. History of Women's Movements in India (Pre-independence, post-independence)Women, Nationalism, Partition, Women and Political Participation
3. Women and Law, Women and the Indian Constitution, Personal Laws (Customary practices on inheritance and Marriage), (Supplemented by workshop on legal awareness)
4. Women and Environment: State interventions, domestic violence, female foeticide, sexual harassment
5. Female Voices: *Rokeya Shekhawat Hossein. Sultana's Dream.*
6. Dalit Discourse: Sharmila Rege. "Dalit Feminist Standpoint". *Gender and Caste*. Ed. A. Rao. Kali for Women, 2003.

B.A. ENGLISH (Honours)
SEMESTER-IV

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-SEC-T-2	Soft Skills	SEC	2	50

Topics and skills to be learnt

Teamwork
Emotional Intelligence
Adaptability
Leadership
Problem solving

Readings

1. S.P. Dhanavel. *English and Soft Skills*. Orient Blackswan, 2013
2. *English for Students of Commerce: Précis, Composition, Essays, Poems*. Eds. Kaushik, et al.
3. Sabina Pillai and Agna Fernandez. *Soft Skills and Employability Skills*. CUP, 2017.

B.A. ENGLISH (Honours)
SEMESTER-V

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-11	Women's Writing	Core	6	60+15=75

Texts:

1. Emily Dickinson. "I cannot live with you". "I'm 'wife'- I've finished that"
2. Sylvia Plath. "Daddy", "Lady Lazarus"
3. Maya Angelou. "Caged Bird". The Complete Collected Poems of Maya Angelou. Random House Inc., 1994.
4. Alice Walker. *The Color Purple*.
5. Katherine Mansfield. "Bliss"
6. Mahashweta Devi. "Draupadi". Translated with a foreword by Gayatri Chakravorty Spivak. *Critical Inquiry*, Vol. 8, No. 2, Writing and Sexual Difference. (Winter, 1981), pp. 381-402.
7. Mary Wollstonecraft. Chapter II. *A Vindication of the Rights of Woman*. Norton Critical Edition. 1988. Pp.19-38.
8. Ramabai Ranade. "A Testimony of our Inexhaustible Treasures". *Pandita Ramabai through Her Own Words: Selected Works*. Tr. Meera Kosambi. New Delhi: OUP, 2000. pp. 295-324.
9. Rassundari Debi. Excerpts from *Amar Jiban* in *Women's Writing in India*. Vol.1. Eds. Susie Tharu and K. Lalita. New Delhi: OUP, 191-2.

Suggested topics for class presentations

1. The confessional mode in women's writing
2. Sexual politics
3. Race, caste and gender
4. Social reform and women's rights

Readings

1. Virginia Woolf. Chapters 1 & 6. *A Room of One's Own*.
2. Simone de Beauvoir. "Introduction". *The Second Sex*. Tr. Constance Borde and Sheila Malovany-Chevallier. London: Vintage, 2010. pp.3-18.
3. Kumkum Sangari and Sudesh Vaid. "Introduction". *Recasting Women: Essays in Colonial History*. New Delhi: Kali for Women, 1989. pp.1-25.
4. Chandra Talapade Mohanty. "Under Western Eyes: Feminist Scholarship and Colonial Discourses". *Contemporary Postcolonial Theory: A Reader*. Ed. Padmini Mongia. New York: Arnold, 1996. pp.172-97.

B.A. ENGLISH (Honours)
SEMESTER-V

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-12	British Literature: The Early 20 th Century	Core	6	60+15=75

Texts:

1. Joseph Conrad. *Heart of Darkness*.
2. John Millington Synge. *Riders to the Sea*.
3. James Joyce. *A Portrait of the Artist as a Young Man*.
4. William Butler Yeats. "Byzantium", "Sailing to Byzantium"
5. Thomas Stearns Eliot. "The Love Song of J. Alfred Prufrock", "Preludes", "Hollow Men"
6. Wystan Hugh Auden. "Unknown Citizen"
7. David Herbert Lawrence. "Odour of Chrysanthemums"
8. Virginia Woolf. "Mark on the Wall"
9. W. Somerset Maugham. "Rain"

Suggested topics for class presentations

1. Modernism
2. Women's movements in early twentieth-century
3. Psychoanalysis and the stream of consciousness
4. Uses of myth

Readings

1. Sigmund Freud. "Theory of Dreams", "Oedipus Complex", "The Structure of the Unconscious". *The Modern Tradition*. Ed. Richard Ellman et al. Oxford: OUP, 1965. pp.571, 578-80, 559-63.
2. T. S. Eliot. "Tradition and the Individual Talent". *Norton Anthology of English Literature*. 8th Ed. Vol.2. Ed. Stephen Greenblatt. New York: Norton, 2006. pp.2319-25.
3. Raymond Williams. "Introduction". *The English Novel from Dickens to Lawrence*. London: Hogarth Press, 1984. pp.9-27.

B.A. ENGLISH (Honours)
SEMESTER-V

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-DSE-T-1	Modern Indian Writing in English Translation	DSE	6	60+15=75

Texts:

1. Premchand. "The Shroud". *New Penguin Book of Classic Urdu Stories*. Ed. M. Assaduddin. Penguin, 2006.
2. Ismat Chughtai. "The Quilt". *Lifting the Veil: Selected Writings of Ismat Chughtai*. Tr. M. Assaduddin. Penguin, 2009.
3. Gurdial Singh. "A Season of No Return". *Earthy Tones*. Tr. Rana Nayar. Fiction House, 2002.
4. Fakir Mohan Senapati. "Rebati". *Oriya Stories*. Ed. Vidya Das. Tr. Kishori Charan Das. Srishti, 2000.
5. G.M. Muktibodh. "The Void" (Tr. Vinay Dharwadker) and "So Very Far" (tr. Vishnu Khare and Adil Jussawala). *Oxford Anthology of Modern Indian Poetry*. OUP, 2000.
6. Amrita Pritam. "I Say unto Waris Shah" (Tr. N.S. Tasneem). *Modern Indian Literature: An Anthology. Plays and Prose. Vol.3*. Ed. K. M. George. Sahitya Akademi, 1992.
7. Thangjam Ibopishak Singh. "Dali, Hussain, or Odour of Dream, Clours of Wind" and "The Land of the Half-Humans". Tr. Robin S. Ngangom. *The Anthology of Contemporary Poetry from the Northeast*. NEHU, 2003.
8. Rabindranath Tagore. *Red Oleanders* or Dharamveer Bharati. *Andha Yug*. Tr. Alok Bhalla. OUP, 2009.
9. G. Kalyan Rao. *Untouchable Spring*. Tr. Alladi Umaamd M. Sridhar. Orient Blackswan, 2010.

Suggested Topics for Class Presentation

1. The aesthetics of translation
2. Linguistic regions and languages
3. Modernity in Indian literature
4. Caste, gender and resistance
5. Questions of form in twentieth-century Indian literature

Readings

1. Namwar Singh. 'Decolonising the Indian Mind', tr. Harish Trivedi, *Indian Literature*, no. 151 (Sept./Oct. 1992).
2. B.R. Ambedkar. "Annihilation of Caste". *Dr. Babasaheb Ambedkar: Writings and Speeches*, vol. 1 (Maharashtra: Education Department, Government of Maharashtra, 1979) chaps. 4, 6, and 14.
3. Sujit Mukherjee. "A Link Literature for India". *Translation as Discovery*. Orient Longman, 1994. pp. 34-45.
4. G.N. Devy. "Introduction". *After Amnesia* in *The G.N. Devy Reader*. Orient BlackSwan, 2009. pp. 1-5.

B.A. ENGLISH (Honours)
SEMESTER-V

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-DSE-T-2	British Literature: Post World War II	DSE	6	60+15=75

Texts:

1. George Orwell. *Animal Farm*
2. John Osborne. *Look Back in Anger*
3. Julian Barnes. *England, England*
4. Phillip Larkin. "Whitsun Weddings" and "Church Going"
5. Ted Hughes. "Hawk Roosting" and "Crow's Fall"
6. Seamus Heaney. "Digging" and "Casualty"
7. Carol Anne Duffy. "Text" and "Stealing"

Suggested Topics for Class Presentations

1. Postmodernism in British Literature
2. Britishness after 1960s
3. Intertextuality and experimentation
4. Literature and counterculture

Readings

1. Alan Sinfield. "Literature and Cultural Production." *Literature, Politics, and Culture in Postwar Britain*. University of California Press, 1989. pp. 23–38.
2. Seamus Heaney. "The Redress of Poetry". *The Redress of Poetry*. Faber, 1995. pp. 1–16.
3. Patricia Waugh. "Culture and Change: 1960-1990". *The Harvest of The Sixties: English Literature And Its Background, 1960-1990*. OUP, 1997.

B.A. ENGLISH (Honours)
SEMESTER-V

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-DSE-T-3	Literary Criticism	DSE	6	60+15=75

Texts:

1. William Wordsworth. "Preface" to the *Lyrical Ballads* (1802)
2. S.T. Coleridge. *Biographia Literaria*. Chapters XIII and XIV
3. Virginia Woolf. "Modern Fiction"
4. T.S. Eliot: "Tradition and the Individual Talent"
5. Matthew Arnold. "The Function of Criticism"
6. I.A. Richards. *Principles of Literary Criticism*. Chapters 1, 2 and 34. London, 1924.
7. Cleanth Brooks. "The Heresy of Paraphrase", and "The Language of Paradox".
The Well-Wrought Urn: Studies in the Structure of Poetry (1947)

Suggested Topics for Class Presentations

1. Summarising and critiquing
2. Point of view
3. Reading and interpreting
4. Media criticism
5. Plot and setting
6. Citing from critics' interpretations

Readings

1. C.S. Lewis. "Introduction". *An Experiment in Criticism*. Cambridge University Press, 1992.
2. M.H. Abrams. *The Mirror and the Lamp*. Oxford University Press, 1971.
3. Rene Wellek and Stephen G. Nicholas. *Concepts of Criticism*. Yale UP, 1963.
4. Andrew Bennett and Nicholas Royle. Eds. *An Introduction to Literature, Criticism and Theory*. 5th Ed. Routledge, 2016.

B.A. ENGLISH (Honours)
SEMESTER-VI

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-13	Modern European Drama	Core	6	60+15=75

Texts (Any four of the following are to be answered)

1. Henrik Ibsen. "Ghosts". *Ghosts and Other Plays*. Tr. Peter Watts. Penguin, 1964.
2. Bertolt Brecht. *The Good Person of Szechwan*. Ed.&Tr. Ralph Manheim. Penguin, 2008.
3. Samuel Beckett. *Waiting for Godot*. OUP.
4. Eugene Ionesco. "Rhinoceros". *Rhinoceros, The Chairs, The Lesson*. Tr. Derek Prouse and Donald Watson. Penguin, 1974.
5. Luigi Pirandello. *Six Characters in Search of an Author*. Tr. John Linstrum. Bloomsbury, 2014.
6. Anton Chekov. "The Seagull". *Plays*. Tr. Peter Carson. Penguin, 2002.

Suggested topics for class presentations

1. Politics, social change and the stage
2. Text and performance
3. European drama: realism and beyond
4. Tragedy and heroism in modern European drama
5. The Theatre of the Absurd

Readings

1. Constantin Stanislavsky. "Faith and the Sense of Truth". Sections 1, 2, 7, 8, 9. Chapter 8. *An Actor Prepares*. Tr. Elizabeth Reynolds Hapgood. Harmondsworth: Penguin, 1967. pp. 121-5, 137-46.
2. Bertolt Brecht. "The Street Scene", "Theatre for Pleasure or Theatre for Instruction", and "Dramatic Theatre vs. Epic Theatre". *Brecht on Theatre: The Development of An Aesthetic*. Ed. and tr. John Willet. London: Methuen, 1992. pp.68-76., 121-8.
3. George Steiner. "On Modern Tragedy". *The Death of Tragedy*. London: Faber, 1995. pp. 303-24.
4. Martin Esslin. "Introduction: Absurdity of the Absurd". *Theatre of the Absurd*. New York: Vintage, 1961.
5. Raymond Williams. "A Generation of Masters". Ch.1. *Drama from Ibsen to Brecht*. Oxford: OUP, 1969. pp.25-111.

B.A. ENGLISH (Honours)
SEMESTER-VI

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-CC-T-14	Postcolonial Literatures	Core	6	60+15=75

Texts

1. Chinua Achebe. *Things Fall Apart*.
2. Gabriel Garcia Marquez. "No One Writes to the Colonel".
3. Bessie Head. "The Collector of Treasures".
4. Ama Ata Aidoo. "The Girl Who Can"
5. Grace Ogot. "The Green Leaves".
6. Pablo Neruda. "Tonight I Can Write", "The Way Spain Was."
7. Derek Walcott. "A Far Cry from Africa", "Names".
8. David Malouf. "Revolving Days", "Wild Lemons".
9. Mamang Dai. "Small Towns and the River", "The Voice of the Mountain"

Suggested Topics for class presentations

1. Decolonization, globalization and literature
2. Literature and identity politics
3. Writing for the new world audience
4. Region, race and gender
5. Postcolonial literatures and questions of form

Readings

1. Franz Fanon. "The Negro and Language". *Black Skin, White Masks*. Tr. Charles Lam Markmann. London: Pluto Press, 2008. pp.8-27.
2. Ngugi waThiong'o. "The Language of African Literature". Sections 4-6. Ch.1. *Decolonising the Mind*. London: James Curry, 1986.
3. Gabriel Garcia Marquez. The Nobel Prize Acceptance Speech. Gabriel Garcia Marquez: New Readings. Ed. Bernard McGuirk and Richard Cardwell. Cambridge: Cambridge UP, 1987.

B.A. ENGLISH (Honours)
SEMESTER-VI

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-DSE-T-4	Literary Theory	DSE	6	60+15=75

Texts

1. Marxism

- a. Antonio Gramsci. "The Formation of the Intellectuals" and "Hegemony (Civil Society) and Separation of Powers". *Selections from the Prison Notebooks*. Ed. and tr. Quentin Hoare and Geoffrey Novell Smith. London: Lawrence and Wishart, 1971. p. 5, 245–6.
- b. Louis Althusser. "Ideology and Ideological State Apparatuses". *Lenin and Philosophy and Other Essays*. New Delhi: Aakar Books, 2006. pp. 85–126.

2. Feminism

- a. Elaine Showalter. "Twenty Years on: A Literature of Their Own Revisited." *A Literature of Their Own: British Women Novelists from Bronte to Lessing*. 1977. Rpt. London: Virago, 2003. pp. xi–xxxiii.
- b. Luce Irigaray. "When the Goods Get Together". *This Sex Which is Not One. New French Feminisms*. Ed. Elaine Marks and Isabelle de Courtivron. New York: Schocken Books, 1981. pp. 107–10.

3. Poststructuralism

- a. Jacques Derrida. "Structure, Sign and Play in the Discourse of the Human Science." Tr. Alan Bass. *Modern Criticism and Theory: A Reader*. Ed. David Lodge. London: Longman, 1988. pp. 108–23.
- b. Michel Foucault. "Truth and Power". *Power and Knowledge*. Tr. Alessandro Fontana and Pasquale Pasquino. New York: Pantheon, 1977. pp. 109–33.

4. Postcolonial Studies

- a. Mahatma Gandhi. "Passive Resistance" and "Education". *Hind Swaraj and Other Writings*, ed. Anthony J Parel. Delhi: CUP, 1997. pp. 88–106.
- b. Edward Said. "The Scope of Orientalism." *Orientalism*. Harmondsworth: Penguin, 1978. pp. 29–110.
- c. Aijaz Ahmad. "Indian Literature: Notes towards the Definition of a Category". *In Theory: Classes, Nations, Literatures*. London: Verso, 1992. pp. 243–285.

Suggested Topics for Class Presentations

1. The East and the West
2. Questions of alterity
3. Power, language, and representation
4. The State and culture

Readings

1. Terry Eagleton. *Literary Theory: An Introduction*. Oxford: Blackwell, 2008.
2. Peter Barry, *Beginning Theory* (Manchester: Manchester University Press, 2002).

B.A. ENGLISH (Honours)
SEMESTER-VI

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-DSE-T-5	Partition Literature	DSE	6	60+15=75

Texts

1. Intizar Husain, Basti. Tr. Frances W. Pritchett. New Delhi: Rupa, 1995.
2. Amitav Ghosh. *The Shadow Lines*.
3.
 - a) Dibyendu Palit, 'Alam's Own House', tr. Sarika Chaudhuri, *Bengal Partition Stories: An Unclosed Chapter*, ed. Basabi Fraser. London: Anthem Press, 2008. pp. 453–72.
 - b) Manik Bandyopadhyay, 'The Final Solution', tr. Rani Ray, *Mapmaking: Partition Stories from Two Bengals*, ed. Debjani Sengupta. New Delhi: Srishti, 2003. pp. 23–39.
 - c) Sa'adat Hasan Manto, "Toba Tek Singh", in *Black Margins: Manto*, tr. M. Asaduddin. New Delhi: Katha, 2003. pp. 212–20.
 - d) Lalithambika Antharajanam. "A Leaf in the Storm". Tr. K. Narayana Chandran, in *Stories about the Partition of India*. Ed. Alok Bhalla. New Delhi: Manohar, 2012. pp. 137–45.
4. a) Faiz Ahmad Faiz. "For Your Lanes, My Country" in *In English: Faiz Ahmad Faiz, A Renowned Urdu Poet*. Tr. and ed. Riz Rahim. California: Xlibris, 2008. p. 138.
- b) Gulzar. "Toba Tek Singh". Tr. Anisur Rahman, in *Translating Partition*. Ed. Tarun Saint et. al. New Delhi: Katha, 2001. p. x.

Suggested Topics and Readings for Class Presentation

1. Colonialism, nationalism, and the Partition
2. Communalism and violence
3. Homelessness and exile
4. Women in the Partition

Readings

1. Ritu Menon and Kamla Bhasin. "Introduction" in *Borders and Boundaries*. New Delhi: Kali for Women, 1998.
2. Sukrita P. Kumar. "Narrating Partition". Delhi: Indialog, 2004.
3. Urvashi Butalia. *The Other Side of Silence: Voices from the Partition of India*. Delhi: Kali for Women, 2000.
4. Sigmund Freud. "Mourning and Melancholia" in *The Complete Psychological Works of Sigmund Freud*. Tr. James Strachey. London: Hogarth Press, 1953. pp. 3041–53.

Films

- Garam Hawa*. (dir. M.S. Sathyu, 1974).
Khamosh Paani: Silent Waters. (dir. Sabiha Sumar, 2003).
Subarnarekha. (dir. Ritwik Ghatak, 1965)

B.A. ENGLISH (Honours)
SEMESTER-VI

Course Code	Course Title	Course Type	Credit	Full Marks
ENGH-H-DSE-T-6	Research Methodology	DSE	6	60+15=75

1. Practical Criticism and writing a term paper
2. Conceptualizing and drafting research proposals
3. Style manuals and their uses
4. Notes, references, and bibliography

Readings:

1. Chicago Manual of Style.17th edition.
2. MLA Style Manual and Guide to Scholarly Publishing. 2008.

Syllabus
for
Under Graduate Compulsory Course
in
ENVIRONMENTAL STUDIES
(Ability Enhancement Compulsory Course)
(AECC)
2018-2019

Under
Choice Based Credit System (CBCS)



UNIVERSITY OF KALYANI
WEST BENGAL

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC 2) ENVIRONMENTAL STUDIES

Unit 1: Introduction to Environmental studies

Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources : Renewable and Non-renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation

- Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots.
- India as a mega-biodiversity nation; Endangered and endemic species of India.
- Threats to biodiversity: Habitat loss, poaching of wildlife, man--wildlife conflicts, biological invasions; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution.
- Nuclear hazards and human health risks.
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.

Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 8: Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M. K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36-37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E. P., Odum, H. T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I. L., Gerba, C. P. & Brusseau, M. L. 2011. *Environmental and Pollution Science*. Academic Press.

11. Rao, M. N. & Datta, A. K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P. H., Hassenzahl, D. M. & Berg, L. R. 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J. S., Singh, S. P. and Gupta, S. R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N. S., Gibson, L. & Raven, P. H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

Syllabus
for
B.Sc. (Honours) in Environmental Science
2018-2019

Under
Choice Based Credit System (CBCS)



UNIVERSITY OF KALYANI
WEST BENGAL

PREAMBLE

The Undergraduate Board of Studies in Environmental Science, University of Kalyani has redesigned and revised the syllabus of B.Sc. (Honours) in Environmental Science under Semester Wise Choice Based Credit System (CBCS) scheme following the recommendations and guidelines of University Grants Commission (UGC) and the notification (No. FCUG/KU-914/17-18 dated 16.11.2017) of the University of Kalyani. After thorough and threadbare examination of the drawbacks of the existing syllabus the UG Board of studies has formulated the present curriculum inclusive of its contents, relevance, quality and pattern of teaching-learning and examination. The contents, structure and date of effect of the proposed syllabus will be decided by the appropriate authority of the University of Kalyani following its acceptance and approval.

As enshrined in the UGC's vision of introducing such new system the main objective of framing this new syllabus of B.Sc. (Honours) in Environmental Science is to impart the students a holistic understanding of the subject giving substantial weightage in both the core contents, skill and ability enhancement. The syllabus has given due importance on the main streams of the body of knowledge on "Environment" with due recognition of its wide spectrum.

The ultimate goal of the syllabus is to enable the students to have an in-depth knowledge on the subject and enhance their scope of employment at the end. Adequate emphasis has been given on the new and emerging techniques and understanding of the subject under the changing regime and global context.

In order to offer a broader window of exposure it is required for the students of Environmental Science (Hons) to select their Generic Elective (GE) Course from a basket of the following other subjects or disciplines: Chemistry/ Botany/ Zoology/ Physiology/ Microbiology/ Molecular Biology and Biotechnology/ Physics/ Geography.

A course on "dissertation" has been introduced to offer special and advanced knowledge as well as to infuse interest, orientation and promotion of skill in research among the students of Environmental Science (Hons).

Hope the proposed curriculum will make it more contextual, viable and suitable to cater the needs of students of Environmental Science.

Undergraduate Board of Studies
in
Environmental Science and Environmental Studies

**CURRICULUM
UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)
UNIVERSITY OF KALYANI, KALYANI**

OUTLINE OF CHOICE BASED CREDIT SYSTEM

1. Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. Elective Course: Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1. Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

2.2. Dissertation/Project: An elective course may be designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.3. Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and *vice versa* and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC): The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; i. Environmental Science and ii. English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1. Ability Enhancement Compulsory Courses (AECC): Environmental Science, English Communication/MIL Communication.

3.2. Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

UG SEMESTER WISE CBCS COURSE STRUCTURE FOR ENVIRONMENTAL SCIENCE HONOURS

TABLE 1. TOTAL NUMBER OF COURSES IN UG-CBCS (B. Sc. HONS) IN ENVIRONMENTAL SCIENCE

Types of Courses	Core Course (CC)	Elective Course		Ability Enhancement Course		Total
		Discipline Specific Elective (DSE)	Generic Elective (GE)	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	
No. of Course	14	04	04	02	02	26
Credit/Course	06	06	06	02	02	140

TABLE 2. DETAILS OF COURSES & CREDIT OF B. Sc. (HONS) IN ENVIRONMENTAL SCIENCE UNDER CBCS

Course	Total no of Papers	Credit			
		Theory		Practical	
		Credit/ Paper	Total	Credit/ paper	Total
Core Courses (CC) (6)	14	4	14x4=56	2	14x2=28
Discipline Specific Elective (DSE) (6)	04	4	4x4=16	2	2x4=8
Generic Elective (GE) (6)	04	4	4x4=16	2	2x4=8
Ability Enhancement Compulsory Course (Language) (AECC) (2)	02	2	2x2=4	-	-
Skill Enhancement (SEC) (2)	02	2	2x2=4	-	-
Total No. of Courses/ Sem	26	-	96	-	44
Total Credit			96 + 44 = 140		

**TABLE 3. SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B. Sc. (HONS.)
IN ENVIRONMENTAL SCIENCE**

Courses/ Credits	SEM-I	SEM-II	SEM-III	SEM-IV	SEM-V	SEM-VI	Total No. of Courses	Total Credits
Core Courses (CC) (6)	2	2	3	3	2	2	14	84
Discipline Specific Elective (DSE) (6)	-	-	-	-	2	2	04	24
Generic Elective (GE) (6)	1	1	1	1	-	-	04	24
Ability Enhancement Compulsory Course (Language) (AECC) (2)	1	1	-	-	-	-	02	04
Skill Enhancement Course (SEC) (2)	-	-	1	1	-	-	02	04
Total No. of Courses/ Sem	04	04	05	05	04	04	26	-
Total Credits/Sem	20	20	26	26	24	24	-	140

TABLE 4. SEMESTER & COURSE WISE CREDIT DISTRIBUTION IN B.Sc.(HONS) IN ENVIRONMENTAL SCIENCE

(6 Credit: 75 Marks)

SEMESTER-I				
Course Code		Course Title	Course Nature	Credit
UG-ENVS-H-CC-01	UG-ENVS-H-CC-L -01 UG-ENVS-H-CC-P -01	Earth and Earth Surface Processes	Core	4+2=6
UG-ENVS-H-CC-02	UG-ENVS-H-CC-L -02 UG-ENVS-H-CC- P-02	Environmental Chemistry and Environmental Physics	Core	4+2=6
UG-ENVS-H-GE-01	UG-ENVS-H-GE-L -01 UG-ENVS-H-GE- P-01	Environment and Society # *	GE	4+2=6
UG-ENVS-H-AECC-01		English Communication / MIL	AECC	2
Total		4 courses	Total	20
SEMESTER-II				
Course Code		Course Title	Course Nature	Credit
UG-ENVS-H-CC-03	UG-ENVS-H-CC-L-03 UG-ENVS-H-CC-P-03	Water and Water Resources	Core	4+2=6
UG-ENVS-H-CC-04	UG-ENVS-H-CC-L-04 UG-ENVS-H-CC-P-04	Land, Soil Conservation and Management	Core	4+2=6
UG-ENVS-H-GE-02	UG-ENVS-H-GE-L-02 UG-ENVS-H-GE-P-02	Wildlife Management # *	GE	4+2=6
UG-ENVS-H-AECC-02		Environmental Studies	AECC	2
Total		4 courses	Total	20
SEMESTER-III				
Course Code		Course Title	Course Nature	Credit
UG-ENVS-H-CC-05	UG-ENVS-H-CC-L-05 UG-ENVS-H-CC-P-05	Ecology and Ecosystems	Core	4+2=6
UG-ENVS-H-CC-06	UG-ENVS-H-CC-L-06 UG-ENVS-H-CC-P-06	Biodiversity and Conservation	Core	4+2=6
UG-ENVS-H-CC-07	UG-ENVS-H-CC-L-07 UG-ENVS-H-CC-P-07	Atmosphere and Global Climate change	Core	4+2=6
UG-ENVS-H-GE-03	UG-ENVS-H-GE-L-03 UG-ENVS-H-GE-P-03	Gender and Environment # *	GE	4+2=6
UG-ENVS-H- SEC-01		1a)Remote Sensing, Geographic Information System (GIS) and Application 1b)Occupational Health and Environmental Safety (Any one from this group)	SEC	2
Total		5 courses	Total	26
SEMESTER-IV				
Course Code		Course Title	Course Nature	Credit
UG-ENVS-H-CC-08	UG-ENVS-H-CC-L-08 UG-ENVS-H-CC-P-08	Systematics and Biogeography	Core	4+2=6
UG-ENVS-H-CC-09	UG-ENVS-H-CC-L-09 UG-ENVS-H-CC-P-09	Natural Resources Management and Sustainability	Core	4+2=6
UG-ENVS-H-CC-10	UG-ENVS-H-CC-L-10 UG-ENVS-H-CC-P-10	Environmental Pollution and Human Health	Core	4+2=6

UG-ENVS-H-GE-04	UG-ENVS-H-GE-L-04 UG-ENVS-H-GE-P-04	Green Chemistry, Green Technology and Environmental Applications # *	GE	4+2=6
UG-ENVS-H- SEC-02		2a)Environment Impact and Risk Assessment 2b)Environmental Quality Monitoring and Assessment (Any one from this group)	SEC	2
Total		5 courses	Total	26
SEMESTER-V				
Course Code		Course Title	Course Nature	Credit
UG-ENVS-H-CC-11	UG-ENVS-H-CC-L-11 UG-ENVS-H-CC-P-11	Environmental Biotechnology	Core	4+2=6
UG-ENVS-H-CC-12	UG-ENVS-H-CC-L-12 UG-ENVS-H-CC-P-12	Evolutionary Biology	Core	4+2=6
UG-ENVS-H-DSE-01	UG-ENVS-H-DSE-L-01 UG-ENVS-H-DSE-P-01	1a)Energy and Environment 1b)Ecotoxicology and Environmental Health (Any one from this group)	DSE	4+2=6
UG-ENVS-H-DSE-02	UG-ENVS-H-DSE-L-02 UG-ENVS-H-DSE-P-02	2a)Environmental Economics 2b)Waste and Wastewater Management (Any one from this group)	DSE	4+2=6
Total		4 courses	Total	24
SEMESTER-VI				
Course Code		Course Title	Course Nature	Credit
UG-ENVS-H-CC-13	UG-ENVS-H-CC-L-13 UG-ENVS-H-CC-P-13	Environmental Legislation and Policy	Core	4+2=6
UG-ENVS-H-CC-14	UG-ENVS-H-CC-L-14 UG-ENVS-H-CC-P-14	Urban Ecosystems	Core	4+2=6
UG-ENVS-H-DSE-03	UG-ENVS-H-DSE-L-03 UG-ENVS-H-DSE-P-03	3a)Natural Hazards and Disaster Management 3b)Instrumental Techniques for Environmental Analysis (Any one from this group)	DSE	4+2=6
UG-ENVS-H-DSE-04	UG-ENVS-H-DSE-D-04 UG-ENVS-H-DSE-P-04	Dissertation	DSE	4+2=6
Total		4 courses	Total	24
Total (All semesters)		26 courses	Total	140

B.Sc. (Honours) with Environmental Science students may select their Generic Elective courses (GE), any two from Chemistry/ Botany/ Zoology/ Physiology/ Microbiology/Molecular biology & Biotechnology/ Physics/ Geography and any branch of Life Sciences .

* Generic Elective courses (GE) may be opted by the students of other honours subjects.

CORE COURSE 01 (Code: UG-ENVS-H-CC-01)
EARTH AND EARTH SURFACE PROCESSES

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: The paper will introduce students to the basic structure and composition of the earth and will explore various surface processes and their impact and role in living systems. It will also deal with the interactive processes in the inner as well as outer Earth's surface.

UG-ENVS-H-CC-L -01

CREDITS: 4; Lectures-60

Unit 1: History of Earth

Formation of the Earth: formation and composition of core, mantle, crust, atmosphere and hydrosphere; chemical composition of earth; geological time scale and major changes on the earth's surface; holocene and the emergence of humans, role of humans in shaping landscapes; development of cultural landscapes.

Unit 2: Earth system processes

Movement of lithosphere plates; mantle convection and plate tectonics, major plates and hot spots, plate boundaries; sea floor spread; earthquakes; volcanic activities; orogeny; continental drift, Pangaea and present-day continents, paleontological evidences of plate tectonics; continental collision and mountain formation with specific example of the Himalaya.

Unit 3: Minerals and rocks

Minerals and important rock forming minerals; rock cycle: lithification and metamorphism; Three rock laws; rock structure, igneous, sedimentary and metamorphic rocks; weathering: physical, biogeochemical processes; erosion: physical processes of erosion, factors affecting erosion; agents of erosion: rivers and streams, glacial and aeolian transportation and deposition of sediments by running water, wind and glaciers.

Unit 4: Earth surface processes

Atmosphere: evolution of earth's atmosphere, composition of atmosphere, physical and optical properties, circulation; interfaces: atmosphere–ocean interface, atmosphere–land interface, ocean–land interface; land surface processes: fluvial and glacial processes, rivers and geomorphology; types of glaciers, glacier dynamics, erosional and depositional processes and glaciated landscapes; coastal processes.

Unit 5: Importance of being a mountain

Formation of Peninsular Indian mountain systems - Western and Eastern Ghats, Vindhyas, Aravallis, etc. Formation of the Himalaya; development of glaciers, perennial river systems and evolution of monsoon in Indian subcontinent; formation of Indo-Gangetic Plains.

Practical:

- Hand specimen: rocks and minerals.
- Microscopic studies of thin section of rock and minerals.
- Topographical sheet interpretation.

Suggested Readings

1. Bridge, J., & Demicco, R. 2008. *Earth Surface Processes, Landforms and Sediment deposits*. Cambridge University Press.
2. Duff, P. M. D., & Duff, D. (Eds.). 1993. *Holmes' Principles of Physical Geology*. Taylor & Francis.
3. Gupta, A. K., Anderson, D. M., & Overpeck, J. T. 2003. Abrupt changes in the Asian southwest monsoon during the Holocene and their links to the North Atlantic Ocean. *Nature* **421**: 354-357.
4. Gupta, A. K., Anderson, D. M., Pandey, D. N., & Singhvi, A. K. 2006. Adaptation and human migration, and evidence of agriculture coincident with changes in the Indian summer monsoon during the Holocene. *Current Science* **90**: 1082-1090.
5. Keller, E. A. 2011. *Introduction to Environmental Geology* (5th edition). Pearson Prentice Hall.
6. Krishnan, M. S. 1982. *Geology of India and Burma*. CBS Publishers & Distributors.
7. Leeder, M., Arlucea, M. P. 2005. *Physical Processes in Earth and Environmental Sciences*. Blackwell Publishing.
8. Pelletier, J. D. 2008. *Quantitative Modeling of Earth Surface Processes* (Vol. 304). Cambridge: Cambridge University Press. Chicago.

CORE COURSE 02: (Code: UG-ENVS-H-CC-02)
Environmental Chemistry and Environmental Physics

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper aims to build conceptual understanding of students by exposing them to the basic principles behind various environmental processes. The paper has been divided into two sections, with the view to introduce students to the concepts of chemistry and physics associated with particle movement, chemical processes and pollutant chemistry.

UG-ENVS-H-CC-L -02

CREDITS: 4; Lectures-60

Unit 1: Fundamentals of environmental chemistry

Atomic structure, electronic configuration, periodic properties of elements (ionization potential, electron affinity and electronegativity), types of chemical bonds (ionic, covalent, coordinate and hydrogen bonds), mole concept, molarity and normality, quantitative volumetric analysis.

Thermodynamic system; types of chemical & reactions products; solutes and solvents; redox reactions, concepts of pH equation, electrochemical cells.

Basic concepts of organic chemistry, hydrocarbons, aliphatic and aromatic compounds, organic functional groups, polarity of the functional groups, xenobiotic compounds like pesticides and dyes, synthetic polymers.

Unit 2: Atmospheric chemistry

Composition of atmosphere; photochemical reactions in atmosphere; smog formation, types of smog (sulphur smog and photochemical smog), aerosols; chemistry of acid rain, case studies; reactions of NO₂ and SO₂; free radicals and ozone layer depletion, role of CFCs in ozone depletion.

Unit 3: Water chemistry

Chemical and physical properties of water; water quality parameters (physical, chemical & biological), heavy metal in water, solubility of metals, complex formation and chelation; colloidal particles; water quality monitoring.

Unit 4: Soil chemistry

Soil composition; relation between organic carbon and organic matter, inorganic and organic components in soil; soil humus; cation and anion exchange reactions in soil; nitrogen, phosphorus and potassium in soil; phenolic compounds in soil; soil quality monitoring.

Unit 5: Fundamentals of environmental physics

Basic concepts of light and matter; quantum mechanics (relation between energy, wavelength and frequency), black body radiation, Kirchhoff's law, Boltzmann equation, spectroscopic concepts: Introduction to the concept of absorption and transmission of light, Beer-Lambert law, photovoltaic and solar cells; scattering of light, Rayleigh and Mie scattering.

Basic concepts of pressure, force, work and energy; types of forces and their relation (pressure gradient, viscous, Coriolis, gravitational, centripetal, and centrifugal force); concept of heat transfer, conduction, convection; concept of temperature, lapse rate (dry and moist adiabatic); laws of thermodynamics; concept of heat and work, Carnot engine, transmission of electrical power, efficiency of turbines, wind mills and hydroelectric power plants.

Unit 6: Movement of pollutants in environment

Diffusion and dispersion, point and area source pollutants, pollutant dispersal; Gaussian plume model, mixing heights, hydraulic potential, Darcy's equation, types of flow, turbulence.

UG-ENVS-H-CC-P -02

CREDITS: 2

Practical:

- Preparation of primary and secondary standard solutions.
- Estimation of metals using standard potassium dichromate/ potassium permanganate solution.
- Measurement of physicochemical parameters of soil and water samples (pH, conductivity, hardness, alkalinity), soil organic matter.
- Field visit to renewable/ non-renewable energy plants.

Suggested Readings

1. Beard, J. M. 2013. *Environmental Chemistry in Society* (2nd edition). CRC Press.
2. Boeker, E. & Grondelle, R. 2011. *Environmental Physics: Sustainable Energy and Climate Change*. Wiley.
3. Connell, D. W. 2005. *Basic Concepts of Environmental Chemistry* (2nd edition). CRC Press.
4. Forinash, K. 2010. *Foundation of Environmental Physics*. Island Press.
5. Girard, J. 2013. *Principles of Environmental Chemistry* (3rd edition). Jones & Bartlett.
6. Harnung, S. E. & Johnson, M.S. 2012. *Chemistry and the Environment*. Cambridge University Press.
7. Hites, R. A. 2012. *Elements of Environmental Chemistry* (2nd edition). Wiley & Sons.
8. Manahan, S. E. 2000. *Fundamentals of Environmental Chemistry*. CRC Press.
9. Pani, B. 2007. *Textbook of Environmental Chemistry*. IK international Publishing House.

GENERIC ELECTIVE 01 (Code: UG-ENVS-H-GE-01)

ENVIRONMENT AND SOCIETY

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: The course examines the relationship between the environment and society enabling the students to understand and appreciate the role played by environment, society, and, their interface in shaping environmental decisions. The students will be enabled to think critically on environmental issues.

UG-ENVS-H-GE-L-01

CREDITS: 4; Lectures-60

Unit 1: Introduction

Social and cultural construction of 'environment'; environmental thought from historical and contemporary perspective in light of the concepts of Gross Net Happiness and Aldo Leopold's Land Ethic.

Unit 2: Issues in environmentalism

Significant global environmental issues such as acid rain, climate change, and resource depletion; historical developments in cultural, social and economic issues related to land, forest, and water management in a global context; interface between environment and society.

Unit 3: Development-environment conflict

Developmental issues and related impacts such as ecological degradation; environmental pollution; development-induced displacement, resettlement, and rehabilitation: problems, concerns, and compensative mechanisms; discussion on Project Affected People (PAPs).

Unit 4: Urbanization and environment

Production and consumption oriented approaches to environmental issues in Indian as well as global context; impact of industry and technology on environment; urban sprawl, traffic congestion and social-economic problems.

Unit 5: Environment and social inequalities

Inequalities of race, class, gender, region, and nation-state in access to healthy and safe environments; history and politics surrounding environmental, ecological and social justice; environmental ethics, issues and possible solutions.

Unit 6: Regulatory framework

Brief account of Forest Conservation Act 1980, 1988; Forest Dwellers Act 2008; Land Acquisition Act 1894, 2007, 2011, 2012; Land Acquisition Rehabilitation and Resettlement Act 2013.

Unit 7: Community participation

State, corporate, civil society, community, and individual-level initiatives to ensure sustainable development; case studies of environmental movements (Appiko Movement, Chipko Movement, Narmada Bachao Andolan); corporate responsibility movement; appropriate technology movement; environmental groups and movements, citizen groups; role played by NGOs; environmental education and awareness.

Practical: Field survey based analysis, exercise and interpretation:

- Interactive session with community for awareness development and survey documentation (Socio-economic/socio cultural/ and other environmental perspectives).

Suggested Readings

1. Chokkan, K. B., Pandya, H. & Raghunathan, H. (eds). 2004. *Understanding Environment*. Sagar Publication India Pvt. Ltd., New Delhi.
2. Robbins, P, J Hintz & SA Moore. 2014. *Environment and Society*. Wiley Blackwell.
3. Elliot, D. 2003. *Energy, Society and Environment, Technology for a Sustainable Future*. Routledge Press.
4. Guha, R. 1989. *Ecological change and peasant resistance in the Himalaya*. Unquiet Woods, Oxford University Press, Delhi.
5. Leopold, A. 1949. *The Land Ethic*. pp. 201-214. Chicago, USA.
6. National Research Council (NRC). 1996. *Linking Science and Technology to Society's Environmental Goals*. National Academy Press.
7. Pandit, M. K. 2013. Chipko: Failure of a Successful Conservation Movement. In: Sodhi, N. S., Gibson, L. & Raven, P. H. *Conservation Biology: Voices from the Tropics*. pp. 126-127. Wiley-Blackwell, Oxford, UK.

CORE COURSE 03 (Code: UG-ENVS-H-CC-03)

WATER AND WATER RESOURCES

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: The paper introduces students to the hydrological cycle, properties of water, physico-chemical and biological water quality assessment and indices, types of water resources, their use and management. It will also highlight the problems associated with water shortages in India and familiarizes students with case studies on international and national conflicts on water.

UG-ENVS-H-CC-L -03

CREDITS: 4; Lectures-60

Unit 1: Introduction

Sources and types of water; hydrological cycle; precipitation, runoff, infiltration, evaporation, evapotranspiration; classification of water resources (oceans, rivers, lakes and wetlands).

Unit 2: Properties of water

Physical: temperature, colour, odour, total dissolved solids and total suspended solids; Chemical: major inorganic and organic constituents, dissolved gases, DO, COD, BOD, acidity and alkalinity, electrical conductivity, sodium adsorption ratio; Biological: phytoplankton, phytobenthos, zooplankton, macro-invertebrates and microbes.

Unit 3: Surface and subsurface water

Introduction to surface and ground water; surface and ground water pollution; water table; vertical distribution of water; formation and properties of aquifers; techniques for ground water recharge; river structure and patterns; watershed and drainage basins; importance of watershed and watershed management; rain water harvesting in urban settings.

Unit 4: Wetlands and their management

Definition of a wetland; types of wetlands (fresh water and marine); ecological significance of wetlands; threats to wetlands; wetland conservation and management; Ramsar Convention, 1971; major wetlands of India.

Unit 5: Marine resource management

Marine resources; commercial use of marine resources; threats to marine ecosystems and resources; marine ecosystem and resource management (planning approach, construction techniques and monitoring of coastal zones).

Unit 6: Water resource in India

Demand for water (agriculture, industrial, domestic); overuse and depletion of surface and ground water resources; water quality standards in India; hot spots of surface water; role of state in water resource management.

Unit 7: Water resource conflicts

Water resources and sharing problems, case studies on Kaveri and Krishna river water disputes; Multi-purpose river valley projects in India and their environmental and social impacts; case studies of dams.

- Narmada and Tehri dam – social and ecological losses versus economic benefits; International conflicts on water sharing between India and her neighbours; agreements to resolve these conflicts.

Unit 8: Major laws and treaties

National water policy; water pollution (control and prevention) Act 1972; Indus water treaty; Ganges water treaty; Teesta water treaty; National River linking plan: ecological and economic impacts.

UG-ENVS-H-CC-P -03

CREDITS: 2

Practical:

- Field study related to rainwater harvesting / groundwater wells and document preparation.
- Field visit to wetland and document preparation.
- Water demand in domestic/ agricultural fields/ industrial areas through preparation of survey sheets followed by documentation.

Suggested Readings

1. Bansil, P. C. 2004. *Water Management in India*. Concept Publishing Company, India.
2. Brebbia, C. A. 2013. *Water Resources Management VII*. WIT Press.
3. CEA. 2011. *Water Resources and Power Maps of India*. Central Board of Irrigation & Power.
4. Grumbine, R. E. & Pandit, M. K. 2013. Threats from India's Himalaya dams. *Science* 339: 36-37.
5. Loucks, D. P., Stedinger, J. R. & Haith, D. A. 1981. *Water Resource Systems Planning and Analysis*. Englewood Cliffs, NJ, Prentice Hall.
6. Mays, L.W. 2006. *Water Resources Sustainability*. The McGraw-Hill Publications.
7. Schward & Zhang, 2003. *Fundamentals of Groundwater*. John Willey and Sons.
8. Souvorov, A. V. 1999. *Marine Ecologonomics: The Ecology and Economics of Marine Natural Resource Management*. Elsevier Publications.
9. Vickers, A. 2001. *Handbook of Water Use and Conservation*. Water Plow Press.

CORE COURSE 4 (Code: UG-ENVS-H-CC-04)
LAND AND SOIL CONSERVATION AND MANAGEMENT

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper introduces students to the fundamentals of land and soil degradation. Each unit covers a range of topics, which will help students develop basic understanding of properties of soil and how the quality of land and soil degrades due to anthropogenic activities.

UG-ENVS-H-CC-L -04

CREDITS: 4; Lectures-60

Unit 1: Introduction

Land as a resource, soil health; ecological and economic importance of soil; types and causes of soil degradation; impact of soil loss and soil degradation on agriculture and food security; need for soil conservation and restoration of soil fertility.

Unit 2: Fundamentals of soil science

Soil formation; classification of soil; soil architecture; physical properties of soil; soil texture; soil water holding capacity; soil temperature; soil colloids; soil acidity and alkalinity; soil salinity and sodicity; soil organic matter; micronutrients of soil; nitrogen, sulphur, potassium and phosphorus economy of soil; soil biodiversity.

Unit 3: Soil degradation - causes

Soil resistance and resilience; nature and types of soil erosion; non-erosive and erosive soil degradation; losses of soil moisture and its regulation; nutrient depletion; soil pollution due to mining and mineral extraction, industrial and urban development, toxic organic chemicals, and organic contaminants in soils; fertilizers and fertilizer management; recycling of soil nutrients.

Unit 4: Landuse changes and land degradation

Land resources: types and evaluation; biological and physical phenomena in land degradation; visual indicators of land degradation; drivers of land degradation - deforestation, desertification; habitat loss, loss of biodiversity; range land degradation; land salinization; drivers of land use and land cover change in major geographic zones and biodiverse regions with particular reference to the Himalaya and the Western Ghats.

Unit 5: Costs of land degradation

Economic valuation of land degradation; onsite and offsite costs of land degradation; loss of ecosystem services; effects on farming communities; effects on food security; effects on nutrient cycles; future effects of soil degradation; emerging threats of land degradation to developing countries.

Unit 6: Controlling land degradation

Sustainable land use planning; role of databases and data analysis in land use planning control and management; land tenure and land policy; legal, institutional and sociological factors; participatory land degradation assessment; integrating land degradation assessment into conservation.

Practical:

- Determination of soil organic matter, nutrients (N, P, K), Soil water holding capacity, Soil texture analysis.
- Soil profile study.
- Identification of degraded land using remote sensing data and topographical sheets.

Suggested Readings

1. Brady, N. C. & Well, R. R. 2007. *The Nature and Properties of Soils* (13th edition), Pearson Education Inc.
2. Gadgil, M. 1993. Biodiversity and India's degraded lands. *Ambio* 22: 167-172.
3. Johnson, D. L. 2006. *Land Degradation* (2nd edition). Rowman & Littlefield Publishers.
4. Marsh, W. M. & Dozier, J. 1983. *Landscape Planning: Environmental Applications*. John Wiley and Sons.
5. Oldeman, L. R. 1994. The global extent of soil degradation. *Soil resilience and sustainable land use*, 9. (http://library.wur.nl/isric/fulltext/isricu_i26803_001.pdf).
6. Pandit, M. K. et. al. 2007. Unreported yet massive deforestation driving loss of endemic biodiversity in Indian Himalaya. *Biodiversity Conservation* 16: 153-163.
7. Pandit, M. K. & Kumar, V. 2013. Land use and conservation challenges in Himalaya: Past, present and future. In: Sodhi, N. S., Gibson, L. & Raven, P. H. *Conservation Biology: Voices From the Tropics*. pp. 123-133. Wiley-Blackwell, Oxford, UK.
([file:///Users/mkpandit/Downloads/Raven%20et%20al.%202013.%20CB%20Voices%20from%20Tropics%20\(2\).pdf](file:///Users/mkpandit/Downloads/Raven%20et%20al.%202013.%20CB%20Voices%20from%20Tropics%20(2).pdf)).
8. Peterson, G. D., Cumming, G. S. & Carpenter, S. R. 2003. Scenario planning: a tool for conservation in an uncertain world. *Conservation Biology* 17: 358-366.
9. Scherr, S. J. 1999. *Soil degradation: A threat to developing-country food security by 2020?* (Vol. 27). International Food Policy Research Institute.

GENERIC ELECTIVE 02 (Code: UG-ENVS-H-GE-02)

WILDLIFE MANAGEMENT

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper deals with the conflicts that have arisen as a result of shrinkage of wildlife habitats and the same being shared by human communities. It raises questions about the moral obligations of humans, need for conservation, and social impacts of conflicts. The paper aims at introducing the students to the scientific and social perspective of conservation.

UG-ENVS-H-GE-L -02

CREDITS: 4; Lectures-60

Unit 1: Introduction to wildlife management

Wildlife: Concept and values; wildlife conservation and management; philosophy of wildlife management; why is it necessary to worry about human-wildlife conflicts? What is the role of government, wildlife biologists and social scientists, concept of deep and shallow ecology.

Unit 2: Evolution of the concept of wildlife management

Journey of mankind from predator to conservator; prehistoric association between wildlife and humans: records from Bhimbetka wall paintings; conservation of wildlife in the reign of king Ashoka: excerpts from rock edicts; Bishnoi community; understanding wildlife management, conservation and policies regarding protected areas in 21st century.

Unit 3: Wildlife conservation laws in India

Types of protected areas (Wildlife Sanctuaries, National Parks, Biosphere Reserves); IUCN categories of protected areas, Natural World Heritage sites; concept of core and buffer area in a protected range, brief introduction to Wildlife Protection Act of 1972, Forest Act 1927, Environmental Protection Act 1986, and Forest conservation Act 1920; introduction of Tiger task force, Status of current protected areas in India.

Unit 4: Socio-economic and legal basis of conflicts

Concepts of development and encroachment, who is the intruders: human or animal? Impact of conflict on humans and wildlife, impact of habitat fragmentation, social inequality in terms of forest conservation: luxury hotels within protected areas vs. displacement of native tribes, forest produce as a need vs. forest exploitation, introduction to tribal rights in India, demographic profile of tribes in India, importance of forest produce to tribal populations, Scheduled tribes and other traditional Forest dwellers (Recognition of forest right) Act, 2006.

Unit 5: Wildlife conflicts

Insight into the important conflicts: Keoladeo National park conflict of Bharatpur, Human and elephant conflicts of Kerala, Fisherman and tiger conflict of Sundarbans forest, shifting cultivation in North east India.

Unit 6: Human wildlife coexistence

Symbiotic relationship between tribals and forest, forest and development, focus on the inclusive growth of tribes: community participation in forest management, case study of Chipko movement, sacred groves forests, India's Bishnoi community and their conservation practices; Community participation; Conservation-Development linkages; conservation of indigenous culture and traditions, role of international organizations: Man and Biosphere programmes; concept of conservation reserves and community reserves, importance of wildlife corridors in minimizing the conflicts and conservation.

UG-ENVS-H-GE-P -02

CREDITS: 2

Practical:

- Orientation to field biology and natural history. Observations and collection of study material, wildlife signs and evidences.
- Study and identification of fish and insects commonly used in any study area.
- Visit to wildlife sanctuary/National Park/Biosphere reserve to make an appraisal of the habitat, wildlife profile and threats.
- Visit to Zoo and Museum followed by document preparation.

Suggested Readings

1. Conover, M. 2001. *Resolving Human Wildlife Conflicts*, CRC Press.
2. Dickman, A. J. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. *Animal Conservation* 13: 458-466.
3. Messmer, T. A. 2000. The emergence of human-wildlife conflict management: Turning challenges into opportunities. *International Biodeterioration & Biodegradation* 45: 97-102.
4. Paty, C. 2007. *Forest Government and Tribe*. Concept Publishing Company.
5. Treves, A. & Karanth, K. U. 2003. Human-carnivore conflict and perspectives on carnivore management worldwide. *Conservation Biology* 17: 1491-1499.
6. Woodroffe, R. 2005. *People and Wildlife: Conflict and Coexistence*. Cambridge.
7. Woodroffe, R., Thirgood, S., & Rabinowitz, A. 2005. *People and Wildlife, Conflict or Coexistence?* (No. 9). Cambridge University Press.

CORE COURSE 5 (Code: UG-ENVS-H-CC-05)

ECOLOGY AND ECOSYSTEMS

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper will introduce to the students the basic understanding of ecosystem and its structural and functional aspects. It will explore the interconnectedness among all the biotic and abiotic components of environment and the dynamic nature of the ecological processes in maintaining equilibrium in nature.

UG-ENVS-H-CC-L -05

CREDITS: 4; Lectures-60

Unit 1: Introduction

Basic concepts and definitions: ecology, landscape, habitat, ecozones, biosphere, ecosystems, ecosystem stability, resistance and resilience; autecology; synecology; major terrestrial biomes.

Unit 2: Ecology of individuals

Ecological amplitude; Limiting factors; Liebig's Law of the Minimum; Shelford's Law of Tolerance; phenotypic plasticity; ecotypes; ecoclines; acclimation; ecological niche; types of niche: Eltonian niche, Hutchinsonian niche, fundamental niche, realized niche; niche breadth; niche partitioning; niche differentiation; thermoregulation; strategies of adaptation in plants and animals.

Unit 3: Ecology of populations

Concept of population and meta-population; r- and K-selection; characteristics of population: density, dispersion, natality, mortality, life tables, survivorship curves, age structure; population growth: geometric, exponential, logistic, density-dependent; limits to population growth; deterministic and stochastic models of population dynamics; rudreal, competitive and stress-tolerance strategies.

Unit 4: Ecology of communities

Discrete versus continuum community view; community structure and organization: physiognomy, sociability, species associations, periodicity, biomass, stability, keystone species, ecotone and edge effect; species interactions: mutualism, symbiotic relationships, commensalism, amensalism, proto cooperation, predation, competition, parasitism, mimicry, herbivory; ecological succession: types, processes and models.

Unit 5: Ecosystem ecology

Ecosystem structure and functions; abiotic and biotic components of ecosystem; ecosystem metabolism; primary production and models of energy flow; secondary production and trophic efficiency; ecosystem connections: food chain, food web; models of energy flow; ecological efficiencies; ecological pyramids; ecosystem services; Some model ecosystems: forest, grassland, lentic, lotic, estuarine, marine, desert, wetlands.

Unit 6: Biogeochemical cycles and nutrient cycling

Concepts of pools, flux, turnover time; types of biogeochemical cycles; carbon cycle; nitrogen cycle; phosphorus cycle; sulphur cycle; hydrological cycle; nutrient cycle models; nutrient budget; impact of anthropogenic activities on the nutrient cycles; nutrient conservation strategies.

Unit 7: Biological invasions

Concept of exotics and invasive; natural spread versus man-induced invasions; characteristics of invaders; stages of invasion; mechanisms of invasions; invasive pathways; impacts of invasion on ecosystem and communities; economic costs of biological invasions.

UG-ENVS-H-CC-P -05

CREDITS: 2

Practical:

- Qualitative and quantitative analysis of planktons of aquatic systems.
- Determination of species, dominance and frequency using quadrat/ plot method.
- Determination of dissolved oxygen, free carbon dioxide and primary productivity of water samples collected from aquatic ecosystems.
- Ecological field visit: pond/forest/river/wetland or other ecosystem.

Suggested Readings

1. Odum, E. P. & Barrett, G. W. 2006. Fundamentals of Ecology (Cengage).
2. Molles, M. C. Ecology. 2009, McGraw Hill.
3. Beeby, A. Applied Ecology. Chapman and Hall.
4. Begon, M. Harper, J. L & Townsend, C. R. 2006. Ecology (Blackwell).
5. Smith R. L & Smith, T. M. Ecology and Field Biology. Benjamin Cummings/Addison Wesley.
6. Loreau, M. & Inchausti, P. 2002. *Biodiversity and Ecosystem functioning: Synthesis and Perspectives*. Oxford University Press, Oxford, UK.
7. Dash, M. C. & S. P. Dash, Fundamental of Ecology. Tata Mcgraw Hill Publication.
8. Pimentel, D. (Ed.). 2011. *Biological invasions: Economic and environmental costs of alien plant, animal, and microbe species*. CRC Press.
9. Singh, J. S., Singh, S. P. & Gupta, S. R. 2006. *Ecology, Environment and Resource Conservation*. Anamaya Publications.
10. Santra, S. C. 2010. Fundamentals of Ecology and Environmental Biology, New Central Book Agency.

CORE COURSE 06 (Code: UG-ENVS-H-CC-06)

BIODIVERSITY AND CONSERVATION

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This course is aimed at helping students to understand and appreciate various concepts and issues concerning biodiversity and conservation at local, regional and global levels. The course will attempt at encouraging students to appreciate the paradigm “think globally, act locally” for a sustainable common future of humankind.

UG-ENVS-H-CC-L -06

CREDITS: 4; Lectures-60

Unit 1: Levels of organization in living world

From genes to ecosystems; tree of life; history of character transformation; organic evolution through geographic time scale; species concept – what’s in a name?; how many species are there on earth?; concept and types of speciation.

Unit 2: Biodiversity patterns

Spatial patterns: latitudinal and elevational trends in biodiversity; temporal patterns: seasonal fluctuations in biodiversity patterns; importance of biodiversity patterns in conservation.

Unit 3: Biodiversity estimation

Sampling strategies and surveys: floristic, faunal, and aquatic; qualitative and quantitative methods: scoring, habitat assessment, richness, density, frequency, abundance, evenness, diversity, biomass estimation; community diversity estimation: alpha, beta and gamma diversity; molecular techniques: RAPD, RFLP, AFLP; NCBI database, BLAST analyses.

Unit 4: Importance of biodiversity

Economic values – medicinal plants, drugs, fisheries and livelihoods; ecological services – primary productivity, role in hydrological cycle, biogeochemical cycling; ecosystem services – purification of water and air, nutrient cycling, climate control, pest control, pollination, and formation and protection of soil; social, aesthetic, consumptive, and ethical values of biodiversity.

Unit 5: Threats to biodiversity

Natural and anthropogenic disturbances; habitat loss, habitat degradation, and habitat fragmentation; climate change; pollution; hunting; over-exploitation; deforestation; hydropower development; invasive species; land use changes; overgrazing; man wildlife conflicts; consequences of biodiversity loss; Intermediate Disturbance Hypothesis.

Unit 6: Biodiversity Conservation

In-situ conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries); Ex-situ conservation (botanical gardens, zoological gardens, gene banks, seed and seedling banks, pollen culture, tissue culture and DNA banks), role of local communities and traditional knowledge in conservation; biodiversity hotspots; IUCN Red List categorization – guidelines, practice and application; Red Data

book; ecological restoration; afforestation; social forestry; agro forestry; joint forest management; role of remote sensing in management of natural resources.

Unit 7: Biodiversity in India

India as a mega diversity nation; phytogeographic and zoogeographic zones of the country; forest types and forest cover in India; fish and fisheries of India; impact of hydropower development on biological diversity; status of protected areas and biosphere reserves in the country; National Biodiversity Action Plan. Biological diversity Act & rule (2002/ 2004) implementation status.

UG-ENVS-H-CC-P -06

CREDITS: 2

Practical:

Biodiversity measurement techniques: Biodiversity richness and diversity indexes.

- IUCN red list categorisation- Guideline criteria.
- Eco restoration – site visit.

Suggested Readings

1. Gaston, K. J. & Spicer, J. I. 1998. *Biodiversity: An Introduction*. Blackwell Science, London, UK.
2. Krishnamurthy, K. V. 2004. *An Advanced Text Book of Biodiversity - Principles and Practices*. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
3. Jeffries, M. J. 2006. *Biodiversity and Conservation*. Routledge.
4. Singh, J. S. & Singh, S. P. 1987. Forest vegetation of the Himalaya. *The Botanical Review* 53: 80-192.
5. Singh, J. S., Singh, S. P. & Gupta, S. 2006. *Ecology, Environment and Resource Conservation*. Anamaya Publications, New Delhi.
6. Sodhi, N. S. & Ehrlich, P. R. (Eds). 2010. *Conservation Biology for All*. Oxford University Press.
7. Sodhi, N. S., Gibson, L. & Raven, P. H. 2013. *Conservation Biology: Voices from the Tropics*. Wiley-Blackwell, Oxford, UK.
8. Maity, P. K. and Maity, P. 2011. *Biodiversity – Perception, Peril & Preservation*. PHI.

CORE COURSE 07 (Code: UG-ENVS-H-CC-07)
ATMOSPHERE AND GLOBAL CLIMATE CHANGE

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: The paper deals with dynamics of atmospheric processes, which include its composition, meteorological phenomena and atmospheric chemistry. The paper also highlights the anthropogenic intervention in ‘anthropocene’, which has led to global climate change. The paper also explores effects of global changes on human communities and initiatives taken at global and regional levels to combat them.

UG-ENVS-H-CC-L -07

CREDITS: 4; Lectures-60

Unit 1: Fundamentals of atmospheric chemistry

Atmospheric structure and composition, Milankovitch cycles. Chemistry of atmospheric particles and gases; smog – types and processes; photochemical processes; ions and radicals in atmosphere; acid-base reactions in atmosphere; atmospheric water; role of hydroxyl and hydroperoxyl radicals in atmosphere. Green house gases (GHGs); greenhouse effect; global warming.

Unit 2: Meteorology and atmospheric stability

Meteorological parameters (temperature, relative humidity, wind speed and direction, precipitation); atmospheric stability and mixing heights; temperature inversion; plume behavior; Gaussian plume model.

Movement of air masses; atmosphere and climate; air and sea interaction; southern oscillation; western disturbances; *El Nino* and *La Nina*; tropical cyclone; Indian monsoon and its development, changing monsoon in Holocene in the Indian subcontinent, its impact on agriculture and Indus valley civilization; effect of urbanization on micro climate; Asian brown clouds.

Unit 3: Global warming and climate change

Earth’s climate through ages; trends of global warming and climate change; drivers of global warming and the potential of different green house gases (GHGs) causing the climate change; atmospheric windows; impact of climate change on atmosphere, weather patterns, sea level rise, agricultural productivity and biological responses - range shift of species, CO₂ fertilization and agriculture; impact on economy and spread of human diseases.

Unit 4: Ozone layer depletion

Ozone layer or ozone shield; importance of ozone layer; ozone layer depletion and causes; Chapman cycle; process of spring time ozone depletion over Antarctica; ozone depleting substances (ODS); effects of ozone depletion; mitigation measures and international protocols.

Unit 5: Climate change and policy

Environmental policy debate; International agreements; Montreal protocol 1987; Kyoto protocol 1997; Convention on Climate Change; carbon credit and carbon trading; clean development mechanism.

Practical:

- Preparation of meteorological charts, graphs and windrose,
- Handling of meteorological data recording instruments (Rain gauge, Anemometer, wet bulb dry bulb thermometer, Barometer) and their uses.
- Field visit to meteorological centre.

Suggested Readings:

1. Barry, R. G. 2003. *Atmosphere, Weather and Climate*. Routledge Press, UK.
2. Gillespie, A. 2006. *Climate Change, Ozone Depletion and Air Pollution: Legal Commentaries with Policy and Science Considerations*. Martinus Nijhoff Publishers.
3. Hardy, J. T. 2003. *Climate Change: Causes, Effects and Solutions*. John Wiley & Sons.
4. Harvey, D. 2000. *Climate and Global Climate Change*. Prentice Hall.
5. Manahan, S. E. 2010. *Environmental Chemistry*. CRC Press, Taylor and Francis Group.
6. Maslin, M. 2014. *Climate Change: A Very Short Introduction*. Oxford Publications.
7. Mathez, E. A. 2009. *Climate Change: The Science of Global Warming and our Energy Future*. Columbia University Press.
8. Mitra, A. P., Sharma, S., Bhattacharya, S., Garg, A., Devotta, S. & Sen, K. 2004. *Climate Change and India*. Universities Press, India.
9. Philander, S. G. 2012. *Encyclopedia of Global Warming and Climate Change* (2nd edition). Sage Publications.

SKILL ENHANCEMENT COURSE 01 (Code: UG-ENVS-H- SEC-01a)
REMOTE SENSING, GEOGRAPHIC INFORMATION SYSTEM & MODELLING

FULL MARKS: 50, CREDITS: 2

Preamble: This course introduces the students to various computer-based and statistical methods used for study and management of natural resources and the environment. The students are expected to learn about remote-sensing techniques, physical principles, sampling, statistics and image-analysis methods.

Unit 1: Remote Sensing: definitions and principles; electromagnetic (EME) spectrum; interaction of EMR with Earth's surface; spectral signature; satellites and sensors; aerial photography and image interpretation.

Unit 2: Geographical Information Systems: definitions and components; spatial and non-spatial data; raster and vector data; database generation; database management system; land use/ land cover mapping; overview of GIS software packages; GPS survey, data import, processing, and mapping.

Unit 3: Applications and case studies of remote sensing and GIS in geosciences, water resource management, land use planning, forest resources, agriculture, marine and atmospheric studies.

Unit 4: Basic elements of statistical analyses: sampling; types of distribution – normal, binomial, poisson; measurements of central tendency and dispersion; skewness; kurtosis; hypothesis testing; parametric and non-parametric tests; correlation and regression; curve fitting; analysis of variance.

Unit 5: Demonstrative exercise

- Visual interpretation of standard False Colour Composite (FCC) data.
- Thematic map generation.
- Digitisation of thematic layer.
- Overlay analysis of thematic layer in GIS environment.
- GIS laboratory visit.

Suggested Readings

1. Zar, J. H. 2010. *Biostatistical Analysis* (5th edition). Prentice Hall Publications.
2. Edmondson, A. & Druce, D.1996. *Advanced Biology Statistics*. Oxford University Press.
3. Demers, M. N. 2005. *Fundamentals of Geographic Information System*. Wiley & Sons.
4. Richards, J. A. & Jia, X. 1999. *Remote Sensing and Digital Image Processing*. Springer.
5. Sabins, F. F. 1996. *Remote Sensing: Principles an Interpretation*. W. H. Freeman.

-OR-

SKILL ENHANCEMENT COURSE 01: (Code: UG-ENVS-H- SEC- 01b)

OCCUPATIONAL HEALTH AND ENVIRONMENTAL SAFETY

FULL MARKS: 50, CREDITS: 2

Preamble: This course introduces the students to acquire knowledge about various occupational diseases and safety measures with particular attention to accident prevention in work place, safety education and training.

Unit 1: Introduction

Concept of occupational health and diseases: Occupation related diseases, mode, effects, risk, diagnosis and methods of prevention.

Unit 2: Occupational health hazards and devices

Evaluation of injuries: Medical services in industrial establishment, its function, action programs for work related diseases at the national level.

Personal Protective Equipment: Introduction, requirements and assessment of PPE, types of PPE.

Non-respiratory personal protective devices; head, ear, face and eye protection, feet and body protection, supply, use, care and maintenance of PPE, requirements under factory Acts and Rules. Respiratory PPE: Types of respiratory PPE, supply, use, care and maintenance of breathing apparatus, training for the use of breathing apparatus.

Unit 3: Introduction to Environmental Safety

Environmental Safety: Safety awareness, annual toll of industrial accidents in India, need for safety, legal, humanitarian factors impending safety, safety audit.

Health concern for workers of textile, dye, bidi making and brick kiln factory/industry.

Unit 4: Principles of accident prevention

Definition of accidents: injury, types of accidents, causes and remedial measures, injury records, prevention, modes of prevention, physiological factors.

Unit 5: Safety education and training

Assessment of training needs, design and developments of training program.

Unit 6: Demonstrative exercise

- Industry/factory visit to assess the safety measures adopted for the workers in textile, dye, bidi making and brick kiln factory/industry and fire.
- Occupational health study of small scale industry workers through survey and documentation.

Suggested Readings

1. Reese, C. D., 2015. *Occupational health and safety management: a practical approach*. CRC press.
2. Friis, R. H., 2015. *Occupational health and safety for the 21st century*. Jones & Bartlett Publishers.

3. Erickson, P. A., 1996. *Practical guide to occupational health and safety*. Elsevier.
- Greenberg, M. I., 2003. *Occupational, industrial, and environmental toxicology*. Elsevier Health Sciences.
4. Greenberg, M. I. *Occupational industrial and environmental toxicology*.

GENERIC ELECTIVE 03 (Code: UG-ENVS-H-GE -03)

GENDER AND ENVIRONMENT

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: The paper is designed to expose students to the concept of gender in society and its relevance in the environmental context. The principal objective of the course is to enable students to examine environmental issues from a gender-sensitized perspective.

UG-ENVS-H-GE-L -03

CREDITS: 4; Lectures-60

Unit 1: Introduction

The socially constructed 'gender' concept.

Unit 2: Gender and society

Gender existence in society; gender: matriarchy and patriarchy as means of social exclusion (case studies in an Indian context); gender equity issues in rural and urban settings.

Unit 3: Gender and the environment

Relevance of the concept in an environmental context; evolution of gender hierarchies in historical and contemporary perspective; gendered division of roles in cultural, social and economic perspective; gender inequalities. Knowledge about the environment among men and women; differential dependencies on environmental resources; implications of gendered responses to environmental degradation.

Unit 4: Gender and environmental management

Women's participation in environmental movements and conservation; historical and contemporary case studies; role of women in environmental education, awareness and sustainable development. Instruments for change: education, media, action groups, policy and management; equity in resource availability and consumption for a sustainable future.

UG-ENVS-H-GE-P -03

CREDITS: 2

Practical: Field survey based analysis, exercise and interpretation

- Assignment on gender/environment: gender equity issues in rural and urban society.
- Field visit and evaluation of gendered responses to environmental degradation.

Suggested Readings

1. Agarwal, B. 1992. *The Gender and Environment Debate: Lessons from India*. Feminist Studies (Minnesota).
2. Agarwal, B. 1997. Gender, Environment and Poverty Interlinks: Regional Variations and Temporal Shifts in Rural India: 1971-1991. *World Development* 25: 1-42.

3. Agarwal, B. 2001. Participatory exclusions, community forestry, and gender: An analysis for South Asia and a conceptual framework. *World Development* 29: 1623-1648.
4. Jackson, C. 1993. Doing what comes naturally? Women and environment in development *World Development* 21:1947-63.
5. Krishna, S. 2004. *Livelihood and Gender*. New Delhi, Sage.
6. Leach, M. 2007. Earth Mother myths and other ecofeminist fables: How a strategic notion rose and fell. *Development and Change* 38: 67-85.
7. Miller, B. 1993. *Sex and Gender Hierarchies*. Cambridge University Press.
8. Stein, R. (ed.). 2004. *New Perspectives on Environmental Justice: Gender, Sexuality, and Activism*. Rutgers University Press.
9. Steingraber, S. 1998. *Living Downstream: A Scientist's Personal Investigation of Cancer and the Environment*. New York: Vintage Books.
10. Zwartveen, M. Z. 1995. *Linking women to the main canal: Gender and irrigation management*. Gatekeeper Series 54, IIED.

CORE COURSE 08 (Code: UG-ENVS-H-CC-08)

BIO-SYSTEMATICS AND BIOGEOGRAPHY

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This course will discuss principles and applications of classical and modern day systematics to classification of living organisms, develop understanding of historical and contemporary patterns of distributions of organisms, and design effective conservation strategies using biogeographic theories in an era of global change and large scale human induced degradation.

UG-ENVS-H-CC-L -08

CREDITS: 4; Lectures-60

Unit 1: Biosystematics - Concept and approaches

Definition of biosystematics; taxonomic identification; keys; field inventory; herbarium; museum; botanical gardens; taxonomic literature; nomenclature; evidence from anatomy, palynology, ultrastructure, cytology, phytochemistry, numerical and molecular methods; taxonomy databases.

Unit 2: Taxonomic hierarchy

Concept of taxa (species, genus, family, order, class, phylum, kingdom); concept of species (taxonomic, typological, biological, evolutionary, phylogenetic); categories and taxonomic hierarchy.

Unit 3: Nomenclature and systems of classification

Principles and rules (International Code of Botanical and Zoological Nomenclature); ranks and names; types and typification; author citation; valid publication; rejection of names; principle of priority and its limitations; names of hybrids; classification systems of Bentham and Hooker; Angiosperm Phylogeny Group (APG III) classification.

Unit 4: Numerical and molecular systematics

Characters; variations; operational taxonomic units; character weighting and coding; phenograms; cladograms; DNA barcoding; phylogenetic tree (rooted, unrooted, ultrametric trees).

Unit 5: Biogeography- An overview

Earth's history; paleo-records of diversity and diversification; continental drift and plate tectonics and their role in biogeographic patterns – past and present; biogeographical dynamics of climate change and Ice Age. Genes as unit of evolutionary change; mutation; genetic drift; gene flow; natural selection; geographic and ecological variation; biogeographical rules – Gloger's rule, Bergmann's rule, Allen's rule, Geist rule; biogeographical realms and their fauna; endemic, rare, exotic, and cosmopolitan species. Types and processes of speciation – allopatric, parapatric, sympatric; ecological diversification; adaptive radiation, convergent and parallel evolution; dispersal and immigration; means of dispersal and barriers to dispersal; extinction.

Unit 6: Conservation Biogeography

Application of biogeographical rules in design of protected area and biosphere reserves; use of remote sensing in conservational planning.

Practical:

- Demonstration of typification procedure.
- Field visit for floral and faunal assessment of an area.
- Criteria used for designation of a protected area- preparation of worksheet.
- Study of invasive species distribution and documentation.

Suggested Readings

1. Lomolino, M. V., Riddle, B. R., Whittaker, R. J. & Brown, J. H. 2010. *Biogeography* (4th edition). Sinauer Associates, Sunderland.
2. Mani, M. S. 1974. *Ecology and Biogeography in India*. Dr. W Junk Publishers. The Hague.
3. Singh, G. 2012. *Plant Systematics: Theory and Practice* (3rd edition). Oxford & IBH Pvt. Ltd., New Delhi.
4. Wheeler, Q. D. & Meier R. 2000. *Species Concepts and Phylogenetic Theory: A Debate*. Columbia University Press, New York.
5. Williams, D. M., Ebach, M. C. 2008. *Foundations of Systematics and Biogeography*. Springer.

CORE COURSE 09 (Code: UG-ENVS-H-CC-09)

NATURAL RESOURCE MANAGEMENT AND SUSTAINABILITY

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper takes an objective view of the nature of Earth's resources, their generation, extraction and impact of human activities on earth's environment. The students are expected to understand effective management strategies. It aims to provide an idea of effective management strategies and a critical insight of the major sustainability issues.

UG-ENVS-H-CC-L -09

CREDITS: 4; Lectures-60

Unit 1: Introduction

Resource and reserves; classification of natural resources; renewable and non-renewable resources; resource degradation; resource conservation; resource availability and factors influencing its availability; land resources; water resources; fisheries and other marine resources; energy resources; mineral resources; human impact on natural resources; ecological, social and economic dimension of resource management.

Unit 2: Natural resources and conservation

Water resources: supply, renewal, and use of water resources, freshwater shortages, strategies of water conservation; soil resources: importance of soil, soil conservation strategies; food resources: world food problem, techniques to increase world food production, green revolution. Forest resources: economic and ecological importance of forests, forest management strategies, sustainable forestry. Mineral resources and the rock cycle; identified resources; undiscovered resources; reserves; types of mining: surface, subsurface, open-pit, dredging, strip; reserve-to-production ratio; global consumption patterns of mineral resources techniques to increase mineral resource supplies; ocean mining for mineral resources; environmental effects of extracting and using mineral resources.

Unit 3: Energy resources-Non-renewable & Renewable

Oil: formation, exploration, extraction and processing, oil shale, tar sands; natural gas: exploration, liquefied petroleum gas, liquefied natural gas; coal: reserves, classification, formation, extraction, processing, coal gasification; environmental impacts of non renewable energy consumption; impact of energy consumption on global economy; application of green technology; future energy options and challenges.

Energy efficiency; life cycle cost; cogeneration; solar energy: technology, advantages, passive and active solar heating system, solar thermal systems, solar cells, JNN solar mission; hydropower: technology, potential, operational costs, benefits of hydropower development; nuclear power: nuclear fission, fusion, reactors, pros and cons of nuclear power, storage of radioactive waste, radioactive contamination; tidal energy; wave energy; ocean thermal energy conversion (OTEC); geothermal energy; energy from biomass; bio-diesel.

Unit 4: Resource management

Approaches in resource management: ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies; concept of sustainability science: different approach towards sustainable development and its different constituents; sustainability of society, resources and framework; sustainable energy strategy; principles of energy conservation; Indian renewable energy programme.

UG-ENVS-H-CC-P -09

CREDITS: 2

Practical:

- Forest area mapping techniques.
- Water bodies mapping techniques.
- Water audit of college/ industry.
- Energy audit of college/ industry.
- Environmental audit of college.
- Visit to mine area, forest area and aquaculture farm.

Suggested Readings

1. Ginley, D. S. & Cahen, D. 2011. *Fundamentals of Materials for Energy and Environmental Sustainability*. Cambridge University Press.
2. Klee, G. A. 1991. *Conservation of Natural Resources*. Prentice Hall Publication.
3. Miller, T. G. 2012. *Environmental Science*. Wadsworth Publishing Co.
4. Owen, O. S, Chiras, D. D, & Reganold, J. P. 1998. *Natural Resource Conservation – Management for Sustainable Future* (7th edition). Prentice Hall.
5. Ramade, F. 1984. *Ecology of Natural Resources*. John Wiley & Sons Ltd.

CORE COURSE 10 (Code: UG-ENVS-H-CC-10)
ENVIRONMENTAL POLLUTION AND HUMAN HEALTH

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper deals with different aspects of environmental contamination, which have adverse effects on human health. It will lay emphasis on understanding mechanisms of pollutants impacting human health by developing an understanding of different types of pollutants, their sources and mitigation measures. The students will also be introduced to the concept of permissible limits.

UG-ENVS-H-CC-L -10

CREDITS: 4; Lectures-60

Unit 1: Introduction

Definition of pollution; pollutants; classification of pollutants.

Unit 2: Air pollution

Ambient air quality: monitoring and standards (National Ambient Air Quality Standards of India); air quality index; sources and types of pollutants (primary and secondary); smog (case study); effects of different pollutants on human health (NO_x, SO_x, PM, CO, CO₂, hydrocarbons and VOCs) and control measures; indoor air pollution: sources, effects on human health and remedial strategies. Vehicular pollution and control measures.

Unit 3: Water pollution

Sources of surface and ground water pollution; water quality parameters and standards; organic waste and water pollution; eutrophication; water quality monitoring, COD, BOD, DO; effect of water contaminants on human health (nitrate, fluoride, arsenic, chlorine, cadmium, mercury, pesticides); water borne diseases; concept and working of effluent treatment plants (ETPs).

Unit 4: Soil pollution

Causes of soil pollution and degradation; effect of soil pollution on environment, vegetation and other life forms; control strategies.

Unit 5: Noise pollution

Noise pollution – sources; frequency, intensity and permissible ambient noise levels; effect on communication, impacts on life forms and humans - working efficiency, physical and mental health; control measures.

Unit 6: Radioactive and thermal pollution

Radioactive material and sources of radioactive pollution; effect of radiation on human health (somatic and genetic effects); thermal pollution and its effects.

Unit 7: Marine pollution

Marine resources and their importance; sources of marine pollution; oil spill and its effects; coral reefs and their demise; coastal area management; existing challenges and management techniques (planning, construction, environmental monitoring of coastal zones).

Unit 8: Chemistry of environmental pollutants

Solubility of pollutants (hydrophilic and lipophilic pollutants), transfer of pollutants within different mediums, role of chelating agents in transferring pollutants, concept of biotransformation and bioaccumulation, concept of radioactivity, radioactive decay and half-life of pollutants, organometallic compounds, acid mine drainage.

Unit 9: Pollution control

Activated Sludge Process (ASP) – Trickling Filters – oxidation ponds, fluidized bed reactors, membrane bioreactor neutralization, ETP sludge management; digesters, up flow anaerobic sludge blanket reactor, fixed film reactors, sequencing batch reactors, hybrid reactors, bioscrubbers, biotrickling filters; regulatory framework for pollution monitoring and control; case study: Ganga Action Plan; Yamuna Action Plan; implementation of CNG in NCT of Delhi. Application of clean technologies for pollution control.

UG-ENVS-H-CC-P -10

CREDITS: 2

Practical:

- Estimation of Ground & surface water quality parameters (COD, BOD, DO, nitrate, fluoride, arsenic, chlorine, cadmium, mercury, pesticides).
- Estimation of air quality parameters (NO_x, SO_x, SPM).
- Field visit to effluent treatment plants (ETP)/ sewage treatment plants (STP).
- Total coliform load of water sample.
- Noise monitoring (Leq).

Suggested Readings

1. Gurjar, B. R., Molina, L. T. & Ojha C. S. P. 2010. *Air Pollution: Health and Environmental Impacts*. CRC Press, Taylor & Francis.
2. Hester, R. E. & Harrison, R. M. 1998. *Air Pollution and Health*. The Royal Society of Chemistry, UK.
3. Park, K. 2015. *Park's Textbook of Preventive and Social Medicine* (23rd edition). Banarsidas Bhanot Publishers.
4. Pepper, I. L., Gerba, C.P. & Brusseau, M. L. 2006. *Environmental and Pollution Science*. Elsevier Academic Press.
5. Purohit, S. S. & Ranjan, R. 2007. *Ecology, Environment & Pollution*. Agrobios Publications.

6. Vesilind, P. J., Peirce, J. J., & Weiner R. F. 1990. *Environmental Pollution and Control*. Butterworth-Heinemann, USA.

SKILL ENHANCEMENT COURSE 02 (Code: UG-ENVS-H-SEC-02a)

ENVIRONMENTAL IMPACT AND RISK ASSESSMENT

FULL MARKS: 50, CREDITS: 2

Preamble: This course recognizes the growing need of industry to anticipate and incorporate environmental concerns and risks while developing large-scale projects. The course emphasizes on the contemporary tools and techniques to assess various environmental impacts and outlines various management options needed to mitigate these risks.

Unit 1: Environmental impact assessment (EIA): definitions, introduction and concepts; rationale and historical development of EIA; scope and methodologies of EIA; role of project proponents, project developers and consultants; Terms of Reference; impact identification and prediction; baseline data collection; Environmental Impact Statement (EIS), Environmental Management Plan (EMP).

Unit 2: Rapid EIA; Strategic Environmental Assessment; Social Impact Assessment; Cost-Benefit analysis; Life cycle assessment; environmental appraisal; environmental management - principles, problems and strategies; environmental planning; environmental audit; introduction to ISO and ISO 14000; sustainable development.

Unit 3: EIA regulations in India; status of EIA in India; current issues in EIA; case study of hydropower projects/ thermal projects, Environmental audit.

Unit 4: Life cycle assessment (LCA)- concept; Cradle to grave approach; lifecycle inventory of solid waste; role of LCA in waste management; advantage and limitation of LCA; case study on LCA of a product.

Unit 5: Risk assessment: introduction and scope; project planning; exposure assessment; toxicity assessment; hazard identification and assessment; risk characterization; risk communication; environmental monitoring; community involvement; legal and regulatory framework; human and ecological risk assessment.

Unit 6: Demonstrative exercise

- Model EIA preparation- Demonstrative exercise.
- Steps in environmental clearance exercise.
- Model public consultation procedure of a developmental project.

Suggested Readings

1. Barrow, C. J. 2000. *Social Impact Assessment: An Introduction*. Oxford University Press.
2. Glasson, J., Therivel, R., Chadwick, A. 1994. *Introduction to Environmental Impact Assessment*. London, Research Press, UK.
3. Judith, P. 1999. *Handbook of Environmental Impact Assessment*. Blackwell Science.
4. Marriott, B. 1997. *Environmental Impact Assessment: A Practical Guide*. McGraw-Hill, New York, USA.

-OR-

SKILL ENHANCEMENT COURSE 02 (Code: UG-ENVS-H- SEC -02b)
ENVIRONMENTAL QUALITY MONITORING AND ASSESSMENT

FULL MARKS: 50, CREDITS: 02

Preamble: This paper deals with environmental quality monitoring and assessment. An attempt will be made to have a compressive idea about different aspects of environmental contamination, with special emphasis on air, water, soil and noise qualities, perturbation of which may have adverse effects on environmental and human health. It will lay emphasis on understanding mechanisms of pollutants impact on human health by developing an understanding of different types of pollutants, their sources and mitigation measures. The students will also be introduced to the concept of standards and permissible limits.

Unit 1: Concept of environmental quality monitoring viz. physical, chemical and biological methods.

Unit 2: Assessment of water and soil quality parameters, their characterization and control strategies. Water resources-origin of waste water, types of water pollution and their effects, water quality standards (surface and drinking water), basic processes of water and waste water treatment, recovery of material from process effluents, solid and hazardous waste management-sources and classification, public health aspects, methods of collection, disposal methods.

Causes of soil pollution and degradation; effect of soil pollution on environment, vegetation and other life forms; control strategies.

Unit 3: Concept of biomonitoring, bioindicator organisms, biomonitoring of water and soil quality-indicator organism (planktons, worms, molluscs/ soil microbes), biomonitoring of air quality (lichens and higher plants).

Unit 4: Assessment of air and noise quality parameters and their characterization, control strategies.

Sources and effects, behaviour and fate of air pollutions, photochemical smog, collection of gaseous and particulate air pollutants, analysis of air pollutants, SO_x, NO_x, CO, oxidants, ozone, hydrocarbons and particulate matter, air quality index, control of particulate and gaseous emission, ambient air quality standards, auto emission standard and noise quality standards.

Unit 5: Mapping of environmental quality zones, air and water pollution laws and standards, ISO14000.

Unit 6: Demonstrative exercise

- Determination of SPM, NO_x and SO_x from air samples.
- Bio-monitoring of water and soil quality (planktons, soil microbes).
- Determination of chloride, iron, arsenic, nitrate.
- Field survey based on environmental quality zone map preparation of a model area (urban/ rural/ industrial).

Suggested readings:

1. Girard, J. 2013. *Principles of Environmental Chemistry* (3rd edition). Jones & Bartlett.
2. Harnung, S. E. & Johnson, M.S. 2012. *Chemistry and the Environment*. Cambridge University Press.
3. Hites, R. A. 2012. *Elements of Environmental Chemistry* (2nd edition). Wiley & Sons.
4. Manahan, S. E. 2000. *Fundamentals of Environmental Chemistry*. CRC Press.
5. Brady, N.C. and Weil, R.R., 2002. The nature and properties of soils, 13th. *Pearson education (Singapore) Pte. Ltd. Indian Branch, 482*, pp.621-624.
6. Stevenson, F.J. and Cole, M.A., 1999. *Cycles of soils: carbon, nitrogen, phosphorus, sulfur, micronutrients*. John Wiley & Sons.
7. Santra, S. C, Environmental Science.
8. Khopkar, S. M, Environmental Pollution Analysis.
9. G. Brun Wiersma, Environmental Monitoring (CRC press).
10. Burden, F.R., Donnert, D., Godish, T. and McKelvie, ID Editors Environmental Monitoring Handbook. (McGro Hill)
11. E. Layer, Environmental Monitoring.

GENERIC ELECTIVE 04 (Code: UG-ENVS-H-GE-04)

GREEN CHEMISTRY, GREEN TECHNOLOGY AND APPLICATIONS

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper introduces students to the concept of green technology, its goals and advantages. It also highlights potential role of green technologies in realizing the goal of sustainable development and focuses on community participation to tap the economic benefits associated with switching to green technologies.

UG-ENVS-H-GE-L -04

CREDITS: 4; Lectures-60

Unit 1: Introduction

Definition and concepts: green technology, green energy, green infrastructure, green economy, and, green chemistry; sustainable consumption of resources; individual and community level participation such as small-scale composting pits for biodegradable waste, energy conservation; encouraged use of public transport instead of private transport.

Unit 2: Green technologies

Green technologies in historical and contemporary perspectives; successful green technologies: wind turbines, solar panels; 3 R's of green technology: recycle, renew and reduce; paradigm shift from 'cradle to cradle' to 'cradle to grave'.

Unit 3: Green infrastructure, planning and economy

Green buildings; history of green buildings, need and relevance of green buildings over conventional buildings, construction of green buildings; associated costs and benefits; outlined examples of green buildings; LEED certified building; Eco-mark certification, establishment of Eco-mark in India, its importance and implementation; Green planning: role of governmental bodies, land use planning, concept of green cities, waste reduction and recycling in cities, role of informal sector in waste management, public transportation for sustainable development, green belts. ; Introduction to UNEP's green economy initiative, inclusive economic growth of the society, REDD+ initiative, and cap and trade concept; green banking.

Unit 4: Applications of green technologies

Increase in energy efficiency: cogeneration, motor system optimization, oxy-fuel firing, isothermal melting process, energy efficient fume hoods, compact fluorescent lights (CFLs), motion detection lighting, or programmable thermostats). Green House Gas (GHG) emissions reduction: carbon capture and storage (CCS) technologies, purchase and use of carbon offsets, promotion and/or subsidy of alternative forms of transportation for employees, such as carpools, fuel efficient vehicles, and mass transit, methane emissions reduction and/or reuse).

Pollution reduction and removal (Flue Gas Desulfurization (FGD) methods, catalytic or thermal destruction of NO_x, Fluidized Bed Combustion, Dioxins reduction and removal methods, Thermal

Oxidizers or Wet Scrubbers to neutralize chemicals or heavy metals, solvent recovery systems, Low Volatile Organic Compound (VOC) paints and sealers).

Unit 5: Green chemistry

Introduction to green chemistry; principles and recognition of green criteria in chemistry; bio-degradable and bio-accumulative products in environment; green nanotechnology; reagents, reactions and technologies that should be and realistically could be replaced by green alternatives; photodegradable plastic bags.

Unit 6: Green future

Agenda of green development; reduction of ecological footprint; role of green technologies towards a sustainable future; major challenges and their resolution for implementation of green technologies; green practices to conserve natural resources (organic agriculture, agroforestry, reducing paper usage and consumption, etc.); emphasis on waste reduction instead of recycling, emphasis on innovation for green future; role of advancement in science in developing environmental friendly technologies.

UG-ENVS-H-GE-P-04

CREDITS: 2

Practical: Field survey based analysis, exercise and interpretation

- Worksheet preparation of schemes of different green processes and practices based on industry visit.
- Visit to biofertilizer, vermicomposting units, organic agriculture farms and report preparation.

Suggested Readings

1. Anastas, P. T. & Warner, J. C. 1998. *Green Chemistry: Theory & Practice*. Oxford University Press.
2. Arceivala, S. L. 2014. *Green Technologies: For a Better Future*. Mc-Graw Hill Publications.
3. Baker, S. 2006. *Sustainable Development*. Routledge Press.
4. Hrubovcak, J., Vasavada, U. & Aldy, J. E. 1999. *Green technologies for a more sustainable agriculture* (No. 33721). United States Department of Agriculture, Economic Research Service.
5. Thangavel, P. & Sridevi, G. 2015. *Environmental Sustainability: Role of Green Technologies*. Springer Publications.
6. Woolley, T. & Kimmins, S. 2002. *Green Building Handbook* (Volume 1 and 2). Spon Press.

CORE COURSE 11 (Code: UG-ENVS-H-CC-11)
ENVIRONMENTAL BIOTECHNOLOGY

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper presents an objective view of the application of biotechnological know-hows in tackling environmental problems. It starts with basic knowledge about molecular biology and later links to application based processes and techniques.

UG-ENVS-H-CC-L -11

CREDITS: 4; Lectures-60

Unit 1: The structure and function of DNA, RNA and protein

Genetic materials of prokaryotes, viruses, eukaryotes and organelles; mobile DNA; chromosomal organization; Central dogma of biology.

DNA: structural forms and their characteristics (B, A, C, D, T, Z); physical properties: UV absorption spectra, denaturation and renaturation kinetics; biological significance of different forms; Synthesis.

RNA: structural forms and their characteristics (rRNA, mRNA, tRNA; SnRNA, Si RNA, miRNA, hnRNA); biological significance of different types of RNA; synthesis.

Protein: hierarchical structure (primary, secondary, tertiary, quaternary), types of amino acids; post- translational modifications and their significance; synthesis; types and their role: structural, functional (enzymes).

Unit 2: Recombinant DNA technology

Concept of genetic engineering; Recombinant DNA: origin and current status; steps of preparation; toolkit of enzymes for manipulation of DNA: restriction enzymes, polymerases (DNA/RNA polymerases, transferase, reverse transcriptase), other DNA modifying enzymes (nucleases, ligase, phosphatases, polynucleotide kinase); genomic and cDNA libraries: construction, screening and uses; cloning and expression vectors (plasmids, bacteriophage, phagmids, cosmids, artificial chromosomes; nucleic acid microarrays

Unit 3: Bioremediation and ecological restoration

Bioremediation: Concept, types, factors, applications, advantages and constraints; Specific bioremediation technologies (prepared beds, biopiles, composting, bioventing, biosparging, pump and treat method, constructed wet lands, use of bioreactors for bioremediation. Phytoremediation – types, mechanism, case studies); Wastewater treatment: anaerobic, aerobic process, methanogenesis, bioreactors, cell and protein (enzyme) immobilization techniques; constructed wetlands; remediation of degraded ecosystems; advantages and disadvantages; degradation of xenobiotics in environment: hydrocarbons, substituted hydrocarbons, pesticides, heavy metals degradative pathways.

Unit 4: Ecologically safe products and processes

PGPR bacteria: biofertilizers, microbial insecticides and pesticides, bio-control of plant pathogen, Integrated pest management; development of stress tolerant plants, biofuel; mining and metal biotechnology: microbial transformation, accumulation and concentration of metals, metal leaching, extraction; exploitation of microbes in copper and uranium extraction.

UG-ENVS-H-CC-P -11

CREDITS: 2

Practical:

- Isolation and characterisation of soil bacteria.
- Gram staining of bacterial sample.
- Enumeration of heterotrophic bacteria from water and soil samples (Spread plate/pore plate technique).
- Determination of chlorophylls, enzymes (catalase, peroxidase and ascorbic acid of plant samples).
- Bioassay of toxic compounds by enzyme assay or seed germination test.
- Estimation of carbohydrate, protein and DNA.
- Study of mitotic and meiotic stages (*A. cepa* and grasshopper testis or pollen).

Suggested Readings

1. Evans, G. G. & Furlong, J. 2010. *Environmental Biotechnology: Theory and Application* (2nd edition). Wiley-Blackwell Publications.
2. Jordening, H. J. & Winter J. 2005. *Environmental Biotechnology: Concepts and Applications*. John Wiley & Sons.
3. Lodish, H.F., Baltimore, D., Berk, A. Zipursky, S. L. Matsudiarra, P. & Darnell, J. 1995. *Molecular Cell Biology*. W.H. Freeman.
4. Nelson, D. L. & Cox, M. M. 2013. *Lehninger's Principles of Biochemistry*. W. H. Freeman.
5. Rittman, B. E. & McCarty, P. L. 2001. *Environmental Biotechnology. Principles and Applications*. McGraw-Hill, New York.
6. Scagg, A. H. 2005. *Environmental Biotechnology*. Oxford University Press.
7. Snustad, D. P. & Simmons, M.J. 2011. *Principles of Genetics* (6th edition). John Wiley & Sons.
8. Wainwright, M. 1999. *An Introduction to Environmental Biotechnology*. Springer.

CORECOURSE 12 (Code: UG-ENVS-H-CC-12)

EVOLUTIONARY BIOLOGY

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper introduces students to the fundamentals of ecology and evolutionary biology. Each unit covers vast range of topics, which will help the students to develop basic concepts of ecology and evolutionary biology.

UG-ENVS-H-CC-L -12

CREDITS: 4; Lectures-60

Unit 1: History of life on Earth

Paleontology and evolutionary history; evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multi cellular organisms; major groups of plants and animals; stages in primate evolution including Homo.

Unit 2: Introduction

Lamarck's concept of evolution; Darwin's Evolutionary Theory: variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; The Evolutionary Synthesis.

Unit 3: Evolution of unicellular life

Origin of cells and unicellular evolution and basic biological molecules; abiotic synthesis of organic monomers and polymers; Oparin-Haldane hypothesis; study of Miller; the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.

Unit 4: Geography of evolution

Biogeographic evidence of evolution; patterns of distribution; historical factors affecting geographic distribution; evolution of geographic patterns of diversity.

Unit 5: Molecular evolution

Neutral evolution; molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence.

Unit 6: Fundamentals of population genetics

Concepts of populations, gene pool, gene frequency; concepts and rate of change in gene frequency through natural selection, migration and genetic drift; adaptive radiation; isolating mechanisms; speciation (allopatric, sympatric, peripatric and parapatric); convergent evolution; sexual selection; co-evolution; Hardy-Weinberg Law.

Practical: Field survey based analysis, exercise and interpretation:

- Hardy-Weinberg Law and its applications.
- Determination of change in allelic frequency due to natural selection, mutation and genetic drift based on data provided from suggested readings (Sl. 10 & 11).

Suggested Readings

1. Futuyma, D. J. 2009. *Evolution* (2nd edition). Sinauer Associates.
2. Gillespie, J. H. 1991. *The Causes of Molecular Evolution*. Oxford University Press.
3. Graur, D. & Li, W. H. 1999. *Fundamentals of Molecular Evolution* (2nd edition). Sinauer Associates.
4. Kimura, M. 1984. *The Neutral Theory of Molecular Evolution*. Cambridge University Press.
5. Minkoff, E. C. 1983. *Evolutionary Biology*. Addison Wesley. Publishing Company.
6. Nei, M. & Kumar, S. 2000. *Molecular Evolution and Phylogenetics*. Oxford University Press.
7. Nei, M. 1975. *Molecular Population Genetics and Evolution*. North-Holland Publishing Company.
8. Nei, M. 1987. *Molecular Evolutionary Genetics*. Columbia university press.
9. Thorne, J. L., Kishino, H., & Painter, I. S. 1998. Estimating the rate of evolution of the rate of molecular evolution. *Molecular Biology and Evolution* 15: 1647-1657.
10. Stansfield W. D. Schaums Outline of Theory and Problems of Genetics. Mcgraw-Hill Book Company ; New York.
11. Banerjee, P. K. Problems on Genetics, Molecular Genetics and Evolutionary Genetics. New Central Book Agency, Kolkata.

DISCIPLINE SPECIFIC ELECTIVE 01 (Code: UG-ENVS-H-DSE -01a)

ENERGY AND ENVIRONMENT

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This course aims to provide students with a broad understanding of the existing energy resources, issues related to energy and the environment, challenges and possible paths to sustainable energy generation and use.

UG-ENVS-H-DSE-L -01a

CREDITS: 4; Lectures-60

Unit 1: Introduction

Defining energy; forms and importance; energy use from a historical perspective: discovery of fire, discovery of locomotive engine and fossil fuels, electrification of cities, oil wars in the Middle East, advent of nuclear energy; sources and sinks of energy; energy over-consumption in urban setting

Unit 2: Energy resources

Global energy resources; renewable and non-renewable resources: distribution and availability; past, present, and future technologies for capturing and integrating these resources into our energy infrastructure; energy-use scenarios in rural and urban setups; energy conservation.

Unit 3: Energy demand

Global energy demand: historical and current perspective; energy demand and use in domestic, industrial, agriculture and transportation sector; generation and utilization in rural and urban environments; changes in demand in major world economies; energy subsidies and environmental costs.

Unit 4: Energy, environment and society

Nature, scope and analysis of local and global impacts of energy use on the environment; fossil fuel burning and related issues of air pollution, greenhouse effect, global warming and, urban heat island effect; nuclear energy and related issues such as radioactive waste, spent fuel; social inequalities related to energy production, distribution, and use.

Unit 5: Energy, ecology and the environment

Energy production as driver of environmental change; energy production, transformation and utilization associated environmental impacts (Chernobyl and Fukushima nuclear accidents, construction of dams, environmental pollution); energy over-consumption and its impact on the environment, economy, and global change.

Unit 6: Politics of energy policy

Political choices in energy policy globally and in the Indian context (historical and contemporary case studies); domestic and international energy policy; energy diplomacy and bilateral ties of India with her neighbours.

Unit 7: Our energy future

Current and future energy use patterns in the world and in India; evolution of energy use over time; alternative sources as green energy (biofuels, wind energy, solar energy, geothermal energy; ocean energy; nuclear energy); need for energy efficiency; energy conservation and sustainability; action strategies for sustainable energy mix and management from a future perspective.

UG-ENVS-H-DSE-P -01a

CREDITS: 2

Practical: Field survey based analysis, exercise and interpretation

- Prepare worksheet of energy conservation based on site visit (school/office/hospital/municipality etc.).
- Checklist for energy saving measures.
- Visit to renewable/non-renewable energy units.

Suggested Readings

1. McKibben, B. 2012. *Global Warming's Terrifying New Math*, Rolling Stone Magazine.
2. Craig. J. R., Vaughan, D. J., Skinner. B. J. 1996. *Resources of the Earth: Origin, use, and environmental impact* (2nd edition). Prentice Hall, New Jersey.
3. Elliott, D. 1997. *Sustainable Technology. Energy, Society and Environment* (Chapter 3). New York, Routledge Press.
4. Rowlands, I. H. 2009. *Renewable Electricity: The Prospects for Innovation and Integration in Provincial Policies* in Debora L. Van Nijnatten and Robert Boardman (eds), *Canadian Environmental Policy and Politics: Prospects for Leadership and Innovation*, Third Edition. Oxford University Press, pp. 167-82.
5. Oliver, J. 2013. *Dispelling the Myths about Canada's Energy Future*, Policy: Canadian Politics and Public Policy, June-July.
6. Mallon, K. 2006. *Myths, Pitfalls and Oversights, Renewable Energy Policy and Politics: A Handbook for Decision-Making*. Earth Scan.

-OR-

DISCIPLINE SPECIFIC ELECTIVE 01 (Code: UG-ENVS-H-DSE- 01b)

ECOTOXICOLOGY AND ENVIRONMENTAL HEALTH

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06.

Preamble: This chapter deals with basic concepts of toxicology, categories of toxicants, their sources, action and effects. It will also consider the preventive and curative measures to reverse toxic impact and maintenance of environmental health.

UG-ENVS-H-DSE-L -01b

CREDITS: 4; Lectures-60

Unit 1: Introduction to Environmental toxicology

Concepts of toxicants and xenobiotics: dose response relationship; EC₅₀, LC₅₀ and LD₅₀: bioaccumulation and biomonitoring of chemical and biological factors influencing toxicity; types of toxicants and their effects in living systems.

Unit 2: Toxicity of heavy metals:

Sources, distribution; toxic effects of heavy metal (Lead, cadmium, chromium, mercury, arsenic, selenium); antidotal measures, case studies.

Unit 3: Pesticide toxicity

Pesticide classification, nature, exposure routes, modes of action, biological health effect; concept of pesticide resistance.

Unit 4: Emerging contaminants

Concept, types and modes of action, environmental threats and health hazards, environmental disruptors and environmental carcinogens: categories, actions and toxic effects.

Unit 5: Environmental epidemiology

Sources and impact on human life, present pollution and impact status in West Bengal; remedial measures; epidemiological studies with respect to arsenicosis, fluorosis, vector borne diseases.

Unit 6: Environmental Health

Basic concepts, physiological responses of human to relevant stress; industrial toxicology and occupational health hazards and toxic manifestations.

UG-ENVS-H-DSE-P-01b

CREDITS: 2

Practical:

- Toxicity bioassay through germination (LD₅₀).
- Toxicity bioassay through microbial test.
- Epidemiological survey in arsenic affected areas.

Suggested Readings:

1. Klassen, C. 2017. Cassarett & Doull's Toxicology: The Basic Science of Poisons. McGraw-Hill.
2. Newman, M. C. and W. H. Clements, 2008: Ecotoxicology- A comprehensive treatment, CRC press.
3. Wright, D. A. and P. Welbourn, 2002. Environmental toxicology, Cambridge University press.
4. William P. L. and J. L. Burson, 1985. Industrial toxicology, safety and health applications in the workplace, Van Nostard Reinhold, New York.
5. Girard, J. E. 2015. Principles of Environmental chemistry. 3rd Ed. Jones & Barllett learning, New Delhi.
6. Walker, C. 2014. Ecotoxicology. CRC Press.
7. Jorgensen, SE. 2016. Ecotoxicology and Chemistry Applications in Environmental Management. CRC Press.
8. Lu F.C. & S Kacew 2002. Lu's Basic Toxicology. CRC Press.
9. Santra S. C. Environmental Science. New Central Book Agency.

DISCIPLINE SPECIFIC ELECTIVE 02 (Code: UG-ENVS-H-DSE-02a)

ENVIRONMENTAL ECONOMICS

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper introduces students to the fundamentals of environmental economics. It covers some basic concepts of economics to familiarize students with absence of market, demand and supply in nature. Each unit covers a range of topics, which will help students to develop modern concepts of environmental economics and its importance in conservation of biodiversity and ecosystems through understanding of economic costs associated with these.

UG-ENVS-H-DSE-L -02a

CREDITS: 4; Lectures-60

Unit 1: Introduction to microeconomics

Definition and scope of environmental economics; environmental economics versus traditional economics; brief introduction to major components of economy: consumer, firm and their interaction in the market, producer and consumer surplus, law of demand and supply, utilitarianism; Pareto optimality; compensation principle.

Unit 2: Environmental economics

Main characteristics of environmental goods; marginal analysis; markets and market failure; social benefit, costs and welfare functions; meaning and types of environmental values; measures of economic values; tangible and intangible benefits; Hardin's Thesis of 'The Tragedy of Commons'; methods of abatement of externalities.

Unit 3: Economic solutions to environmental problems

Social costs and benefits of environmental programmes: marginal social benefit of abatement, marginal social cost of abatement; pollution control: policies for controlling air and water pollution, disposal of toxic and hazardous waste- standards vs. emissions charges, environmental subsidies, modelling and emission charges; polluter pay principles; pollution permit trading system.

Unit 4: Natural resource economics

Economics of non-renewable resources; economics of renewable resources; economics of water use, management of fisheries and forests; introduction to natural resource accounting.

Unit 5: Tools for environmental economic policy

Growth and environment; environmental audit and accounting, Kuznets curve, assessing cost benefit analysis and valuation: discounting, principles of Cost-Benefit Analysis, estimation of costs and benefits, techniques of valuation, adjusting and comparing environmental benefits and costs.

UG-ENVS-H-DSE-P -02a

CREDITS: 2

Practical: Field survey based analysis, exercise and interpretation

- Valuation of a forest/wetland- model exercise.
- Field visit for evaluation of forest and fisheries management system and document preparation.

Suggested Readings

1. Arrow, K., Bolin, B., Costanza, R., Dasgupta, P., Folke, C., Holling, C. S., Jansson, B. O., Levin, S., Maler, K. G., Perrings, C., Pimentel, D. 1995. Economic growth, carrying capacity, and the environment. *Ecological Economics* 15: 91-95.
2. Hanley, N., Shogren, J. F., & White, B. 2007. *Environmental Economics: In Theory and Practice*. Palgrave Macmillan.
3. Kolstad, C. D. 2010. *Environmental Economics*. Oxford University Press.
4. Perman, R. 2003. *Natural Resource and Environmental Economics*. Pearson Education.
5. Singh, K. & Shishodia, A. 2007. *Environmental Economics: Theory and Applications*. Sage Publications.
6. Thomas, J. M. & Callan, S. J. 2007. *Environmental Economics*. Thomson Learning Inc.
7. Tietenberg, T. 2004. *Environmental and Natural Resource Economics* (6th Edition). Pearson Education Pvt. Ltd.
8. Tietenberg, T. H. & Lewis, L. 2010. *Environmental Economics and Policy*. Addison-Wesley.
9. Turner, R. K., Pearce, D., & Bateman, I. 1994. *Environmental Economics: An Elementary Introduction*. Harvester Wheatsheaf.

-OR-

DISCIPLINE SPECIFIC ELECTIVE 02 (Code: UG-ENVS-H-DSE-02b)

WASTE AND WASTEWATER MANAGEMENT

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: Every human activity ends up in the generation of unwanted waste product. This paper throws light on the current scenario of waste and waste water generation, problems in handling and management. It also deals with the different governmental policies for proper management in order to minimize their effect on environment.

UG-ENVS-H-DSE-L -02b

CREDITS: 4; Lectures-60

Unit 1: Waste water treatment

Sources and generation of waste water; physicochemical and biological properties; primary, secondary and advanced treatment strategies (domestic/municipal and industrial wastewater treatment). Standards for wastewater discharge; reuse and recycling.

Unit 2: Effect of solid waste disposal on environment

Definition, Types, characterization and chemical composition. Impact of solid waste on environment, human and plant health; effect of solid waste and industrial effluent discharge on water quality and aquatic life; municipal solid waste; hazardous waste and biomedical waste, mining waste and land degradation; effect of land fill leachate on soil characteristics and ground water pollution.

Unit 3: Solid waste management

Different techniques used in collection, storage, transportation and disposal of solid waste (municipal, hazardous and biomedical waste); landfill (traditional and sanitary landfill design); thermal treatment (pyrolysis and incineration) of waste material; drawbacks in waste management techniques.

Unit 4: Industrial waste management

Types of industrial waste: hazardous and non-hazardous; effect of industrial waste on air, water and soil; industrial waste management and its importance; stack emission control and emission monitoring; effluent treatment plant and sewage treatment plant.

Unit 5: Resource recovery

4R- reduce, reuse, recycle and recover; biological processing - composting, anaerobic digestion, aerobic treatment; reductive dehalogenation; mechanical biological treatment; green techniques for waste treatment. Waste- to- energy (WTE) - concept; refuse derived fuel (RDF); different WTE processes: combustion, pyrolysis, landfill gas (LFG) recovery; anaerobic digestion; gasification.

Unit 6: Integrated waste management

Concept of Integrated waste management; waste management hierarchy; methods and importance of Integrated waste management.

Unit 7: Policies for solid waste management

Municipal Solid Wastes (Management and Handling) Rules 2000; Hazardous Wastes Management and Handling Rules 1989; Bio-Medical Waste (Management and Handling) Rules 1998; Ecofriendly or green products.

UG-ENVS-H-DSE-L -02b

CREDITS: 2

Practical:

- Physico-chemical characterisation of waste water (TSS, TDS, oil & grease, phenolics).
- Sludge characterisation (moisture content, ash, VOC, metal etc.).
- Visit to waste disposal sites and report preparation.

Suggested Readings

1. Asnani, P. U. 2006. Solid waste management. *India Infrastructure Report 570*.
2. Bagchi, A. 2004. *Design of Landfills and Integrated Solid Waste Management*. John Wiley & Sons.
3. Blackman, W. C. 2001. *Basic Hazardous Waste Management*. CRC Press.
4. McDougall, F. R., White, P. R., Franke, M., & Hindle, P. 2008. *Integrated Solid Waste Management: A Life Cycle Inventory*. John Wiley & Sons.
5. US EPA. 1999. *Guide for Industrial Waste Management*. Washington D.C.
6. White, P. R., Franke, M. & Hindle P. 1995. *Integrated Solid waste Management: A Life cycle Inventory*. Blackie Academic & Professionals.
7. Zhu, D., Asnani, P. U., Zurbrugg, C., Anapolsky, S. & Mani, S. 2008. *Improving Municipal Solid waste Management in India*. The World Bank, Washington D.C.

CORE COURSE 13 (Code: UG-ENVS-H-CC-13)
ENVIRONMENTAL LEGISLATION AND POLICY

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06.

Preamble: This paper introduces students to the legal structure of India and fundamentals of environmental legislation and policy making. Each unit will help the students to develop basic concepts of environmental legislation and policy making in India and around the world.

UG-ENVS-H-CC-L -13

CREDITS: 4; Lectures-60

Unit 1: Introduction

Constitution of India; fundamental rights; fundamental duties; Union of India; union list, state list, concurrent list; legislature; state assemblies; judiciary; panchayats and municipal bodies; National Green Tribunal.

Unit 2: History of environmental legislation and policy

Ancient period: worship of water, air, trees; Mauryan period: Kautilya's Arthashastra, Yajnavalkya smriti and Charaksamhita; Medieval period: forests as woodland and hunting Resources during Mughal reign; British India: Indian Penal Code 1860, Forest Act 1865, Fisheries Act 1897; Independent India: Van Mahotsava 1950, National Forest Policy 1952, Orissa River pollution and prevention Act 1953.

Unit 3: Environmental legislation

Legal definitions (environmental pollution, natural resource, biodiversity, forest, sustainable development); Article 48A (The protection and improvement of environment and safeguarding of forests and wildlife); Article 51 A (Fundamental duties).

Unit 4: Legislative instruments

The Indian Forest Act 1927; The Wildlife (Protection) Act 1972; The Water (Prevention and Control of Pollution) Act 1974; The Forests (Conservation) Act 1980; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; The Public Liability Insurance Act 1991; Noise Pollution (Regulation and Control) Rules 2000; The Biological Diversity Act 2002; The Schedule Tribes and other Traditional Dwellers (Recognition of Forests Rights) Act 2006; The National Green Tribunal Act 2010; scheme and labeling of environment friendly products, Ecomarks.

Unit 5: Government institutions

Role of Ministry of Environment, Forests & Climate Change in environmental law and policy making; role of central and state pollution control boards in environmental law and policy making.

Unit 6: Case studies

National Green Tribunal: Aditya N Prasad vs. Union of India & Others; Ganga Tanneries Case: M.C. Mehta vs. Union of India 1988; environmental education case: M.C. Mehta vs. Union of India, WP 860/1991.

Unit 7: International laws and policy

Ramsar convention, 1971; Stockholm Conference 1972; United Nations Conference on Environment and Development 1992; Rio de Janeiro (Rio Declaration, Agenda 21); Montreal Protocol 1987; Kyoto Protocol 1997; Copenhagen and Paris summits.

UG-ENVS-H-CC-P -13

CREDITS: 2

Practical: Field survey based analysis, exercise and interpretation

- Field visit for assessment of environmental policy adoption, environment safety policy adoption in industry and document preparation.
- Survey on perception of environmental laws in communities/ societies and document preparation.

Suggested Readings

1. Agarwal, V. K. 2005. Environmental Laws in India: Challenges for Enforcement. *Bulletin of the National Institute of Ecology* 15: 227-238.
2. Divan, S. & Rosencranz, A. 2002. *Environmental Law and Policy in India: Cases, Materials and Statutes* (2nd edition). Oxford University Press.
3. Gupta, K. R. 2006. *Environmental Legislation in India*. Atlantic Publishers and Distributors.
4. Shastri, S. C. 2015. *Environmental Law*. Eastern Book Company.
5. Leelakrishnan, P. 2008. *Environmental Law in India* (3rd edition). Lexis Nexis India.
6. Venkat, A. 2011. *Environmental Law and Policy*. PHI Learning Private Ltd.

CORECOURSE-14 (Code: UG-ENVS-H-CC-14)

URBAN ECOSYSTEMS

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: The paper is designed to enable the students to examine the existing environmental issues, conflicts and their potential role in urban development. It beholds importance as interaction between urban society and its environment transpires in governance and policy decisions. It also aims to address key challenges posed by increasing development to far-reaching goal of sustainability in urban areas.

UG-ENVS-H-CC-L -14

CREDITS: 4; Lectures-60

Unit 1: Introduction

Introduction to urbanization; urban sprawl and associated environmental issues.

Unit 2: Environment in an urban setting

Man as the driver of urban ecosystem; commodification of nature; metros, cities and towns as sources and sinks of resources; resource consumption and its social, cultural, economic and ecological perspectives; urban transformation; increasing challenges posed by modernity for the environment; urban pollution (air, water, soil).

Unit 3: Urban dwelling

Housing scenario across a range of large-medium-small cities; poverty and slums in an urban context; Town planning Acts and their environmental aspects; energy consumption and waste disposal as well as accumulation; environmental costs of urban infrastructure.

Unit 4: Urban interface with the environment

Management of urban environment; alternative resources; policy and management decisions; urban settings as loci of sustainability; challenges associated with sustainability and urban future.

Unit 5: Natural spaces in a city

Concept of 'controlled nature'; scope, importance and threats to nature in the city; organization and planning of green spaces such as parks, gardens and public spaces; concept of green belts; urban natural forest ecosystem as green lungs.

Unit 6: Planning and environmental management

Urban planning and its environmental aspects from historical and contemporary perspectives; benefits of environmental management; introduction to green buildings; urban governance; political complexity of applying ecological science to urban policy and planning, smart cities.

Practical: Field survey based analysis, exercise and interpretation

- Exercises: Students will carry out a group work in which the development of the infrastructure of the city of the future is explored and presented. The assignment concentrates on the development of one infrastructure (clean water, waste water or energy) in two possible surroundings (newly built city or transition from present to future situation).
- Tutorial focusing on introducing the state-of-the-art technologies for drinking water supply, wastewater treatment, energy supply and material/nutrient recycling and recovery.
- Individual assignment the student will perform a technological assessment for the solution of a specific urban environmental problem performing basic calculations on urban flows and their transformations and considering the sustainability outcome.
- Field visits to experience various environmental technologies working in practice.

Suggested Readings

1. Niemelä, J., Breuste, J. H., Guntenspergen, G., McIntyre, N. E., Elmqvist, T., James, P. (eds) (2011) *Urban Ecology. Patterns, Processes, and Applications*. Oxford University Press: UK.
2. Van Bueren, E. M, van Bohemen, H., Itard, L., Visscher, H. (Eds). (2011) *Sustainable Urban environment. An ecosystem approach*. Springer.
3. D'Monte, Darryl. 1985. *Industry versus Environment Temples or Tombs*. Three Controversies, Delhi, CSE.
4. Gaston, K. J. 2010. *Urban Ecology*. Cambridge University Press, New York.
6. Montgomery, M. R. 2009. Urban Transformation of the developing world. *Science* 319: 761-764.
7. Richter, M & Weiland, U. (ed.) 2012. *Applied Urban Ecology*. Wiley-Blackwell, UK.

DISCIPLINE SPECIFIC ELECTIVE 03 (Code: UG-ENVS-H-DSE- 03a)

NATURAL HAZARDS AND DISASTER MANAGEMENT

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper introduces the students to various aspects of environmental hazards, their causes, classifications, and impacts. It also focuses on the management strategies and governmental action plan to mitigate and prepare for such hazards.

UG-ENVS-H-DSE-L -03a

CREDITS: 4; Lectures-60

Unit 1: Introduction

Definition of hazard; natural, technological, and context hazards; concept of risk and vulnerability; reasons of vulnerability - rapid population growth, urban expansion, environmental pollution, epidemics, industrial accidents, inadequate government policies.

Unit 2: Natural hazards

Natural hazards: hydrological, atmospheric & geological hazards; earthquake: seismic waves, epicentre; volcanoes: causes of volcanism, geographic distribution; floods: types and nature, frequency of flooding; landslides: causes and types of landslides, landslide analysis; drought: types of drought - meteorological, agricultural, hydrological, and famine; Glacial Lake Outburst Floods (GLOF); tornadoes, cyclone & hurricanes; tsunamis: causes and location of tsunamis; coastal erosion, sea level changes and its impact on coastal areas and coastal zone management.

Unit 3: Anthropogenic hazards

Impacts of anthropogenic activities such as rapid urbanization, injudicious ground water extraction, sand mining from river bank, deforestation, mangroves destruction; role of construction along river banks in elevating flood hazard; disturbing flood plains. deforestation and landslide hazards associated with it; large scale developmental projects, like dams and nuclear reactors in hazard prone zones; nature and impact of accidents, wildfires and biophysical hazards. Case studies of Bhopal, Minamata and Chernobyl disaster.

Unit 4: Risk and vulnerability assessment

Two components of risk: likelihood and consequences, qualitative likelihood measurement index; categories of consequences (direct losses, indirect losses, tangible losses, and intangible losses); application of geoinformatics in hazard, risk and vulnerability assessment.

Unit 5: Mitigation and preparedness

Concept of mitigation; types of mitigation: structural and non-structural mitigation, use of technologies in mitigations such as barrier, deflection and retention systems; concept of preparedness; importance of planning, exercise, and training in preparedness; role of public, education and media in hazard preparedness.

Unit 6: Disaster management in India

Lessons from the past considering the examples of Bhuj earthquake, tsunami disaster, and Bhopal tragedy; National Disaster Management Framework, national response mechanism, role of government bodies such as NDMC and IMD; role of armed forces and media in disaster management; role of space technology in disaster management; case study of efficient disaster management during cyclone 'Phailin' in 2013.

UG-ENVS-H-DSE-P -03a

CREDITS: 2

Practical: Field survey based analysis, exercise and interpretation

- Visit to disaster prone/ affected areas and submission of report.
- Mock drill for emergency preparation of fire hazard.
- Preparation of a report on vulnerability and risk assessment, and safety measures to be adopted in the study area.

Suggested Readings

1. Coppola D. P. 2007. *Introduction to International Disaster Management*. Butterworth Heinemann.
2. Cutter, S. L. 2012. *Hazards Vulnerability and Environmental Justice*. Earth Scan, Routledge Press.
3. Keller, E. A. 1996. *Introduction to Environmental Geology*. Prentice Hall, Upper Saddle River, New Jersey.
4. Pine, J. C. 2009. *Natural Hazards Analysis: Reducing the Impact of Disasters*. CRC Press, Taylor and Francis Group.
5. Schneid, T. D. & Collins, L. 2001. *Disaster Management and Preparedness*. Lewis Publishers, New York, NY.
6. Smith, K. 2001. *Environmental Hazards: Assessing Risk and Reducing Disaster*. Routledge Press.
7. Wallace, J. M. & Hobbs, P. V. 1977. *Atmospheric Science: An Introductory Survey*. Academic Press, New York.
8. Wasson, R. J., Sundriyal, Y. P., Chaudhary, S., Jaiswal, M. K., Mortheikai, P., Sati, S. P. & Juyal, N. 2013. A 1000-year history of large floods in the upper Ganga catchment, Central Himalaya, India. *Quaternary Science Reviews* 77: 156–166.

-OR-

DISCIPLINE SPECIFIC ELECTIVE 03 (Code: UG-ENVS-H-DSE-03b)
INSTRUMENTAL TECHNIQUES FOR ENVIRONMENTAL ANALYSIS

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

Preamble: This paper introduces the students to various instrumental techniques for environmental analysis along with their principle and applications. An attempt will be made to have a compressive idea about various sampling techniques along with sample preparation. The students will also be introduced to the concept of radioactivity detection techniques and their applications.

UG-ENVS-H-DSE-L -03b

CREDITS: 4; Lectures-60

Unit 1: Introduction

Instrumental methods for environmental analysis.

Unit 2: Principle and application

Titrimetric, gravimetric, potentiometric, nephelometry, turbidimetry, spectrophotometry, spectrofluorimetry, flame photometry, atomic absorption spectrometry, inductively coupled plasma mass spectrometry, chromatographic techniques, gel electrophoresis, gas chromatography.

Unit 3: Water and Soil sampling techniques and sample preparation

Sampling methods, sample preservation, storage and processing techniques.

Unit 4: Air quality sampling and analysis

Air samplers, air sampling design, air sampling techniques and application, biomonitoring.

Unit 5: Noise monitoring

Techniques for measurement of noise level; Abatement and protective measures

Unit 6: Radioactivity

Detection techniques and application.

UG-ENVS-H-DSE-P -03b

CREDITS: 2

Practical: Field survey based analysis, exercise and interpretation

- Principles and application of instruments and document preparation.
- Demonstration of selected instruments and document preparation.

Suggested Readings

1. Instrumental methods of chemical analysis - Chatwal G. R. and S. K. Anand, 2005, Himalayan Pub. House, Mumbai.
2. Standard Methods for the Examination of water & Waste Water – 21st Edition 2005, APHA.

DISCIPLINE SPECIFIC ELECTIVE 04 (Code: UG-ENVS-H-DSE-04)
DISSERTATION

FULL MARKS: 75, CREDITS: 4 (L) + 2(P) = 06

UG-ENVS-H-DSE-L -04

CREDITS: 2

Dissertation

A dissertation has to be prepared on consultation with teachers/mentors on a topic from any area of Environmental Science. During examination a thorough viva-voce will be conducted by the examiners / adjudicators. The dissertation will be evaluated on the basis of written documents submitted by the candidate, originality and importance.

UG-ENVS-H-DSE-P -04

CREDITS: 2

Practical

A power point presentation has to be prepared and a short oral presentation will be considered for continuous evaluation. A PDF file/print copy of the power point will be required to be submitted.

ABILITY ENHANCEMENT COMPULSORY COURSE (Code: UG-ENVS-H-AECC-02)

ENVIRONMENTAL STUDIES

FULL MARKS: 50, CREDITS: 02

Unit 1: Introduction to environmental studies

Multidisciplinary nature of environmental studies;

Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources: Renewable and Non-renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots.
- India as a mega-biodiversity nation; Endangered and endemic species of India.
- Threats to biodiversity : Habitat loss, poaching of wildlife, man---wildlife conflicts, biological invasions; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution.
- Nuclear hazards and human health risks.
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.

Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 8 Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site---Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems---pond, river, Delhi Ridge, etc.

Suggested Readings:

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M. K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E. P., Odum, H. T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I. L., Gerba, C. P. & Brusseau, M. L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M. N. & Datta, A. K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P. H., Hassenzahl, D. M. & Berg, L. R. 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J. S., Singh, S. P. and Gupta, S. R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.

16. Sodhi, N. S., Gibson, L. & Raven, P. H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

UNIVERSITY OF KALYANI

**Syllabus for B.A/B.Sc. (General)
in
Geography**

**According to the
Choice Based Credit System (CBCS)
and
Semester System: I-VI**

WITH EFFECT FROM THE ACADEMIC SESSION

2018-2019

COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM FOR B.A. GENERAL IN GEOGRAPHY

Semester-wise course structure

(6 Credit: 75 Marks)

SEMESTER-I				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/CC/T/01	Core	GEOTECTONICS AND GEOMORPHOLOGY AND SCALE AND CARTOGRAPHY	60L	4
GEO/G/CC/P/01			60P	2
-	Core	As to be offered by other departments	-	6
-	Language Core	Lang 1-1	-	6
-	AECC	Environmental studies	-	2
Total		4 courses	-	20
SEMESTER-II				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/CC/T/02	Core	CLIMATOLOGY, SOIL AND BIOGEOGRAPHY AND SURVEYING AND LEVELLING	60L	4
GEO/G/CC/P/02			60P	2
-	Core	As to be offered by other departments	-	6
-	Language Core	Lang 2-1	-	6
-	AECC	Communicative English/ MIL	-	2
Total		4 courses	-	20
SEMESTER-III				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/CC/T/03	Core	HUMAN GEOGRAPHY AND MAP PROJECTION AND MAP INTERPRETATION	60L	4
GEO/G/CC/P/03			60P	2
-	Core	As to be offered by other departments	-	6
-	Core	Core Lang 1-2	-	6
(GEO/G/SEC/P/01/A or GEO/G/SEC/P/01/B)	SEC	COMPUTER BASICS AND COMPUTER APPLICATIONS OR REMOTE SENSING	60P	2
Total		4 courses	-	20

COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM FOR B.A. GENERAL IN GEOGRAPHY

Semester-wise course structure

(6 Credit: 75 Marks)

SEMESTER-IV				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/CC/T/04	Core	ENVIRONMENTAL GEOGRAPHY	60L	4
GEO/G/CC/P/04		AND FIELD WORK	60P	2
-	Core	As to be offered by other departments	-	6
-	Language Core	Core Lang2-2	-	6
(GEO/G/SEC/P/02/A or GEO/G/SEC/P/02/B)	SEC	REGIONAL PLANNING AND DEVELOPMENT OR GIS BASED PROJECT REPORT	60P	2
Total		4 courses	-	20
SEMESTER-V				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/DSE/T/01/A or GEO/G/DSE/T/01/B	DSE	GEOGRAPHY OF INDIA OR ECONOMIC GEOGRAPHY	60L	4
GEO/G/DSE/P/01		FIELD WORK	60P	2
-	DSE	As to be offered by other departments	-	6
-	GE	Any discipline other than discipline 1 and 2	-	6
(GEO/G/SEC/P/03/A or GEO/G/SEC/P/03/B)	SEC	FIELD TECHNIQUES AND SURVEY BASED PROJECT REPORT OR COLLECTION, MAPPING AND INTERPRETATION OF CLIMATIC DATA	60P	2
Total		4 courses	-	20
SEMESTER-VI				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/DSE/T/02/A or GEO/G/DSE/T/02/B	DSE	DISASTER MANAGEMENT OR GEOGRAPHY OF TOURISM	60L	4
GEO/G/DSE/P/02		FIELD WORK	60P	2
-	DSE	As to be offered by other departments	-	6
-	GE	Any discipline other than discipline 1 and 2	-	6
(GEO/G/SEC/P/04/A or GEO/G/SEC/P/04/B)	SEC	COLLECTION, MAPPING AND INTERPRETATION OF PEDOLOGICAL DATA OR ROCKS AND MINERALS AND THEIR MEGASCOPIC IDENTIFICATION	60P	2
Total		4 courses	-	20
Total (All semesters)		24 courses	-	120

COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM FOR B.Sc GENERAL IN GEOGRAPHY

Semester-wise course structure

(6 Credit: 75 Marks)

SEMESTER-I				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/CC/T/01	Core	GEOTECTONICS AND GEOMORPHOLOGY AND SCALE AND CARTOGRAPHY	60L	4
GEO/G/CC/P/01			60P	2
-	Core	As to be offered by other departments	-	6
-	Core	As to be offered by other departments	-	6
-	AECC	Environmental studies	-	2
Total		4 courses	-	20
SEMESTER-II				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/CC/T/02	Core	CLIMATOLOGY, SOIL AND BIOGEOGRAPHY AND SURVEYING AND LEVELLING	60L	4
GEO/G/CC/P/02			60P	2
-	Core	As to be offered by other departments	-	6
-	Core	As to be offered by other departments	-	
-	AECC	Communicative English/ MIL	-	2
Total		4 courses	Total	20
SEMESTER-III				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/CC/T/03	Core	HUMAN GEOGRAPHY AND MAP PROJECTION AND MAP INTERPRETATION	60L	4
GEO/G/CC/P/03			60P	2
-	Core	As to be offered by other departments	-	6
-	Core	As to be offered by other departments	-	6
(GEO/G/SEC/P/01/A or GEO/G/SEC/P/01/B)	SEC	COMPUTER BASICS AND COMPUTER APPLICATIONS OR REMOTE SENSING	60P	2
Total		4 courses	-	20

COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM FOR B.Sc GENERAL IN GEOGRAPHY

Semester-wise course structure

(6 Credit: 75 Marks)

SEMESTER-IV				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/CC/T/04	Core	ENVIRONMENTAL GEOGRAPHY AND FIELD WORK	60L	4
GEO/G/CC/P/04			60P	2
-	Core	As to be offered by other departments	-	6
-	Core	As to be offered by other departments	-	6
(GEO/G/SEC/P/02/A or GEO/G/SEC/P/02/B)	SEC	REGIONAL PLANNING AND DEVELOPMENT OR GIS BASED PROJECT REPORT	60P	2
Total		4 courses	-	20
SEMESTER-V				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/DSE/T/01/A or GEO/G/DSE/T/01/B	DSE	GEOGRAPHY OF INDIA OR ECONOMIC GEOGRAPHY	60L	4
GEO/G/DSE/P/01			60P	2
-	DSE	As to be offered by other departments	-	6
-	GE (Any discipline other than discipline 1 and 2)	-	-	6
(GEO/G/SEC/P/03/A or GEO/G/SEC/P/03/B)	SEC	FIELD TECHNIQUES AND SURVEY BASED PROJECT REPORT OR COLLECTION, MAPPING AND INTERPRETATION OF CLIMATIC DATA	60P	2
Total		4 courses	-	20
SEMESTER-VI				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/G/DSE/T/02/A or GEO/G/DSE/T/02/B	DSE	DISASTER MANAGEMENT OR GEOGRAPHY OF TOURISM	60L	4
GEO/G/DSE/P/02			60P	2
-	DSE	As to be offered by other departments	-	6
-	GE (Any discipline other than discipline 1 and 2)	-	-	6
(GEO/G/SEC/P/04/A or GEO/G/SEC/P/04/B)	SEC	COLLECTION, MAPPING AND INTERPRETATION OF PEDOLOGICAL DATA OR ROCKS AND MINERALS AND THEIR MEGASCOPIIC IDENTIFICATION	60P	2
Total		4 courses	-	20
Total (All semesters)		24 courses	-	120

B.A. / B.Sc. (General) in Geography

CORE COURSE (CC):

CC/01: Geotectonics and Geomorphology and Scale and Cartography **6 Credits**

GEO/G/CC/T/01: (Theory): Geotectonics and Geomorphology **4 Credits**

1. Lithosphere – Internal Structure of Earth based on Seismic Evidence
2. Weathering: Types and Related Landforms
3. Plate Tectonics and its Associated Landforms
4. Landform Development in Arid Regions
5. Landform Development in Glaciated Regions
6. Development of Fluvial Landforms
7. Fluvial Cycle of Erosion – Davis and Penck
8. Hydrosphere: Hydrological Cycle, Ocean Bottom Relief Features, Tides and Ocean Currents

Reference Books:

- Conserva, H. T., 2004: Illustrated Dictionary of Physical Geography, Author House, USA
- Gabler, R. E., Petersen, J. F., and Trapasso, L. M., 2007: Essentials of Physical Geography (8th Edition), Thompson, Brooks/Cole, USA
- Garrett, N., 2000: Advanced Geography, Oxford University Press
- Goudie, A., 1984: The Nature of the Environment: An Advanced Physical Geography, Basil Blackwell Publishers, Oxford
- Hamblin, W. K., 1995: Earth's Dynamic System, Prentice Hall, NJ
- Husain, M., 2002: Fundamentals of Physical Geography, Rawat Publications, and Jaipur
- Monkhouse, F. J., 2009: Principles of Physical Geography, Platinum Publishers, Kolkata
- Strahler, A. N., and Strahler, A. H., 2008: Modern Physical Geography, John Wiley & Sons, New York

GEO/G/CC/P/01: (Practical): Scale and Cartography **2 Credits**

1. Map Scale: Types and Application
2. Linear and Comparative Scale
3. Representation of Data: Dot, Proportional Circles, Choropleth, Flow Diagram
4. Taylor's Climograph and Hythergraph

Reference Books:

- Dent, B. D., 1999: Cartography: Thematic Map Design, (Vol. 1), McGraw Hill
- Gupta, K. K., and Tyagi, V. C., 1992: Working with Maps, Survey of India, DST, New Delhi
- Mishra, R. P., and Ramesh A., 1989: Fundamentals of Cartography, Concept Publishing
- Robinson, A., 1953: Elements of Cartography, John Wiley
- Sharma, J. P., 2010: Prayogic Bhugol, Rastogi Publishers
- Singh, R. L., and Singh, R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers
- Singh, R. L., 1998: Prayogic Bhoogol Rooprekha, Kalyani Publications
- Steers, J. A., 1965: An Introduction to the Study of Map Projections, University of London

CC/02: Climatology, Soil and Biogeography and Surveying and Levelling 6 Credits

GEO/G/CC/T/02: (Theory): Climatology, Soil and Biogeography 4 Credits

1. Elements of Weather and Climate; Thermal and Chemical Composition and Layering of the Atmosphere
2. Heat Balance, Pressure Belt and Planetary Wind Circulation System
3. Forms of Precipitation and Types of Rainfall
4. Tropical and Temperate Cyclones, Climatic Classification (Koppen)
5. Definition of Soil; Physical and Chemical Properties of Soil (Soil Texture, Colour and pH)
6. Soil Forming Factors; Soil Formation (Podzol and Laterite)
7. Definition of Biosphere and Biogeography; Meaning of Ecology, Ecosystem, Environment, Ecotone, Communities, Habitats and Biotopes
8. Environmental Problems and Management: Air Pollution, Bio-diversity Loss, Solid and Liquid Waste

Reference Books:

- Barry, R. G., and Carleton, A. M., 2001: Synoptic and Dynamic Climatology, Routledge, UK
- Barry, R. G., and Chorley, R. J., 1998: Atmosphere, Weather and Climate, Routledge, New York
- Critchfield, H. J., 1987: General Climatology, Prentice-Hall of India, New Delhi
- Lutgens, F. K., Tarbuck, E. J., and Tasa, D., 2009: The Atmosphere: An Introduction to Meteorology, Prentice-Hall, Englewood Cliffs, New Jersey
- Oliver, J. E., and Hidore, J. J., 2002: Climatology: An Atmospheric Science, Pearson Education, New Delhi
- Trewartha, G. T., and Horne, L. H., 1980: An Introduction to Climate, McGraw

GEO/G/CC/P/02: (Practical): Surveying and Levelling 2 Credits

1. Definition and Classification of Surveying
2. Open and Close Traversing by Prismatic Compass
3. Drawing of Longitudinal Profile by Dumpy level

Reference Books:

- Singh, R. L., and Singh, R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers
- Sarkar, A., 2015: Practical Geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi

CC/03: Human Geography and Map Projection and Map Interpretation 6 Credits

GEO/G/CC/T/03: (Theory): Human Geography 4 Credits

1. Definition, Nature, Major Subfields, Contemporary Relevance
2. Space and Society: Cultural Regions; Race; Religion and Language
3. Population: Population Growth and Demographic Transition Theory
4. Types of Population Migration with Reference to India
5. World Population Distribution and Composition (Age, Gender and Literacy)
6. Settlements: Types and Patterns of Rural Settlements
7. Classification of Urban Settlements; Functional Classification of Towns

Reference Books:

- Chandna, R. C., 2010: Population Geography, Kalyani Publisher
- Daniel, P.A., and Hopkinson, M. F., 1989: The Geography of Settlement, Oliver & Boyd, London
- Johnston, R., Gregory, D., Pratt, G. et al., 2008: The Dictionary of Human Geography, Blackwell Publication
- Jordan-Bychkov et al., 2006: The Human Mosaic: A Thematic Introduction to Cultural Geography. W. H. Freeman and Company, New York
- Ghosh, S., 2015: Introduction to Settlement Geography. Orient Black Swan Private Ltd., Kolkata

GEO/G/CC/P/03: (Practical): Map Projection and Map Interpretation 2 Credits

1. Simple Conical Projection with One Standard Parallel
2. Cylindrical Equal Area Projection
3. Interpretation of Topographical Maps: relation between Physiography, Drainage and Settlement
4. Interpretation of Weather Maps (Pre-Monsoon, Monsoon and Post Monsoon)

Reference Books:

- Dent, B. D., 1999: Cartography: Thematic Map Design, (Vol. 1), McGraw Hill
- Gupta, K. K., and Tyagi, V. C., 1992: Working with Maps, Survey of India, DST, New Delhi
- Mishra, R. P., and Ramesh, A., 1989: Fundamentals of Cartography, Concept Publishing
- Robinson, A., 1953: Elements of Cartography, John Wiley
- Sharma, J. P., 2010: Prayogic Bhugol, Rastogi Publishers
- Singh, R. L., and Singh R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers
- Steers, J. A., 1965: An Introduction to the Study of Map Projections, University of London

SKILL ENHANCEMENT COURSE (SEC):

SEC/01: Computer Basics and Computer Applications OR Remote Sensing 2 Credits

GEO/G/SEC/P/01/A: (Practical): Computer Basics and Computer Applications 2 Credits

1. Numbering Systems; Binary Arithmetic
2. Data Computation, Storing and Formatting in Spreadsheets: Computation of Rank, Mean, Median, Mode, Standard Deviation, Moving Averages, Derivation of Correlation, Coefficient of Variation , Regression
3. Preparation of Annotated Diagrams and its Interpretation: Scatter Diagram and Histogram
4. Internet Surfing: Generation and Extraction of Information

Reference Books:

- Bartee, T. C., 1977: Digital Computer Fundamental; McGraw Hill
- Chauhan, S., Chauhan, A., and Gupta, K., 2006: Fundamental of Computer; Firewall Media
- Flake, L. J., McClintock, C. E., and Turner, S., 1989: Fundamental of Computer Education; Wordsworth Pub. Co
- Leon, A., and Leon, M., 1999: Introduction to Computer, USB Publishers' Distributors Ltd
- Malvino, A. P., Leach, D. P., 1981: Digital Principles and Applications; Tata McGraw Hill
- Mano, M. M., and Kime, C. R., 2004: Logic and Computer Design Fundamental; Prentice Hall
- Rajaraman, V., 2003: Fundamentals of Computer, Prentice Hall Publisher
- Sarkar, A., and Gupta, S. K., 2002: Elements of computer Science, S Chand and Company, New Delhi
- Blissmer, 1996: Working with MS Word; Houghton Mifflin Co
- Johnson, S., 2007: Microsoft Power Point 2007; Pearson Paravia Bruno
- Leon, A., and Leon, M., 1999: Introduction to Computer, USB Publishers' Distributors Ltd
- Leon, A., and Leon, M., 1999: A Beginners Guide to Computers, Vikas
- Rajaraman, V., 2008: Computer Primer; Prentice Hall of India Pvt. Ltd
- Sarkar, A., and Gupta, S. K., 2002: Elements of Computer Science, S Chand and Company, New Delhi
- Shepard, A., 2007: Perfect Pages; Shepard Publications
- Tyson, H. L., 2007: Microsoft Word 2007 Bible; John Wiley
- Walkenbach, J., 2007: Excel 2007 Bible; John Wiley

OR

GEO/G/SEC/P/01/B: (Practical): Remote Sensing

2 Credits

1. Remote Sensing: Definition, Development, Platforms and Types
2. Aerial Photography: Principles, Types and Geometry
3. Satellite Remote Sensing: Principles, EMR Interaction with Atmosphere and Earth Surface; Satellites (Landsat and IRS) and Sensors
4. Preparation of Inventories of Landuse/ Landcover Features from Satellite Images

*A Project File on the Above Themes is to be submitted

Reference Books:

- Bhatta, B., 2008: Remote Sensing and GIS, Oxford University Press, New Delhi
- Campbell, J. B., 2007: Introduction to Remote Sensing, Guildford Press
- Jensen, J. R., 2005: Introductory Digital Image Processing: A Remote Sensing Perspective, Pearson Prentice-Hall
- Joseph, G., 2005: Fundamentals of Remote Sensing, United Press India
- Lillesand, T. M., Kiefer, R. W., and Chipman, J. W., 2004: Remote Sensing and Image Interpretation, Wiley. (Wiley Student Edition)
- Li, Z., Chen, J., and Batsavias, E., 2008: Advances in Photogrammetry, Remote Sensing and Spatial Information Sciences CRC Press, Taylor and Francis, London
- Mukherjee, S., 2004: Textbook of Environmental Remote Sensing, Macmillan, Delhi
- Nag, P., and Kudra, M., 1998: Digital Remote Sensing, Concept, New Delhi
- Singh, R. B., and Murai, S., 1998: Space-informatics for Sustainable Development, Oxford and IBH Pub

UNIVERSITY OF KALYANI

**Syllabus for B.A./B.Sc. (Honours)
in
Geography**

**According to the
Choice Based Credit System (CBCS)
&
Semester System: I-VI**

**WITH EFFECT FROM THE ACADEMIC SESSION
2018-2019**

**COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM FOR B.A./B.Sc.
HONOURS IN GEOGRAPHY**

Semester-wise course structure

(6 Credit: 75 Marks)

SEMESTER-I				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/H/CC/T/01	Core	GEOTECTONICS AND GEOMORPHOLOGY	75L+15T	6
GEO/H/CC/T/02	Core	CARTOGRAPHIC TECHNIQUES AND GEOLOGICAL MAP STUDY	60T	4
GEO/H/CC/P/02			60P	2
GEO/H/GE/T/01/A or GEO/H/GE/T/01/B	GE	DISASTER MANAGEMENT OR GEOGRAPHY OF TOURISM	75L+15T	6
-	AECC	Environmental studies	-	2
Total		4 courses	-	20
SEMESTER-II				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/H/CC/T/03	Core	HUMAN GEOGRAPHY	75L+15T	6
GEO/H/CC/T/04	Core	CARTOGRAMS, SURVEY AND THEMATIC MAPPING	60T	4
GEO/H/CC/P/04			60P	2
GEO/H/GE/T/02/A or GEO/H/GE/T/02/B	GE	GEOSPATIAL TECHNOLOGY OR REGIONAL DEVELOPMENT	75L+15T	6
-	AECC	Communicative English/ MIL	-	2
Total		4 courses	-	20
SEMESTER-III				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/H/CC/T/05	Core	CLIMATOLOGY	75L+15T	6
GEO/H/CC/T/06	Core	STATISTICAL METHODS IN GEOGRAPHY	60T	4
GEO/H/CC/P/06			60P	2
GEO/H/CC/T/07	Core	GEOGRAPHY OF INDIA	75L+15T	6
GEO/H/GE/T/03/A or GEO/H/GE/T/03/B	GE	CLIMATE CHANGE: VULNERABILITY AND ADAPTATION OR RURAL DEVELOPMENT	75L+15T	6
GEO/H/SEC/P/01/A or GEO/H/SEC/P/01/B	SEC	COMPUTER BASIC AND COMPUTER APPLICATIONS OR REMOTE SENSING	60P	2
Total		5 courses	-	26

COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM FOR B.A./B.Sc.
HONOURS IN GEOGRAPHY

Semester-wise course structure

(6 Credit: 75 Marks)

SEMESTER-IV				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/H/CC/T/08	Core	REGIONAL PLANNING AND DEVELOPMENT	75L+15T	6
GEO/H/CC/T/09	Core	ECONOMIC GEOGRAPHY	75L+15T	6
GEO/H/CC/T/10	Core	ENVIRONMENTAL GEOGRAPHY	60T	4
GEO/H/CC/P/10			60P	2
GEO/H/GE/T/04/A or GEO/H/GE/T/04/B	GE	INDUSTRIAL GEOGRAPHY OR SUSTAINABLE DEVELOPMENT	75L+15T	6
GEO/H/SEC/P/02/A or GEO/H/SEC/P/02/B	SEC	ADVANCE SPATIAL STATISTICAL TECHNIQUES OR FIELD WORK	60P	2
Total		5 courses	-	26
SEMESTER-V				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/H/CC/T/11	Core	RESEARCH METHODOLOGY AND FIELD WORK	60T	4
GEO/H/CC/P/11			60P	2
GEO/H/CC/T/12	Core	REMOTE SENSING AND GIS	60T	4
GEO/H/CC/P/12			60P	2
GEO/H/DSE/T/01/A or GEO/H/DSE/T/01/B	DSE	URBAN GEOGRAPHY OR CULTURAL AND SETTLEMENT GEOGRAPHY	75L+15T	6x2=12
GEO/H/DSE/T/02/A or GEO/H/DSE/T/02/B	DSE	POPULATION GEOGRAPHY OR SOCIAL GEOGRAPHY	75L+15T	
Total		4 courses	-	24
SEMESTER-VI				
Course Code	Course Nature	Course Title	Course wise Class (L+T+P)	Credit
GEO/H/CC/T/13	Core	EVOLUTION OF GEOGRAPHICAL THOUGHTS	75L+15T	6
GEO/H/CC/T/14	Core	DISASTER MANAGEMENT	60T	4
GEO/H/CC/P/14			60P	2
GEO/H/DSE/T/03/A or GEO/H/DSE/T/03/B	DSE	FLUVIAL GEOMORPHOLOGY OR RESOURCE GEOGRAPHY	75L+15T	6x2=12
GEO/H/DSE/T/04/A or GEO/H/DSE/T/04/B	DSE	SOIL AND BIO GEOGRAPHY OR AGRICULTURAL GEOGRAPHY	75L+15T	
Total		4 courses	-	24
Total (All semesters)		26 courses	-	140

B.A./B.Sc. (Honours) in Geography:

CORE COURSE (CC):

GEO/H/CC/T/01: (Theory): Geotectonics and Geomorphology **6 Credits**

Unit-1: Geotectonics **2 Credits**

1. Earth's tectonic and structural evolution with reference to geological time scale
2. Earth's interior with special reference to seismology
3. Concept of Isostasy: Theories of Airy and Pratt
4. Earth movements: Plate tectonics; Types of folds and faults; Earthquakes and Volcanoes

Unit-2: Geomorphology **4 Credits**

1. Geomorphology: Nature and Scope
2. Degradation processes: Weathering; Mass wasting and resultant landforms
3. Models of landscape evolution: Views of Davis, Penck, King and Hack
4. Development of river network and landforms on uniclinal and folded structures
5. Evolution of Landforms (Erosional and Depositional): Fluvial, Karst, Aeolian, Glacial and Coastal

Reference Books:

- Bloom, A. L., 2001: Geomorphology: A Systematic Analysis of Late Cenozoic Landforms, Prentice-Hall of India, New Delhi
- Bridges, E. M., 1990: World Geomorphology, Cambridge University Press, Cambridge
- Christopherson, R. W., 2011: Geosystems: An Introduction to Physical Geography, 8 Ed., Macmillan Publishing Company
- Kale, V. S., and Gupta, A., 2001: Introduction to Geomorphology, Orient Longman, Hyderabad
- Knighton, A. D., 1984: Fluvial Forms and Processes, Edward Arnold Publishers, London
- Selby, M. J., 2005: Earth's Changing Surface, Indian Edition, OUP
- Skinner, B. J., and Stephen, C. P., 2000: The Dynamic Earth: An Introduction to physical Geology, 4th Edition, John Wiley and Sons
- Thornbury, W. D., 1969: Principles of Geomorphology, Wiley
- Singh, S. 1998: Geomorphology, Prayag Pustak, Allahabad

CC/02: Cartographic Techniques and Geological Map Study**6 Credits****GEO/H/CC/T/02: (Theory): Cartographic Techniques and Geological Map Study****4 Credits**

1. Cartography: Nature and Scope
2. Maps: Classification and Types; Components of a Map
3. Concept of Scales: Linear, Comparative, Diagonal and Vernier
4. Coordinate Systems: Polar and Rectangular; Concept of Geoid and Spheroid; Map Projections: Classification, Properties and Uses; Concept and Significance of UTM Projection
5. Survey of India Topographical Maps: Reference Scheme of Old and Open series
6. Types of Rocks and Minerals; Characteristics of Granite, Basalt, Dolerite, Pegmatite, Gneiss, Shale, Sandstone, Slate, Marble, Quartzite, Quartz, Feldspar, Mica, Limestone, Calcite, Bauxite, Magnetite, Hematite, Galena (using samples of rocks and minerals)
7. Concept of Bedding Plane, Unconformity and Non-conformity, Thickness of Bed, Dip, Throw, Hade, Heave

GEO/H/CC/P/02: (Practical): Cartographic Techniques and Geological Map Study**2 Credits**

1. Construction of Scales: Linear, Comparative, Diagonal and Vernier
2. Construction of Projections: Polar Zenithal Stereographic Projection, Simple Conic with One Standard Parallel Projection, Bonne's Projection and Mercator's Projection
3. Construction and Interpretation of Relief Profiles (Superimposed, Projected and Composite), Preparation of Relative Relief Map, Average Slope Map (Wentworth Method), and Stream Ordering (After Strahler) on a Drainage Basin
4. Transect chart: Relation between physical and cultural features from topographical maps (Survey of India)
5. Geological Map (Problems related to Horizontal, Uniclinal, Folded and Faulted Structure); Drawing of Geological Section and Interpretation of the Map

*A Project File, comprising one exercise each is to be submitted.

Reference Books:

- Anson, R., and Ormelling, F. J., 1994: International Cartographic Association: Basic Cartographic Vol., Pregmen Press
- Gupta, K. K., and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi
- Mishra, R. P., and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi
- Monkhouse, F. J., and Wilkinson H. R., 1973: Maps and Diagrams, Methuen, London
- Robinson, A. H., 2009: Elements of Cartography, John Wiley and Sons, New York
- Singh, R. L., and Singh, R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers
- Sarkar, A. 2015: Practical Geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi

GEO/H/CC/T/03 : (Theory): Human Geography

6 Credits

Unit-1: Nature and Principles

2 Credits

1. Introduction: Defining Human Geography; Major Themes; Contemporary Relevance
2. Evolution of Humans; Concept of Race and Ethnicity; Major Racial Groups of the World
3. Space, Society and Cultural Regions (Language and Religion)
4. Concept: Culture, Cultural Diffusion, Community, Society, Cultural Realms

Unit-2: Society, Demography and Ekistics

4 Credits

1. Evolution of Human Society: Hunting and Gathering, Pastoral Nomadism, Subsistence Farming, Industrial and Urban Society
2. Population Growth and Distribution, Population Composition; Demographic Transition Model
3. Population–Resource Regions (Ackerman)
4. Population and Environment Relations with special reference to Development–Environment Conflict
5. Social Morphology and Rural House Types in India
6. Types and Patterns of Rural Settlements
7. Functional Classification of Urban Settlements
8. Trends and Pattern of World Urbanization

Reference Books:

- Bergman, E. F., 1995: Human Geography-Culture, Connections and Landscape, Prentice Hall, New Jersey
- Chisholm, 1975: Human Geography, Penguin Books, Hermondsworth
- Daniel, P. A., and Hopkinson, M. F., 1989: The Geography of Settlement, Oliver & Boyd, London
- Johnston, R., Gregory, D., Pratt, G. et al., 2008: The Dictionary of Human Geography, Blackwell Publication
- Jordan-Bychkov, et al., 2006: The Human Mosaic: A Thematic Introduction to Cultural Geography, W. H. Freeman and Company, New York
- Pearce, D., 1995: Tourism Today: A Geographical Analysis, 2nd edition, Longman Scientific & Technical, London
- Pickering, K., and Owen, A. A., 1997: An Introduction to Global Environmental Issues, 2nd edition, Rutledge, London
- Raw, M., 1986: Understanding Human Geography: A Practical Approach, Bell and Hyman. London
- Rubenstein, J. M., 2002: The Cultural Landscape, 7th edition, Prentice Hall, Englewood Cliffs
- Smith, D. M., 1982: Human Geography: A Welfare Approach, Edward Arnold, London
- Hussain, M., 2011: Human Geography, Rawat publication, Jaipur
- Chandna, R. C., 2016: Geography of Population- Concepts, Dterminants and Patterns, Kalyani publishers

CC/04: Cartograms, Survey and Thematic Mapping 6 Credits

GEO/H/CC/T/04: (Theory): Cartograms, Survey and Thematic Mapping 4 Credits

1. Concepts of Cartograms and Thematic Maps
2. Concept and Utility of Isopleth and Choropleth
3. Concept, utility and Interpretation of: Climograph, Hythergraph and Ergograph
4. Preparation and Interpretation of Demographic Charts and Diagrams (Age-Sex Pyramid)
5. Concepts of Bearing: Magnetic and True, Whole-circle and Reduced
6. Basic Concepts of Surveying and Survey Equipments: Abneys Level, Clinometer
7. Basic Concepts of Surveying and Survey Equipments: Prismatic Compass, Dumpy Level, Transit Theodolite
8. Interpretation of Landuse and landcover maps

GEO/H/CC/P/04: (Practical): Cartograms, Survey and Thematic Mapping 2 Credits

1. Diagrammatic Representation of Data: Star and Age-sex Pyramid Diagram, Pie Diagram
2. Representation of Data on Map by Proportional Circles, Dots and Spheres, Isolines and Choropleth method
3. Survey: Traversing by Prismatic Compass and Dumpy Level with One Change Point (Profile Drawing)
4. Determination of Height of Objects using Transit Theodolite (Accessible bases)

*A Project File, comprising one exercise each is to be submitted

Reference Books:

- Cuff, J. D., and Mattson, M. T., 1982: Thematic Maps: Their Design and Production, Methuen Young Books
- Dent, B. D., Torguson, J. S., and Holder, T. W., 2008: Cartography: Thematic Map Design (6th Edition), Mcgraw-Hill Higher Education
- Gupta, K. K., and Tyagi, V. C., 1992: Working with Maps, Survey of India, DST, New Delhi
- Kraak, M.-J., and Ormeling, F., 2003: Cartography: Visualization of Geo-Spatial Data, Prentice-Hall
- Mishra, R. P., and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi
- Singh, R. L., and Singh, R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers
- Slocum, T. A., McMaster, R. B., and Kessler F. C., 2008: Thematic Cartography and Geovisualization (3rd Edition), Prentice Hall
- Tyner, J. A., 2010: Principles of Map Design, The Guilford Press
- Sarkar, A., 2015: Practical Geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi

Unit-1: Elements of the Atmosphere

2 Credits

1. Nature, Composition and Layering of the Atmosphere
2. Insolation: Controlling Factors. Heat Budget of the Atmosphere
3. Temperature: Horizontal and Vertical Distribution; Inversion of Temperature: Types, Causes and Consequences
4. Greenhouse Effect and Importance of Ozone Layer

Unit-2: Atmospheric Phenomena, Climate Change and Climatic Classification

4 Credits

1. Condensation: Processes and Forms; Mechanism of Precipitation: Bergeron-Findeisen Theory, Collision and Coalescence; Forms of Precipitation
2. Air mass: Typology, Origin, Characteristics and Modification
3. Fronts: Warm and Cold; Frontogenesis and Frontolysis
4. Weather: Stability and Instability; Barotropic and Baroclinic Conditions
5. Circulation in the Atmosphere: Planetary Winds; Jet Stream
6. Monsoon Circulation and Mechanism with reference to India
7. Tropical and Mid-latitude Cyclones
8. Climatic Classification after Köppen, Thornthwaite (1931 and 1948)

Reference Books:

- Barry, R. G., and Carleton, A. M., 2001: Synoptic and Dynamic Climatology, Routledge, UK
- Barry, R. G., and Chorley, R. J., 1998: Atmosphere, Weather and Climate, Routledge, New York
- Critchfield, H. J., 1987: General Climatology, Prentice-Hall of India, New Delhi
- Lutgens, F. K., Tarbuck, E. J., and Tasa D., 2009: The Atmosphere: An Introduction to Meteorology, Prentice-Hall, Englewood Cliffs, New Jersey
- Oliver, J. E., and Hidore, J. J., 2002: Climatology: An Atmospheric Science, Pearson Education, New Delhi
- Trewartha, G. T., and Horne L. H., 1980: An Introduction to Climate, McGraw
- Lal, D. S., 1993: Climatology, 3rd edition, Chaitanya Pub. House, New Delhi
- Singh, S., 2013: Climatology, Prayag Pustak Bhawan, Allahabad

CC/06: Statistical Methods in Geography**6 Credits****GEO/H/CC/T/06: (Theory): Statistical Methods in Geography****4 Credits****Unit-1:**

1. Importance and Significance of Statistics in Geography; Discrete and Continuous Data; Population and Samples; Scales of Measurement (Nominal, Ordinal, Interval and Ratio); Sources of Data
2. Collection of Data and Formation of Statistical Tables
3. Sampling: Need, Types, and Significance and Methods of Purposive, Random
4. Distribution: Frequency, Cumulative Frequency; Probability: Normal, Systematic and Stratified Distribution

Unit-2:

1. Central Tendency: Mean, Median, Mode, Partition Values
2. Measures of Dispersion: Range, Mean Deviation, Standard Deviation, Coefficient of Variation
3. Association and Correlation: Rank Correlation, Product Moment Correlation
4. Linear Regression and Time Series Analysis

GEO/H/CC/P/06: (Practical): Statistical Methods in Geography**2 Credits**

1. Construction of Data Matrix with each Row representing an Aerial Unit (Districts / Blocks / Mouzas / Towns) and Corresponding Columns of Relevant Attributes
2. Based on the above, a Frequency Table, Measures of Central Tendency and Dispersion would be Computed and Interpreted
3. Histograms and Frequency Curve would be Prepared on the Dataset
4. Based on the Sample Set and using Two Relevant Attributes, a Scatter Diagram and Regression Line would be Plotted and Residual from Regression would be Mapped with a short Interpretation

*A Project File, comprising one exercise each is to be submitted

Reference Books:

- Berry, B. J. L., and Marble, D. F. (eds.): Spatial Analysis – A Reader in Geography
- Ebdon, D., 1977: Statistics in Geography: A Practical Approach
- Hammond, P., and McCullagh, P. S., 1978: Quantitative Techniques in Geography: An Introduction, Oxford University Press
- King, L. S., 1969: Statistical Analysis in Geography, Prentice-Hall
- Mahmood, A., 1977: Statistical Methods in Geographical Studies, Concept
- Pal, S. K., 1998: Statistics for Geoscientists, Tata McGraw Hill, New Delhi
- Silk, J., 1979: Statistical Concepts in Geography, Allen and Unwin, London
- Spiegel, M. R.: Statistics, Schaum's Outline Series
- Yeats, M., 1974: An Introduction to Quantitative Analysis in Human Geography, McGraw Hill, New York
- Das, N. G., 2017: Statical Methods (combined volumes) Mc.Grew Hill Education

GEO/H/CC/T/07: (Theory): Geography of India

6 Credits

Unit-1: Geography of India

4 Credits

1. Physical: Geology and Physiographic Divisions
2. Regionalisation of India: Physiographic (R.L. Sing); Socio-Cultural (Sopher) and Economic (Sengupta)
3. Climate, Soil and Vegetation: Characteristics and Classification
4. Population: Distribution, Growth, Structure and Policy
5. Distribution of Population by Race, Caste, Religion, Language, Tribes
6. Agricultural Regions; Green Revolution and its Consequences
7. Mineral and Power Resources: Distribution and Utilisation of Iron Ore, Coal, Petroleum, Natural Gas
8. Industrial Development: Automobile and Information Technology

Unit 2: Geography of West Bengal

2 Credits

1. Physical Perspectives: Physiographic Divisions, Forest and Water Resources
2. Population: Growth, Distribution and Human Development
3. Resources: Mining, Agriculture and Industries
4. Regional Development: Darjeeling Hills, Sundarban Delta, Nadia and Murshidabad District

Reference Books:

- Deshpande, C. D., 1992: India: A Regional Interpretation, ICSSR, New Delhi
- Johnson, B. L. C., (ed.), 2001: Geographical Dictionary of India, Vision Books, New Delhi
- Mandal, R. B. (ed.), 1990: Patterns of Regional Geography – An International Perspective, Vol. 3 – Indian Perspective
- Galina, S., and Sengupta, P., 1967: Economic Regionalisation of India, Census of India
- Sharma, T. C., 2003: India - Economic and Commercial Geography. Vikas Publ., New Delhi
- Singh, R. L., 1971: India: A Regional Geography, National Geographical Society of India
- Singh, J., 2003: India - A Comprehensive & Systematic Geography, Gyanodaya Prakashan, Gorakhpur
- Spate, O. H. K., and Learmonth, A. T. A., 1967: India and Pakistan: A General and Regional Geography, Methuen
- Tirtha, R., 2002: Geography of India, Rawat Publs., Jaipur & New Delhi
- Pathak, C. R., 2003: Spatial Structure and Processes of Development in India. Regional Science Assoc., Kolkata
- Tiwari, R. C., 2007: Geography of India. Prayag Pustak Bhawan, Allahabad
- Sharma, T. C., 2013: Economic Geography of India. Rawat Publication, Jaipur
- Khullar, D. R., 2014: India: A Comprehensive Geography, Kalyani publishers
- Dutta, R., and Sundaram, K. P. M., 1999: Indian Economy. S. Chand and Company Limited, New Delhi
- Mamoria, C. B., 1996: Economic and Commercial Geography of India. Revised edition, Shival Aggarwala and Co., Agra

Generic Elective (GE):

[For Students other than Geography Honours]

GE/01: Disaster Management or Geography of Tourism **6 Credits**

GEO/H/GE/T/01/A: (Theory): Disaster Management **6Credits**

1. Definition and Concepts: Hazards, Disasters; Risk and Vulnerability; Classification of hazards
2. Disasters in India: (a) Flood: Causes, Impact, Distribution and Mapping; Landslide: Causes, Impact, Distribution and Mapping; Drought: Causes, Impact, Distribution and Mapping
3. Disasters in India: (b) Earthquake and Tsunami: Causes, Impact, Distribution and Mapping; Cyclone: Causes, Impact, Distribution and Mapping.
4. Manmade disasters: Causes, Impact, Distribution and Mapping of Soil erosion and Accidental release of toxic chemicals
5. Response and Mitigation to Disasters: Institutional set up, NDMA and NIDM; Indigenous Knowledge and Community-Based Disaster Management; Do's and Don'ts During and Post Disasters

Reference Books:

- Government of India., 1997: Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
- Kapur, A., 2010: Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.
- Modh, S., 2010: Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
- Singh, R.B., 2005: Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3
- Singh, R. B. (ed.), 2006: Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
- Sinha, A., 2001: Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
- Stoltman, J.P. et al., 2004: International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
- Singh Jagbir., 2007: "Disaster Management Future Challenges and Oppurtunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India (www.ikbooks.com).

OR

GEO/H/GE/T/01/B: (Theory): Geography of Tourism

6 Credits

1. Scope and Nature: Concepts and Issues, Tourism, Recreation and Leisure Inter-Relations; Geographical Parameters of Tourism by Robinson
2. Types of Tourism: Nature Tourism, Cultural Tourism, Medical Tourism, Pilgrimage
3. Recent Trends of Tourism: International and Regional; Domestic (India); Eco-Tourism, Sustainable Tourism, Meetings, Incentives, Conventions and Exhibitions (MICE)
4. Impact of Tourism: Economy; Environment; Society
5. Tourism in India: Tourism Infrastructure; Case Studies of Himalaya, Desert and Coastal Areas; National Tourism Policy

Reference Books:

- Dhar, P.N., 2006: International Tourism: Emerging Challenges and Future Prospects. Kanishka, New Delhi.
- Hall, M. and Stephen, P., 2006: Geography of Tourism and Recreation – Environment, Place and Space, Routledge, London.
- Kamra, K. K. and Chand, M., 2007: Basics of Tourism: Theory, Operation and Practise, Kanishka Publishers, Pune.
- Page, S. J., 2011: Tourism Management: An Introduction, Butterworth-Heinemann-USA. Chapter 2.
- Raj, R. and Nigel, D., 2007: Morpeth Religious Tourism and Pilgrimage Festivals Management: An International perspective by, CABI, Cambridge, USA, www.cabi.org.
- Tourism Recreation and Research Journal, Center for Tourism Research and Development, Lucknow
- Singh Jagbir., 2014: “Eco-Tourism” Published by - I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India (www.ikbooks.com).

GE/2: Geospatial Technology or Regional Development 6 Credits

GEO/H/GE/T/02/A: (Theory): Geospatial Technology 6 Credits

1. Definition, scope and historical development of geospatial technology
2. Concepts of spheroid, ellipsoid and projection systems. Significance of WGS 84 and UTM
3. Data types and structures in spatial technology
4. Classification of Remote Sensing platforms, sensors and resolution. IRS (Resourcesat and Cartosat) and Landsat systems
5. Concept and function of GPS, DGPS and Total Station
6. Functions of Spatial information system: Information retrieval; Topological modeling; Networks; Overlay; Data output
7. Visual and Digital techniques of image interpretation
8. Development of web-based spatial platforms with reference to Bhuvan and Google Earth
9. Application of Geospatial Technology

Reference Books:

- C. Esperança and H. Samet, An overview of the SAND spatial database system, to appear in Communications of the ACM, 1997. <http://www.cs.umd.edu/~hjs/pubs/sandprog.ps.gz>
- G. Hjaltason and H. Samet, Ranking in Spatial Databases in Advances in Spatial Databases —4th Symposium, SSD'95, M. J. Egenhofer and J. R. Herring, Eds., Lecture Notes in Computer Science 951, Springer-Verlag, Berlin, 1995, 83-95. <http://www.cs.umd.edu/~hjs/pubs/incnear.ps>
- H. Samet, Spatial Data Structures in Modern Database Systems: The Object Model, Interoperability, and Beyond, W. Kim, Ed., Addison-Wesley/ACM Press, 1995, 361-385. <http://www.cs.umd.edu/~hjs/pubs/kim.ps>
- H. Samet, Applications of Spatial Data Structures: Computer Graphics, Image Processing, and GIS, Addison-Wesley, Reading, MA, 1990. ISBN 0-201- 50300-0. 6. H. Samet, The Design and Analysis of Spatial Data Structures, Addison-Wesley, Reading, MA, 1990. ISBN 0-201-50255-0.
- H. Samet and W. G. Aref, Spatial Data Models and Query Processing in Modern Database Systems: The Object Model, Interoperability, and Beyond, W. Kim, Ed., Addison-Wesley/ACM Press, 1995, 338-360. <http://www.cs.umd.edu/~hjs/pubs/kim2.ps>
- C. D. Tomlin, Geographic Information Systems and Cartographic Modeling, Prentice-Hall, Englewood Cliffs, NJ, 1990. ISBN 0-13-350927-3.

OR

GEO/H/GE/T/02/B: (Theory): Regional Development

6 Credits

1. Definition of Region, Evolution, Types and Need of Regional planning: Formal, Functional and Planning Regions and Regional Development
2. Regional Imbalances and Problems of Functional Regions
3. Choice of a Region for Planning: Characteristics of an Ideal Planning Region; Delineation of Planning Region; Regionalization of India for Planning (Agro Ecological Zones)
4. Strategies/Models for Regional Planning: Growth Pole Model of Perroux; Growth Centre Model in Indian Context; Village Cluster
5. Problem Regions and Regional Planning: Backward Regions and Regional Plans- Special Area Development Plans in India; DVC-The Success Story and the Failures
6. Concept of Human Development and HDI (Human Development Index)

Reference Books:

- Adell, Germán., 1999: Literature Review: Theories and Models Of The Peri-Urban Interface: A Changing Conceptual Landscape, Peri-urban Research Project Team, Development Planning Unit, University College London at
- Bhatt, L.S., 1976: Micro Level Planning in India. KB Publication, Delhi
- Deshpande C. D., 1992: *India: A Regional Interpretation*, ICSSR, New Delhi.
- Dreze J. and A. Sen, Indian Development: Select Regional Perspectives (Oxford: Oxford University Press, 1996).
- Ses, Amratya., 2000: Development as Freedom. Random House, Toronto
- Raza, M., Ed., 1988:. Regional Development. Contributions to Indian Geography. New Delhi, Heritage Publishers.
- Rapley, John., 2007: Understanding Development: Theory and Practice in the 3rd World. Lynne Rienner, London.
- Schmidt-Kallert, Einhard., 2005: A Short Introduction to Micro-Regional Planning, Food and Agriculture Organization of the United Nations (FAO) at
- Sdyasuk Galina and P Sengupta., 1967: *Economic Regionalisation of India*, Census of India

GE/3: Climate Change: Vulnerability and Adaptation or Rural Development 6 Credits

GEO/H/GE/T/03/A: (Theory): Climate Change: Vulnerability and Adaptation

6 Credits

1. Science of Climate Change: Understanding Climate Change; Green House Gases and Global Warming; Global Climatic Assessment- IPCC Reports
2. Climate Change and Vulnerability: Physical Vulnerability; Economic Vulnerability; Social Vulnerability
3. Impact of Climate Change: Agriculture and Water; Flora and Fauna; Human Health
4. Adaptation and Mitigation: Global Initiatives with Particular Reference to South Asia
5. Key Concepts of National Action Plan of India on Climate Change; Role of Local Institutions (Urban Local Bodies, Panchayats) on Climatic Change Mitigation: Awareness and Action Programmes

Reference Books:

- IPCC. 2007: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.*
- IPCC. 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IPCC. 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Palutikof, J. P., van der Linden, P. J. and Hanson, C. E. (eds.), Cambridge University Press, Cambridge, UK.
- OECD. 2008: *Climate Change Mitigation: What Do we Do? Organisation and Economic Cooperation and Development.*
- UNEP. 2007: *Global Environment Outlook: GEO4: Environment for Development, United Nations Environment Programme.*
- Singh, M., Singh, R.B. and Hassan, M.I. (Eds.) 2014: *Climate change and biodiversity: Proceedings of IGU Rohtak Conference, Volume 1. Advances in Geographical and Environmental Studies, Springer*
- Sen Roy, S. and Singh, R.B., 2002: *Climate Variability, Extreme Events and Agricultural Productivity in Mountain Regions, Oxford & IBH Pub., New Delhi.*

OR

GEO/H/GE/T/03/B: (Theory): Rural Development

6 Credits

1. Defining Development: Inter-Dependence of Urban and Rural Sectors of the Economy; Need for Rural Development, Gandhian Approach of Rural Development
2. Rural Economic Base: Panchayatiraj System, Agriculture and Allied Sectors, Seasonality and Need for Expanding Non-Farm Activities, Co-operatives, PURA
3. Area Based Approach to Rural Development: Drought Prone Area Programmes, PMGSY
4. Target Group Approach to Rural Development: SJSY, MNREGA, Jan Dhan Yojana and Rural Connectivity
5. Provision of Services – Physical and Socio-Economic Access to Elementary Education and Primary Health Care and Micro credit

Reference Books:

- Gilg A. W., 1985: *An Introduction to Rural Geography*, Edwin Arnold, London.
- Krishnamurthy, J. 2000: *Rural Development - Problems and Prospects*, Rawat Publs., Jaipur
- Lee D. A. and Chaudhri D. P. (eds.), 1983: *Rural Development and State*, Methuen, London.
- Misra R. P. and Sundaram, K. V. (eds.), 1979: *Rural Area Development: Perspectives and Approaches*, Sterling, New Delhi.
- Misra, R. P. (ed.), 1985: *Rural Development: Capitalist and Socialist Paths*, Vol. 1, Concept, New Delhi.
- Palione M., 1984: *Rural Geography*, Harper and Row, London.
- Ramachandran H. and Guimaraes J.P.C., 1991: *Integrated Rural Development in Asia – Learning from Recent Experience*, Concept Publishing, New Delhi.
- Robb P. (ed.), 1983: *Rural South Asia: Linkages, Change and Development*, Curzon Press.
- UNAPDI 1986: *Local Level Planning and Rural Development: Alternative Strategies*. (United Nations Asian & Pacific Development Institute, Bangkok), Concept Publs. Co., New Delhi.
- Wanmali S., 1992: *Rural Infrastructure Settlement Systems and Development of the Regional Economy in South India*, International Food Policy Research Institute, Washington, D.C.
- Yugandhar, B. N. and Mukherjee, Neela (eds.) 1991: *Studies in Village India: Issues in Rural Development*, Concept Publs. Co., New Delhi.

SKILL ENHANCEMENT COURSE (SEC):

GEO/H/SEC/P/01/A: (Practical): Computer Basics and Computer Applications

2 Credits

1. Numbering Systems; Binary Arithmetic
2. Data Computation, Storing and Formatting in Spreadsheets: Computation of Rank, Mean, Median, Mode, Standard Deviation, Moving Averages, Derivation of Correlation, Coefficient of Variation , Regression
3. Preparation of Annotated Diagrams and its Interpretation: Scatter Diagram and Histogram
4. Internet Surfing: Generation and Extraction of Information

Reference Books:

- Bartee, T. C., 1977: Digital Computer Fundamental; McGraw Hill
- Chauhan, S., Chauhan, A., and Gupta, K., 2006: Fundamental of Computer; Firewall Media
- Flake, L. J., McClintock, C. E., and Turner, S., 1989: Fundamental of Computer Education; Wordsworth Pub. Co
- Leon, A., and Leon, M., 1999: Introduction to Computer, USB Publishers' Distributors Ltd
- Malvino, A. P., Leach, D. P., 1981: Digital Principles and Applications; Tata McGraw Hill
- Mano, M. M., and Kime, C. R., 2004: Logic and Computer Design Fundamental; Prentice Hall
- Rajaraman, V., 2003: Fundamentals of Computer, Prentice Hall Publisher
- Sarkar, A., and Gupta, S. K., 2002: Elements of computer Science, S Chand and Company, New Delhi
- Blissmer, 1996: Working with MS Word; Houghton Mifflin Co
- Johnson, S., 2007: Microsoft Power Point 2007; Pearson Paravia Bruno
- Leon, A., and Leon, M., 1999: Introduction to Computer, USB Publishers' Distributors Ltd
- Leon, A., and Leon, M., 1999: A Beginners Guide to Computers, Vikas
- Rajaraman, V., 2008: Computer Primer; Prentice Hall of India Pvt. Ltd
- Sarkar, A., and Gupta, S. K., 2002: Elements of Computer Science, S Chand and Company, New Delhi
- Shepard, A., 2007: Perfect Pages; Shepard Publications
- Tyson, H. L., 2007: Microsoft Word 2007 Bible; John Wiley
- Walkenbach, J., 2007: Excel 2007 Bible; John Wiley

OR

GEO/H/SEC/P/01/B: (Practical): Remote Sensing

2 Credits

1. Concepts and Principles of Remote Sensing (RS): Classification of RS Satellites and Sensors
2. Sensor Resolutions and Their Application with reference to IRS and Landsat Missions, Image Referencing Schemes and Data Acquisition
3. Preparation of False Colour Composites (FCC) from IRS LISS-III and Landsat TM, Landsat ETM; Principles of Image Rectification and Enhancement
4. Principles of Image Interpretation and Feature Extraction, Preparation of Inventories of Landuse/ landcover Features from Satellite Images

*A Project File Consisting of Four Exercises on the Above Themes is to be submitted

Reference Books:

- Bhatta, B., 2008: Remote Sensing and GIS, Oxford University Press, New Delhi
- Campbell, J. B., 2007: Introduction to Remote Sensing, Guildford Press
- Jensen, J. R., 2005: Introductory Digital Image Processing: A Remote Sensing Perspective, Pearson Prentice-Hall
- Joseph, G., 2005: Fundamentals of Remote Sensing, United Press India
- Lillesand, T. M., Kiefer, R. W., and Chipman, J. W., 2004: Remote Sensing and Image Interpretation, Wiley. (Wiley Student Edition)
- Li, Z., Chen, J., and Batsavias, E., 2008: Advances in Photogrammetry, Remote Sensing and Spatial Information Sciences CRC Press, Taylor and Francis, London
- Mukherjee, S., 2004: Textbook of Environmental Remote Sensing, Macmillan, Delhi
- Nag, P., and Kudra, M., 1998: Digital Remote Sensing, Concept, New Delhi
- Singh, R. B., and Murai, S., 1998: Space-informatics for Sustainable Development, Oxford and IBH Pub

UNIVERSITY OF KALYANI

DEPARTMENT OF HISTORY

Structure of the revised syllabus for B.A. Honours/Programme course for semester-wise CBCS curriculum

A. TOTAL Number of courses in UG-CBCS (B.A. in History Honours):

Types of course	Core course (CC)	Elective course		Ability enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

TABLE-1: DETAILS OF COURSES & CREDIT OF B.A. IN HISTORY HONOURS UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory + Tutorial
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (14 papers)	14x4 = 56	14x5 = 70
1.B.	Core Course (Practical/Tutorial)*(14 papers)	14x2 = 28	14x1 = 14
2.	Elective Courses: (8 papers)		
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x4 = 16	4x5 = 20
2.B.	DSE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
2C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x4 = 16	4x5 = 20
2.D.	GE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
<i>#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester</i>			
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
Total Credit:		140	140
<i>## Wherever there is a practical, there will be no tutorial and vice-versa.</i>			

TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.A.(HISTORY) HONOURS

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1			--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

A. TOTAL Number of courses in UG-CBCS UNDER B.A. IN HISTORY(PROG.) COURSE

Types of course	Core course (CC)	Elective course		Ability Enhancement Course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course(AECC)	Skill Enhancement course (SEC)	
No. of course	12	6(BSc)/4(BA/B.Com)	2((BA/B.Com)	2	2	24
Credit/course	6	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.A. IN HISTORY(PROGRAMME) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practicl	Theory + Tutoril
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (12 papers)	12x4 = 48	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x2 = 24	12x1 = 12
2.	Elective Courses: (6 papers)		
A.	DSE (6 papers for B.Sc./ 4 papers for B.A. & B.Com.)	6x4 = 24	4x5 = 20
B.	DSE(Pract./ Tutor.)* (6 papers for B.Sc./4 for B.A. &B.Com.)	6x2 = 12	4x1 = 4
C.	GE (Interdisciplinary) (2 papers for B.A. & B.Com.)	--	2x5 = 10
D.	GE (Pract./Tutor.)* (4 papers) (2 papers for B.A. & B.Com.)	--	2x1 = 2
#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester			
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication / MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (4 papers of 2 credits each)-----	4x2 = 8	4x2 = 8
Total Credit:		120	120
## Wherever there is a practical, there will be no tutorial and vice-versa.			

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.A. HISTORY (PROG.)

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC-1,2 (6)	2(1A,2A)	2 1B,2B)	2 (1C,2C)	2 (1D,2D)			8	48
Language CC - 1,2 (6)	1 (L ₁ -1)	1 (L ₂ -1)	1 (L ₁ -2)	1 (L ₂ -2)			4	24
DSE (6)	-	-	-	-	2(1A,2A)	2 (1B,2B)	4	24
GE (6)					1(GE-1)	1(GE-2)	2	12
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Courses/ Sem.	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

Core Course

(14 Courses, Each Course would be allotted 40 lectures)

Semester-1

Course – I

History of Early India, from remote past to the end of the Vedic Polity

Unit-1: Historiography of early India – historical interpretations - imperialist vs nationalist school - leftist vs liberal school - secular vs religious school.

Unit-2: Evolution from paleolithic to neolithic cultures - chalcolithic societies from Baluchistan to Gujrat - growth and decline of pre-state non-iron urban culture - the Harappan Civilization ; problem of the Indus script - journey from proto-historic to historic India.

Unit-3: Legacy of the Harappan Culture - the Aryan penetration and the Anglo-Oriental debate ; beginning of iron age and settled agriculture - patterns of settlement and cultural changes - emergence of caste society, organized religion and state territoriality - the Vedic literature.

Unit-4: The non-Vedic political economy of the 16 Mahajanapadas - spread of protestant religions – Ajivikism, Jainism and Buddhism ; commercial and urban growth of India - rise of Magadha as an imperial power.

Reading

1. D. D. Kosambi : *The Culture and Civilization of Ancient India in Historical Outline*
2. A. L. Basam : *The Wonder that was India.*
3. Irfan Habib : *Pre-History ; Indus Civilization (2002) ; The Vedic Age (2003)*
4. Romila Thapar : *Early India from the Beginning to 1300*
5. Upinder Singh : *A History of Ancient and Early Medieval India.*
6. R.S.Sharma : *India's Ancient Past.*
7. Bridget and Allchin : *The Rise of Civilization in India and Pakistan.*
8. Uma Chakraborty : *The Social Dimensions of Early Buddhism.*

Course – II

Social Formation and Cultural pattern of the Ancient and early Medieval World

Unit-1: Pre-historic and proto-historic cultures beyond India – beginning of agriculture and animal husbandry – searches into the history of Africa, the Aztec Civilization and the Inca Society.

Unit-2: Bronze Civilizations of Egypt, Mesopotamia, China and eastern Mediterranean lands.

Unit-3: The Polis and slave society of ancient Greece - rise of ancient Rome – decline of the Roman Empire – agrarian economy and trade – the Church and the question of religion.

Unit-4: Societies in Central Islamic Lands - spread of Islam – the Ummah, Caliphite State, Shariah and Sufi culture.

Reading

1. *Oxford History of the Classical World*
2. Burns and Ralph : *World Civilizations*
3. V. Gordon Childe : *What Happened in History*
4. Amar Farooqui : *Early Social Formations.*
5. R.T.Matthews and F. DeWitt Platt : *Western Humanities*
6. J. Kelley Sowards : *Western Civilization*
7. Jacquetta Hawkes : *First Civilizations*
8. M.G.S. Hodgson : *The Venture of Islam*

Semester-2

Course-III

Ancient India from the Maurya to Late Gupta period

Unit-1:The Maurya rule in Magadha - Asoka's Dhamma and administration - the policy of cultural conquest.

Unit-2: The post-Maurya India of the Kushanas, Satavahanas and Tamil powers, Chera,Chola and Pandya - new trends in economy and society – peasantization of tribes and changes in the caste system ; spread of megalithic culture - splits in Jainism and Buddhism - Vaishnavism, Saivism and Tantricism.

Unit-3: Age of the Guptas - consolidation of Second Magadhan empire - debates on golden age, brahminical revival and growth of feudalism - decline of the Gupta power and beginning of political decentralization of India - assessing Harshavardhana as the last great emperor.

Unit-4: Early India in retrospect – society and culture and environment - literature and philosophy - art and architecture - science, technology and guild - trade and industry.

Reading

1. Romila Thapar : (i) *Ancient India* ; (ii) *Asoka and the Decline of the Mauryas*
2. D.D. Kosambi : *An Introduction to the Study of Indian History*
3. Irfan Habib : *The Mauryan India*
4. R.S.Sharma : *Indian Feudalism*
5. S.K.Maity : *Economic Life in Northern India in the Gupta Period*
6. B.P.Sahu ed. : *Land System and Rural Society in Early India*

7. Susan Huntington : *The Art of Ancient India*
8. D.P.Chattopadhyay : *History of Science and Technology in Ancient India*

Course-IV

History of Early Medieval India

Unit-1: Sources of History and historiography of the period - contemporary texts and travelogues - indigenous literature and archaeology.

Unit-2: From centralized to decentralized India - The Rajputs of North India - Palas and Senas in Bengal - Kingdoms of the South – The Pallavas, Rashtrakutas, Chalukyas and Cholas.

Unit-3: Condition in the pre-Sultanate period - Polity, Society, Economy, Religion and Culture - towards transition.

Unit-4: Northern India under the Delhi Sultanate - the Turkish invasions from 997 to 1206 AD - consolidation of the Sultanate from 1206 to 1286 AD - the Khalji Revolution and the omnipotent state under the Khaljis - The Tughluq period of reforms and counter reforms - decline of the Delhi Sultanate.

Reading

1. B.D.Chattopadhyay : *The Making of Early Medieval India*
2. Satish Chandra : *The Delhi Sultanate*
3. R.S.Sharma and K.M.Srimali eds. : *Comprehensive History of India*, Vol. IV
4. Md. Habib and K.A.Nizami eds. : *Comprehensive History of India*, Vol V
5. Hermann Kulke ed.: *The State in India (AD 1000 – 1700)*
6. Irfan Habib : *Medieval India – The Study of a Civilization*
7. N. Karashima : *South Indian History and Society*
8. Salma Farooqui : *A Comprehensive History of Medieval India*

Semester-3

Course – V

The Delhi Sultanate in Retrospect

Unit-1: The successor states of Bijohnagar, Bahmani and Bengal - society, economy, art, architecture and literature.

Unit-2: Delhi on the eve of the Mughal ascent - Timur's invasion - the Sayyids and Lodis - Babur's adventure - Babur's central Asian connection - Humayun's misfortune - Sher Shah Sur and Afghan rule in India.

Unit-3: Economy of Sultanate India - changes in land revenue administration - new agrarian relations - industry and urbanization - trade and currency.

Unit-4: Ideas of state and kingship - moves from theocracy to secular administration - development of bhakti and sufi philosophy - language, literature, art and architecture.

Reading

1. A.L.Srivasva : *The Sultanate of Delhi*
2. S.A.A.Rizvi : *The Wonder that was India*
3. Satish Chandra : *Medieval India-1, The Delhi Sultanate*
4. Peter Jackson : *The Delhi Sultanate*
5. Hermann Kulke ed.: *The State in India (AD 1000 – 1700)*
6. Irfan Habib : *Medieval India – The Study of a Civilization*
7. N. Karashima : *South Indian History and Society*
8. Salma Farooqui : *A Comprehensive History of Medieval India*

Course - VI

Rise of the Modern West

Unit-1: Structural features of European feudalism - the Crusades and the 14th century crisis of feudalism - decline of feudalism in western Europe but its survival in eastern Europe .

Unit-2: Socio-economic roots of Renaissance - spread of new social ideas - secularism and humanism - art, architecture, science and literature - the printing revolution.

Unit-3: Reformation – origin, course and results - progress of the movement from Luther to Calvin ; the counter Reformation.

Unit-4: Europe from Thirty Years' War to Seven Years' War – rise of early nation states, Spain, France, England and Russia.

Reading

1. Meenaxi Phukan : *Rise of the Modern West*
2. Eugene F. Rice and Jr. Anthony Grafton : *The Foundations of Early Modern Europe*
3. Euan Cameron : *Early Modern Europe*
4. Wallace K. Ferguson ed. : *Renaissance-Studies towards the Modern State*
5. V.H.H.Green : *Renaissance and Reformation – A Survey of European History Between 1450-1660.*
6. Theodore Rabb ed. : *The Struggle for Stability in Early Modern Europe*
7. J.H.Parry : *Europe and a Wider World*
8. J.Huizinga : *Waning of the Middle Ages*

Course – VII

Europe in Transition

Unit-1: Geographical explorations and overseas empires of Portugal and Spain - shift of economic balance from the Mediterranean to the Atlantic ocean - commercial and price revolution.

Unit-2: Seventeenth century crisis in Europe - mercantilism and economic transition - Glorious Revolution in England and great changes in political, economic and state structure; from scientific to Industrial Revolution - rise of industrial societies in Europe.

Unit-3: American War of Independence – birth of new democratic politics.

Unit-4: From the age of Enlightenment to the Age of Liberalism - from feudalism to capitalism- the transition debate.

Reading

1. *The New Cambridge Modern History of Europe*, Vol. VI-VII
2. *D.H.Pennington : Seventeenth century Europe*
3. Jan de Vries : *Economy of Europe in an Age of Crisis, 1600-1750*
4. Stephen J. Lee : *Aspects of European History, 1494-1789*
5. Rodney : *Transition from Feudalism to Capitalism*
6. C.M.Cipolla : *Before the Industrial Revolution, 1000-1700*
7. Rila Mukherjee : *Europe Transformed (1350-1789)*
8. Rila Mukherjee : *The Lost Worlds of Europe*

Semester-4

Course - VIII

History of Mughal India

Unit-1: Survey of sources and different aspects of historiography of Mughal India – reading of the texts of AbulFazal, Badauni, Abdul Hamid Lahori and Bernier - Studies in the writings of Sir Jadunath Sarkar and historians from Delhi and Aligarh schools.

Unit-2: Making of the Mughal State from Akbar to Aurangzeb - state and religion - management of land and agriculture - evolution of the administrative system - mansab and jagir - the Mughal ruling classes - nobility and zamindars - the peasants and village community.

Unit-3: Trade, commerce, and monetary system - routes of trade and commodity pattern of internal transactions - overseas trade and commodity pattern - markets and monetary system.

Unit-4: Urban centres - morphology of cities - urban economy – crafts, technology and industry - imperial *karkhanas* - urban social structure, merchant communities, bankers, artisans, craftsmen and labourers.

Reading

1. Satish Chandra : *Medieval India Par II, The Mughal Empire*
2. S.A.A.Rizvi : *The Wonder that was India*
3. Tapan Raychaudhuri and Irfan Habib eds. ; *The Cambridge Economic History of India, Vol.I*
4. Mohibul Hasan : *Historians of Medieval India*
5. Richard M. Eaton ed. : *India's Islamic Traditions*
6. A.L.Srivastava : *The Mughal Empire*
7. Satish Chandra : *Parties and Politics at the Mughal Court*
8. Goutam Bhadra : *Mughal Juge Krishi Arthaniti O Krishak Bidroha*

Course – IX

History of Late Medieval India

Unit-1: Society and culture – religion of the masses - language, music and literature - art and architecture.

Unit-2: Regional polity – the Marathas under *Shivaji* and the *Peshwas* - the Sikh challenge.

Unit-3: Decline of the Mughal Empire - agrarian crisis and the eighteenth century debate.

Unit -4 : Emergence of successor states – Bengal, *Awadh*, Mysore and Hyderabad.

Reading

1. Catherine Asher and Cynthia Talbot : *India Before Europe*
2. Cynthia Talbot : *Pre-Colonial India in Practice*
3. S.A.A.Rizvi : *The Wonder that was India*
4. Tapan Raychaudhuri and Irfan Habib eds. ; *The Cambridge Economic History of India, Vol.I*
5. Richard M. Eaton ed. : *India's Islamic Traditions*
6. C.A.Bayly : *Rulers, Townsmen and Bazars*
7. Satish Chandra : *Parties and Politics at the Mughal Court*
8. Goutam Bhadra : *Mughal Juge Krishi Arthaniti O Krishak Bidroha*

Course - X

Rise of Modern Europe

Unit-1: Historiography – studies in the writings of Alfred Cobban, Lefebvre, Eric Hobsbawm, E.P.Thompson, David Thomson and A.J.P.Taylor.

Unit-2: The eighteenth century background to the French Revolution - society, economy, and polity ; the philosophers and the ideological revolution.

Unit-3: People in the French Revolution – aristocracy, bourgeois, peasants and workers - the Constituent Assembly and its achievements - Girondins and Jacobins - the Reign of Terror and the Rise and fall of the Jacobin Republic - the Thermidorian reaction and the Directory ; the Napoleonic Era - interpreting the French Revolution.

Unit-4: The unity and disunity in Europe in 1815 - the Vienna Congress and rise of Metternich - struggle between forces of continuity and change.

Reading

1. Eric Hobsbawm : *The age of Revolution* (1789-1848)
2. Arun Bhattacharyya : *History of Europe* (1453-1789)
3. Alfred Cobban : *A History of Modern France* (2 vols.) ; *The debate on the French Revolution*
4. Georges Lefebvre : *The Coming of the French Revolution*
5. E.P.Thompson : *The Making of the English working Class*
6. David Thomson : *Europe Since Napoleon*
7. A.J.P.Taylor : *Europe, Grandeur and Decline*
8. S.N.Sen : *Europe and the World*

Semester-5

Course - XI

History of Modern India from the beginning of colonial rule to the Great Revolt

Unit-1: Understanding Modern Indian History- historiography, concepts, terminologies, approaches.

Unit-2: Expansion and Consolidation of British Rule with special reference to Bengal, Maharashtra, Mysore, Punjab and Awadh ; colonial state and its ideology - rule of law, orientalism, utilitarianism.

Unit-3: Rural Economy and Society – land revenue settlements - agrarian structure and transformation debate - commercialization of agriculture - rural stratification thesis, peasants and landless labourers - detribalization and the environmental question - de-industrialization, rural credit and indebtedness.

Unit-4: Nature of colonial exploitation - drain of wealth - famines in India - monetization and entitlement debate - resistance from the tribes and peasants till the Revolt of 1857 - analysing the Revolt and its aftermath.

Reading

1. Amar Farooqui : *The Establishment of British Rule* (1757-1813)
2. Bipan Chandra : *Modern India*
3. B.L.Grover : *A New Look on Modern Indian History*
4. Dharma Kumar ed. : *The Cambridge economic History of India*, Vol. 2
5. Tirthankar Roy : *The Economic History of India*
6. Irfan Habib : *Indian Economy Under Early British Rule* (1757-1857)
7. Sabyasachi Bhattacharyya ed. : *1857-Drohakal*
8. Elisabeth Kolesky : *Colonial Justice in British India – White Violence and the Rule of Law*

Course – XII

History of Modern India from Renaissance to Independence

Unit-1: The cultural revolution of the nineteenth century - critique of Young Bengal Movement, Bengal Renaissance, social and religious reforms - colonisation of education - the women's question.

Unit-2: Re-industrialisation of India following the spread of railway network - colonial fiscal policy and the balance of Indian trade - rise and growth of the Indian capitalist and working class.

Unit-3: Interpreting Indian nationalism – messianic and developmental - different phases of the nationalist struggle - politics of association and politics of union - different political parties and their ideologies - role of Gandhi, Tagore, Subhas Bose, Nehru and Jinnah - workers' and peasants' movements.

Unit-4: Colonial policy of divide and rule - religious polarisation of the nationalist leaders - demand for Pakistan and partition of 1947 - the refugee question - struggle for new developmental economy, democracy and security in the bi-polar world.

Reading

1. Sekhar Bandyopadhyay : *From Plassey to Partition*
2. Bipan Chandra, Mridula Mukherjee et.al.eds. : *India's Struggle for Independence*
3. Bipan Chandra : *Rise and Growth of Economic Nationalism in India*
4. Judith Brown : *Gandhi's Rise to Power, 1915-22*
5. Sumit Sarkar : *Modern India (1885-1947)*
6. Ranajit Guha ed. : *A Subaltern Studies Reader*
7. Paul Brass : *The Politics of India Since Independence*
8. Bipan Chandra : *India After Independence*

Semester-6

Course – XIII

Modern Europe : From Nationalism to Socialism

Unit-1: The age of Revolutions – the national revolutions (1830-1850) - the liberal revolutions and the transformation of Russian society - remaking of eastern Europe.

Unit-2: The economic revolutions, consolidation of capitalism and formation of big national states in Germany and Italy - imperial advances before and after Bismarck – developments in eastern Europe - the new balance of power in Europe - Europe divided.

Unit-3: Politics of democracy - industrial society and its critics - new concept of welfare state and revolution in medical science - reason, social change and social reform - the new woman - arts transformed.

Unit-4: The socialist challenge - from utopian to Marxian socialism - the German, French and Russian variety of socialist politics.

Reading

1. Eric Hobsbawm : *The Age of Capital* (1848-1875) ; *The Age of Empire* (1875-1914)
2. Eric Hobsbawm : *Industry and Empire ; Nations and Nationalism*
3. James Joll : *Europe Since 1870*
4. T.C.W. Blanning : *The Short Oxford History of Europe (nineteenth century), 1989-1914*
5. G. Barraclough : *An Introduction to Contemporary History*
6. Anthony Wood : *History of Europe (1815-1960)*
7. Andrew Porter : *European Imperialism* (1870-1914)
8. George Lichtheim : *A Short History of Socialism*

Course – XIV

Trends in World Politics from the First to the Second World War

Unit-1: Different theories of world politics - the Marxist and non-Marxist approaches.

Unit-2: Roots of European imperialism and the World Wars as the total war - impact of war on European mind - Peace settlement of 1919 and search for the collective security - the League of Nations.

Unit-3: Aspects of the war economy in the inter-war period - the depression and new theories of mixed economy - the collapse of the Weimer state in Germany and the rise of the Nazis to power - fascism in Italy.

Unit-4: The World after 1945 - theories of the Cold War and the division of Europe - the emergence of the American and Soviet spheres of influence - various military and economic alliances - regional conflicts in the bi-polar world, Vietnam, Korea, Cuba, the middle east and Afghanistan.

Reading

1. J.M.Gabriel : *Worldviews and Theories of International Relations*
2. J.J.Roth ed. : *World War 1 – A Turning Point in Modern History*
3. Eric Hobsbawm : *The Age of Extremes, the Short Twentieth Century*
4. A.J.P.Taylor : *Origins of the Second World War*
5. J. Robert wegs : *Europe Since 1945*
6. Kanti Bajpai and Harish C. Shukul ; *Interpreting World Politics*
7. W.C.McWilliams and Harry Piotrowski : *The World Since 1945*
8. Andreas Wenger and Doron Zimmermann : *Internatinal Relations(Cold War to Globalized World)*

Discipline Specific Elective Course (Any four out of Six)
Semester-5 (any two out of three)

Course – I

History of China from Tradition to Revolution

Unit-1: Traditional China – sino-centrism - society - social groups and classes - confucian value system - closed chinese economy - the canton trade.

Unit-2: Confronting the foreigners - Opium Wars - treaties with imperialist powers - foreigners' struggle for concessions in China - China as an 'informal colony' – increasing western pressure - the open door policy - transformation of China from a feudal society to a semi-colonial and semi-feudal society.

Unit-3: The People's response – from Taiping to Boxer - self –strengthening movement and reforms 1860 -1898 and 1901-1908 - revolution of 1911 – from nationalism to comprador-ship, Sun Yat Sen to Yuan-Shi-Kai - Warlordism since 1916 - revolt of the Chinese working class, the May Fourth Movement.

Unit-4: Development of Chinese industrial economy and growth of the Chinese proletariat - spread of communism among the proletariat in between the world wars - Chiang Kai Shek, Kuomintang and the united front - break with the front and the mature phase of Chinese communist movement under Mao Tse Tung - the Long March and the Communist Revolution of China.

Reading

1. Sachindranath Chattopadhyay : *Mahachiner Itikatha*
2. P.B.Ebrey ed. : *Chinese Civilization and Society*
3. J.K.Fairbank ed. : *The Cambridge History of China*
4. J.K.Fairbank et al : *East Asia – Modern Transformation*
5. Foreign Language Press, Peking : *The Opium War to The Revolution of 1911*, series of 5 vols.
6. Tan Chung : *Studies on the 19th Century China and Imperialists China the Brave New World*
7. Jean Chesneaux et al : *China from 1911 Revolution to Liberation*
8. Y. Immanuel Hsu : *The Rise of Modern China*

Course – II

History of Japan from Meiji Restoration to the Second World War

Unit-1: Tokugawa Baku-han system of Japan– its nature - crisis encounter with the west - Meiji restoration - processes of modernization – social, military, political and economic.

Unit-2: Popular and democratic movements - Satsuma rebellion; popular rights movement and Meiji constitution.

Unit-3: Growth of militarism in Japan and her imperialist projects - Sino -Japanese relations; Anglo-Japanese alliance - Russo-Japanese war - World War I and after - the Manchurian crisis.

Unit-4: Rise of political parties in Japan and their failure to sustain democratic system - Japan and the two World Wars.

Reading

1. The Cambridge History of Japan
2. K.Asakawa : The Early Institutional Life of Japan
3. Richard Storry : A History of Modern Japan
4. J.K.Fairbank et al : East Asia – Modern Transformation
5. G.Beasley : The Modern History of Japan
6. E.H.Norman : Japan’s emergence as a Modern State
7. J.W.Hall : Japan from Pre-history to Modern Times
8. K.B.Pyle : The Making of Modern Japan

Course – III

Issues of the Contemporary World

Unit-1: De-colonization of Asia and Africa - emergence of the Third World - struggle for survival in Asia and apartheid in Africa.

Unit-2: Crisis in the socialist block – theory and practice - impact of the rise of China as a new socialist state ; the sino-soviet rift and tensions within the east European Soviet Bloc : Hungary, Czechoslovakia, and Poland ; glasnost- perestroika and collapse of Soviet socialism - end of the cold war and German reunification.

Unit-3: Oil politics and the Arabian world : Israel, Palestine, Iran and Iraq - nuclear diplomacy in the twentieth century world

Unit-4: From Bi-polarism to Uni-polarism - globalization and its impact on culture and society- information revolution and its impact of the present day world.

Reading

1. Robert J.C.Young : *Postcolonialism*
2. Pramod K. Mishra : South asia – *Challenge and Co-operation*
3. Walter Lippman : *The Cold War and Making of the Modern World*
4. Herbert Feis : *From Trust to terror-the Onset of the Cold War*
5. Julius Braunthal : *History of the International-World Socialism,2 Vols.*
6. M.R.Gordon and B.F.Trainor : *The General’s War-the inside Story of the Conflict in the Gulf*
7. W.C.McWilliams and Harry Piotrowski : *The World Since 1945*
8. C.V.Findley and John Rothay : *Twentieth Century World*

Semester-6
(Any two out of three)

Course - I

History of Bangladesh from Liberation to the present day

Unit-1 : The genesis – issues of conflict between Pakistani non-Bengali elite group and the rising Bengali middle class of East Pakistan.

Unit 2 : Political transformation in East Pakistan – emergence of linguistic nationalism since 1952 – resistance against Pakistani militarism – rise of Sheikh Mujibur Rahman as the new mass leader – Awami League Movement, 1966 to 1970 – Bangladesh liberation movement of 1971 – birth of Bangladesh in 1972.

Unit 3 : Bangladesh after independence – society, economy and politics.

Unit 4 : Foreign policy of Bangladesh – relations with India – role of Bangladesh in the SAARC and ASEAN.

Reading

1. Jaya Chatterjee : *Bengal Divided*
2. Asfak Hossain : *Bangladesher Itihas*
3. Sirajul Islam ed. : *History of Bangladesh*
4. Badruddin Umar : *Purba Banglar Bhasha andolon O Tatkalin Rajniti*
5. Amitabha Gupta : *Purba Pakistan*
6. Israil Khan : *Bhashar Rajniti O Banglar Samasya*
7. Sukumar Biswas ed. : *Bangladesher Bhasha Andolon O Kolkatar sambadpatra*
8. Purabi Basu O Harun Habib eds. : *Bangali*

Course – II

History of Africa, 1500 to 2000 A.D.

Unit-1 : Main issues in the Historiography of Africa

Unit-2 : Africa and African societies before colonization – informal empire of the 19th century – European imperialism and partition of Africa in the 20th century – the French in the Maghreb and West Africa – The British in the East, West and Southern Africa – the Belgians in Congo.

Unit-3 : Socio-economic transformation – structural changes in agriculture, forest management and mining – changing patterns of trade – trans-Atlantic slave trade – migration of capital of labour with special reference to Southern Africa – race, class and religions in colonial South Africa, Apartheid – language, education and cultural forms.

Unit-4 : Popular protests, Rebellions and National Liberation Movements – role of peasants and workers – nationalist movements in Algeria, Ghana, Kenya, Congo, Angola and South Africa.

Reading

1. Michael Crowder ed. : *Cambridge History of Africa, Vol.VIII*
2. Basil Davidson : *Africa in Modern History*
3. E.Flint ed. : *Cambridge History of Africa, Vol. V*
4. A.J.Temu and B.swal eds. : *Historians and Africanist History*
5. A.Mazrui ed. : *UNESCO General History of Africa*

6. A.G.Hopkins : *An Economic History of West Africa*
7. Ralph Austen : *African Economic History*
8. Donald Crummy ed. : *Banditry, Rebellion and Social Protest in Africa*

Course – III
History of Women in India

Unit-1 : Women in the Indian tradition – different socio-religious movements in pre-colonial India and women’s position re-defined.

Unit-2 : Feminism revisited in the Indian context – the women’s question in 19th century India during colonial modernization – the debates on Sati and Purdah.

Unit-3 : The nationalist resolution on the women’s question – women in the freedom movement in India.

Unit-4 : Emerging new woman in post-colonial India – women’s organizations and fight against their marginalization – women in Indian literature and performing art.

Reading

1. C.T.Mohanty : *Third World women and the Politics of Feminism*
2. Rinita Mazumder : *A Short Introduction to Feminist theory*
3. Kumkum Sangari and Sudesh Vaid eds. : *Recasting Women*
4. Clarisse Bader : *Women in Ancient India*
5. M.Kaur : *Women in Indian Freedom Struggle*
6. Mrinalini Sinha : *Colonial Politics and the Idea of Masculinity*
7. Rajat Kanta Roy ed. : *Mind, Body and Society*
8. Geraldine Forbes : *Women in Modern India*

Generic Elective

(Any four out of six courses, one course in each semester up to the 4th one)

Course – I
Human Rights in India

Unit-1 : Basic concepts and theories of human rights – social structure and the question of human rights in India, gender, caste, class and religion – state and human rights, politics and economic policies.

Unit-2 : International Conventions and Charters on human rights – Constitution of India and provisions for protection of human rights – legislation and landmark court judgments on human rights in India.

Unit-3 : History of human right movements in India – intensity and impact.

Unit-4 : Women’s rights in India – the question of women’s empowerment – women’s access to resources of the country – violence against women, protective laws, protests and movements.

Reading

1. Bertrand Russell : *Freedom versus Authority*
2. Sujata Bhadra : *Prasanga Manabadhikar*
3. Bina agarwal : *Field of Her Own*

Course – II

History of Indian Environment

Unit-1 : Concepts and theories of environment and ecology developed in India, idealist, materialist, non-materialist and post-materialist philosophies.

Unit-2 : Indigenous knowledge system – animal ethics - social formation and collective management of rivers, forests and hills in pre-colonial India.

Unit-3 : The colonial impact, structural changes in land and environment of India – jangalmahals and jalmahals – spread of railway network – environmental degradation and problems of public health.

Unit-4 : Political economy of environment in post-colonial India – industry and pollution – development vs environment debate – various environmental movements.

Reading

- Richard Grove et al eds. : *Nature and the Orient*
Ranjan Chakraborty Ed. : *Situating Environmental History*
Ramchandra Guha : *Environmentalism*

Course – III

Making of Contemporary India

Unit-1 : Towards independence – from Government of India Act (1935) to the Mountbatten Plan – partition and birth of the new State of India in 1947 – communal riots, influx of refugees and their rehabilitation.

Unit-2 : Making of the Republic – the Constituent Assembly and framing of the Constitution – integration of princely states – electoral politics and the changing party system – setting the tone for new foreign policy, non-aligned movement, issues of Pakistan, Bangladesh and China.

Unit-3 : The Indian Economy – planned economy – the land question – industry and labour – the demographic and public health.

Unit-4 : The Indian Society – caste, religion and gender – movements and legislations – education - cultural trends, institutions and ideas, literature, media and performing arts.

Reading

1. Rajni Kothari : *Politics in India*
2. Stephen P. Cohen : *Emerging Power India*
3. Robert W. Stern : *Changing India*

Course – IV

Social and Cultural History of Bengal ,14th to 20th centuries

Unit-1 : Bengal in the 14th century – geographical and socio-economic formation – the Chaitanya Movement – aspects of social transformation.

Unit-2 : Colonial rule in Bengal and debates on the imperial impact – structural changes in rural and urban economy.

Unit-3 : Bengal's response to the Western Impact – social and religious reforms in 19th and 20th centuries – trends of politics, nationalism, leftism and communalism.

Unit-4 : The pangs of partition – the refugee question – development Bengali literature in the 19th and 20th centuries – performing arts, urban and rural.

Reading

1. N.K.Sinha ed. : *History of Bengal*
2. Sirajul Islam Ed. : *History of Bengal, 3 Vols*
3. Pradip Bose ed. : *Refugee rehabilitation in West Bengal*

Course – V

Regional History of Bengal – Nadia and Murshidabad

Unit-1 : Nadia in the post-Gupta period – as a Pargana in medieval India – colonial settlement and socio-economic changes – partition of India and birth of the present Nadia district.

Unit-2 : The society – the Chaitanya Movement and revolution in culture and literature – the rich tradition of indigenous education –minor religious sects and folk culture of Nadia.

Unit-3 : Rise and fall of the Nawabi state in Murshidabad – the colonial confrontation – the new society and economy – growth of small towns.

Unit-4 : History of Art, Architecture and culture of Murshidabad.

Reading

1. Kumudnath Mallik : *Nadia Kahini* ; Kantichandra Rardi : *Nabadwip Mahima* (ed.by J. Chaudhuri)
2. *Nadia District Gazetteer* and Mohit Roy : *Nadia Oonish Satak*
3. J.H.T. Walsh : *A History of Murshidabad District* and K.M.Mohsin ; *A Bengal District in Transition*

Course – VI

Great Historians of the World and their Philosophy of History

Unit-1 : Essentials of Renaissance historiography – Bodin, Bacon, Descartes and Vico – Gibbon and development of enlightened historiography – Hegel and aspects of Romantic historiography.

Unit-2 : Ranke and the Berlin Revolution – Auguste Comte and positivism – Karl Marx and historical materialism.

Unit-3 : Growth of scientific historiography in the 20th century, Trevelyan – renewed interest in philosophy, Spengler and Toynbee – idealist view of history, Croce and Collingwood – towards total historiography, Marc Bloch – Fernand Braudel and the Annales School.

Unit-4 : From modernism to post-modernism – the Marxist historiography of Christopher Hill, E.H. Hosbawm and E.P. Thompson – structuralism in history and Antonio Gramsci – post-modern interpretation of history, Michel Foucault and Jacques Derrida.

Reading

1. E. Sreedharan : *A Textbook of Historiography*
2. J.O.Urmson and J.Ree eds. : *Philosophy and Philosophers*
3. R.B.Woodings : *Fontana Dictionary of Modern Thinkers*

Ability Enhancement Compulsory Course

Semester-I

Essentials of the Environmental Science

Unit-1 : Essentials of ecology and environment – ecosystem and biosphere – environmental support systems – pollution, air, water, soil and noise.

Unit-2 : Climatic change and related issues – global warming and sustainability – world water resources.

Unit-3 : Biodiversity – understanding the problem – endangered species – habitats in danger – accounts of Indian biodiversity.

Unit-4 : Current environmental issues – trends in world population – global ocean resources – the Hungry Planet – global human migration.

Reading

1. Manindra Narayan Majumder : *Pariveshvidya*
2. Robert Arvill : *Man and Environment* : Lores and Margery Milne : *Water and Life*
3. L.R.Brown et al eds. : *State of the World*

Semester-2

Communicative and Interpretative English

Unit-1 : Language of Communication - Verbal and Non-verbal (Spoken and Written), Personal, Social and Business, Barriers and Strategies, Intra-personal, Inter-personal and Group communication

Unit-2 : Speaking Skills - Monologue, Dialogue, Group Discussion, Effective Communication/ Mis- Communication, Interview, Public Speech

Unit-3 : Reading and Understanding Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation (from Indian language to English and vice-versa) Literary/Knowledge Texts

Unit-4 : Writing Skills Documenting, Report Writing, Making notes, Letter writing

Reading

1. *Fluency in English* - Part II, Oxford University Press
2. *Business English*, Pearson
3. *Language, Literature and Creativity*, Orient Blackswan

Skill Enhancement Elective Course

Semester-3

(Any one)

Course – I

Understanding Heritage, Art and architecture of India

Unit-1 : Defining heritage – an overview of cultural and built heritage of India – notions of art and craft.

Unit-2 : Pre-colonial Indian Art and Architecture – early illustrated manuscripts and mural painting traditions – nearly medieval sculpture, style and iconography – numismatic art – miniature painting, Mughal, Rajasthani and Pahari - early Indian architecture, stupa, cave and temple – the Mughals -Indo-Persian architecture, fort, palace and mosque.

Unit-3 : The colonial period – western influences on Indian Art and architecture – changes in the post-colonial period.

Unit-4 : The Bengal School of art and architecture – Birbhum, Bankura and Bishnupur Gharana – Art Movements – Santiniketan style - Progressive Artists' Group – major artists and their works – popular art forms – folk art traditions.

Reading

1. David Lowenthal : *Possessed by the Past – The Heritage Crusade and the Spoils of History*
2. B.N.Goswami : *Essence of Indian Art* ; Niharranjan Roy : *An approach to Indian Art*
- S.S.Biswas : *Protecting the Cultural Heritage* ; D.P.Agarwal : *The Archaeology of India*

Course – II

Sports and Society in India in Historical Perspective

Unit-1 : Concepts and theories – Sports and History – Greek Philosophy of Sports – Greek and Roman Tradition of Sports – the Olympics.

Unit-2 : Ideas of sports from ancient and medieval texts of India – sociology of pre-colonial Indian sports – race, religion, caste and gender.

Unit-3 : Colonization of Indian sports in the 19th and 20th centuries – imposition of European sports on Indian society – commercialization of sports - impact on mind and body.

Unit-4 : Sports in post-colonial India – sports in education – sports and economy – sports and politics – sports and diplomacy - effects of globalization on Indian sports.

Reading

1. Kausik Bandyopadhyay : *Sports History in India, Prospects and Problems*
2. Ronojoy Sen : *Nation at Play, A History of Sports in India*
3. J. Coakley : *Sports and Society, Issues and Controversies*

Semester-4 (Any one)

Course – I

The Bengal Music

Unit-1 : History of Music in Bengal – influence of Vaishnava poetry of the 13th – 14th century – mixture of Hindu and Islamic trends – patronage of Nawabs and big landlords particularly the Baro Bhuiyans.

Unit-2 : Consolidation of the elite society in Bengal and growth of different forms of music in the 18th, 19th and early 20th centuries – Bishnupur Gharana – Rabindrasangeet, Nazrulgeeti, Dwijendrageeti, Atulprasadi Rajanikanter Gaan – swadeshi and nationalist songs.

Unit-3 : Aspects of folk culture and folk music of Bengal – Baul, Bhatiali, Bhawaiya, Dhamali, Gambhira, Jhumur, Kavigaan and Jatra.

Unit-4 : Modern Bengali Music – post-colonial western influences – middle class romanticism and transformation of Bengali music – leftist movements and new forms of music – media and music – Bengali music in theatre and film – globalization and changes in musical forms – rock and band music.

Reading

1. Karunamaya Goswami : *History of Bengali Music*
2. Dilipkumar Mukhopadhyay : *Banglar Ragsangeet Charchar Itihas*
3. Gita Chatterjee : *Bengali Swadeshi Sangeet*

Course – II

Studies in Electronic Communication System

Unit-1 : Different communication theories – communication in a globalized society and economy – aspects of electronic communication.

Unit-2 : Technologies and instruments of electronic communication – state and administration – people and their culture.

Unit-3. Introduction to Computer Networks - Data communications, components, data representation(ASCII,ISO etc.) - direction of data flow(simplex, half duplex, full duplex);

Networks - distributed processing, network criteria, physical structure (type of connection, topology) - categories of network (LAN, MAN, WAN).

Unit-4 : Internet - brief history, internet today - protocols and standards - reference models: OSI reference model, TCP/IP reference model, their comparative study.

Reading

1. B. A. Forouzan : *Data Communications and Networking*
2. A. S. Tanenbaum : *Computer Networks*
3. Ralf Steinmetz and Klara Naharstedt : *Multimedia: Computing, Communications Applications*

Structure of B.A.(General Program) in History

Core Course

(One in each Semester up to the 4th one)

Course – 1

History of India from the Earliest times to the Early Medieval Period

Unit-1 : Sources and interpretation – broad survey of paleolithic, mesolithic and neolithic cultures – the Harappan Civilisation – journey from the Vedic state to the 16 Mahajanapadas – from the age of the Vedas to the age of Jainism and Buddhism.

Unit-2 : The Maurya rule in Magadha - Asoka's Dhamma and administration - The post-Maurya India of the Kushanas, Satavahanas and Tamil powers, Splits in Jainism and Buddhism - Vaishnavism, Saivism

Unit-3: Age of the Guptas ; consolidation of Magadhan empire ; debates on golden age, brahminical revival and growth of feudalism ; decline of the Gupta power and beginning of political decentralization of India ; assessing Harshavardhana as the last great emperor.

Unit-4: From centralized to decentralized India - The Rajputs of North India - Palas and Senas in Bengal - Kingdoms of the South – The Pallavas, Rashtrakutas, Chalukyas and Cholas – changes in Polity, Society, Economy, Religion and Culture - towards transition.

Course – 11

History of Medieval India

Unit-1 : Northern India under the Delhi Sultanate - consolidation of the Sultanate from 1206 to 1286 AD ; the Khalji Revolution and the omnipotent state under the Khaljis ; The Tughluq period of reforms and counter reforms ; decline of the Delhi Sultanate - the successor states of Bijoynagar, Bahmani and Bengal - society, economy, art, architecture and literature.

Unit-2: Delhi on the eve of the Mughal ascent - Timur's invasion - the Sayyids and Lodis - Babu's adventure - Babur's central Asian connection - Humayun's misfortune - Sher Shah Sur and Afghan rule in India - Making of the Mughal State from Akbar to Aurangzeb.

Unit -3 : Agrarian crisis and the decline of the Mughal Empire - regional polity – the Marathas under *Shivaji* and the *Peshwas* ; the Sikh challenge - emergence of successor states – Bengal, *Awadh*, Mysore and Hyderabad.

Unit – 4 : Mughal India in retrospect - state and religion ; evolution of the administrative system – mansab and jagir - management of land and agriculture – features of urban economy, trade and industry - society and culture – religion of the masses - language, music and literature ; art and architecture.

Course – 111

History of Modern India till Independence

Unit-1: Expansion and Consolidation of British Rule with special reference to Bengal, Maharashtra, Mysore, Punjab and Awadh ; colonial state and development of its administration – orientalism and utilitarianism - land revenue settlements and results thereof.

Unit-2: Exploitation and resistance – de-peasantization and de-industrialization - drain of wealth - famines in India - resistance from the tribes and peasants till the Revolt of 1857 - analysing the revolt and its aftermath – colonial policy of further exploitation through railways and industrial network.

Unit-3: The cultural revolution of the nineteenth century ; critique of Young Bengal Movement, Bengal Renaissance, social and religious reforms ; colonisation of education ; the women's question.

Unit-4: Interpreting Indian nationalism – swadeshi movement and different phases of the nationalist struggle - role of Gandhi, Tagore, Subhas Bose, Nehru and Jinnah ; workers' and peasants' movements – religious polarisation of national politics – partition and independence (1947).

Course – 1V

History of Europe from the Fifteenth to the Twentieth Century.

Unit-1: Renaissance and Reformation - socio-economic roots - secularism and humanism - art, architecture, science and literature - the printing revolution.

Unit-2: Seventeenth century crisis - Glorious Revolution in England and great changes in political, economic and state structure - American War of Independence, birth of new democratic politics - from scientific to Industrial Revolution - rise of industrial societies in Europe – the transition debate.

Unit-3: The French Revolution ; society, economy, and polity ; the philosophers and the ideological revolution – the Napoleonic era – the Vienna Settlement and the Metternich system - revolutions of 1830 and 1848 – birth of the united nation states of Germany and Italy – Karl Marx and the socialist challenge in Europe.

Unit-4: Roots of European imperialism, Nazism and Fascism - the World Wars as the total wars - from the League of Nations to the UNO - the Cold War after 1945 - various military and economic alliances ; regional conflicts in the bi-polar world, Vietnam, Korea, Cuba, the middle East and Afghanistan.

General Reading

1. N.K.Sinha and N.R.Roy : *History of India*
2. R.C.Majumder ed. : *History and Culture of the Indian People* (different volumes)
3. Norman Lowe : *Mastering Modern World history*

Reference Reading

1. R.C.Majumder : *Ancient India*
2. H.C.Raychaudhuri : *Political History of Ancient India*
3. D.N.Jha : *Early India*
4. Ranabir Chakraborty : *Bharat Itihaser Adi Parba*
5. Ranabir Chakraborty : *Prachin Bharater Arthanaitik Itihaser Sandhane*
6. Narendranath Bhattacharyya : *Dharma O Samskriti-Prachin Bharatiya Prekshapat*
7. A.L.Srivastava : *The Sultanate of Delhi*
8. A.L.Srivastava : *The Mughal Empire*
9. Amal Tripathi : *Italir Renaissance Bangalir Samskriti*
10. Amal Tripathi : *Swadhinata Sangrame Bharater Jatiya Congress*
11. Arjun Dev and Indira Arjun Dev : *History of the World*
12. David S. Mason : *A Concise History of Modern Europe*

Text Reading

1. Gopal Chandra Sinha : *Bharatbarsher Itihas, Prachin O Adi Madhyajug*
2. Soumitra Srimani : *Sultani Rajattakale Bharat*
3. Subodh Mukhopadhyay : *Adimadhya O Madhyajuger Bharat*
4. Aniruddha Ray : *Mughaljuger Bharat*
5. Samar Mallik : *Adhunik Bharat*
6. Suranjan Chattopadhyay) Siddhartha Guha Ray : *Adhunik Bharater Itihas*
7. Samar Mallik : *Adhunik Europe*
8. Subodh Mukhopadhyay : *Adhunik Europe*
9. Nirmal Chandra Datta : *Madhyajug Theke Europer Adhunikatay Uttaran*
10. Basabendra Basu : *Adhunik Europer Bibartan*
11. Gourisankar Dey : *Itihaser Aloya Samakalin Bishwa*
12. Alok Kumar Ghosh : *Antarjatic Samparka O Bartaman Bishwa*

Draft

SYLLABUS FOR B.A./B.SC.

(HONOURS)

in

MATHEMATICS

Under

Choice Based Credit System (CBCS)



UNIVERSITY OF KALYANI

KALYANI-741235

WEST BENGAL

Preamble

In response to the notification (No.FCUG/KU-914/17-18 dt 16.11.2017) of University of Kalyani, the Undergraduate Board of Studies in Mathematics of University of Kalyani has revised and modified syllabi of **B.Sc. (Honors) in Mathematics** under Semester and Choice Based Credit System (CBCS) scheme following the recommendations and Guidelines of University Grant Commission (UGC) and West Bengal Higher Education Council (WBHEC). Content, structure and date of effect of this proposed syllabus will be decided by the appropriate authority of University of Kalyani after acceptance and approval.

The objectives and overview of the requirements have been stated by the WBHEC in the Introduction of their proposed draft syllabus which has been reiterated as “The main objective of framing this new syllabus is to give the students a holistic understanding of the subject giving substantial weightage to both the core content and techniques used in Mathematics. The ultimate goal of the syllabus is that the students at the end are able to secure a job. Keeping in mind and in tune with the changing nature of the subject, adequate emphasis has been given on new techniques and understanding of the subject.”

**SEMESTERIZED DRAFT UG-CBCS SYLLABUS IN MATHEMATICS (HONS) OF
UNIVERSITY OF KALYANI**

A. TOTAL Number of courses in UG-CBCS (B.A./B.Sc. Hons.):

Types of course	Core course (CC)	Elective course		Ability enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

TABLE-1: DETAILS OF COURSES & CREDIT OF B.A./ B.SC. (HONOURS) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory + Tutorial
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (14 papers)	14x4 = 56	14x5 = 70
1.B.	Core Course (Practical/Tutorial)* (14 papers)	14x2 = 28	14x1 = 14
2.	Elective Courses: (8 papers)		
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x4 = 16	4x5 = 20
2.B.	DSE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
2C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x4 = 16	4x5 = 20
2.D.	GE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester			
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
Total Credit:		140	140
## Wherever there is a practical, there will be no tutorial and vice-versa.			

TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.A./B.SC. HONS

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1			--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

**TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN IN B.A./B.COM/B.SC.(Hons.)
(6 Credit: 75 Marks)**

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
<i>MATH-H-CC-T-01</i>	Calculus, Geometry & Differential Equations	5:1:0	6
<i>MATH-H-CC-T-02</i>	Algebra	5:1:0	6
<i>MATH-H-GE-T-01</i>	Calculus, Geometry & Differential Equations	5:1:0	6
<i>AECC-T-01</i>	Environmental Studies	2:0:0	2
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
<i>MATH-H-CC-T-03</i>	Real Analysis	5:1:0	6
<i>MATH-H-CC-T-04</i>	Differential Equations and Vector Calculus	5:1:0	6
<i>MATH-H-GE-T-02</i>	Algebra	5:1:0	6
<i>AECC-T-02</i>	English/Modern Indian Language	2:0:0	2
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
<i>MATH-H-CC-T-05</i>	Theory of Real Functions & Introduction to Metric Spaces	5:1:0	6
<i>MATH-H-CC-T-06</i>	Group Theory I	5:1:0	6
<i>MATH-H-CC-T-07</i>	Numerical Methods & Numerical Methods Lab	5:1:0	6
<i>MATH-H-GE-T-03</i>	Real Analysis	5:1:0	6
<i>MATH-H-SEC-T-01</i>	A. Logic and Sets B. Computer Graphics (Choose any one)	2:0:0	2
Total	5 courses	Total	26
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
<i>MATH-H-CC-T-08</i>	Riemann Integration and Series of Functions	5:1:0	6
<i>MATH-H-CC-T-09</i>	Multivariate Calculus	5:1:0	6
<i>MATH-H-CC-T-10</i>	Ring Theory and Linear Algebra I	5:1:0	6
<i>MATH-H-GE-T-04</i>	Linear Programming	5:1:0	6
<i>MATH-H-SEC-T-02</i>	A. Graph Theory B. Operating System (Linux) (Choose any one)	2:0:0	2
Total	5 courses	Total	26
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
<i>MATH-H-CC-T-11</i>	Partial Differential Equations and Applications	5:1:0	6
<i>MATH-H-CC-T-12</i>	Group Theory-II	5:1:0	6
<i>MATH-H-DSE-T-01</i>	A. Linear Programming B. Point Set Topology (Choose any one)	5:1:0	6x2=12
<i>MATH-H-DSE-T-02</i>	A. Probability & Statistics B. Differential Geometry (Choose any one)	5:1:0	
Total	4 courses	Total	24
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
<i>MATH-H-CC-T-13</i>	Metric Spaces and Complex Analysis	5:1:0	6
<i>MATH-H-CC-T-14</i>	Ring Theory and Linear Algebra II	5:1:0	6
<i>MATH-H-DSE-T-03</i>	A. Fuzzy Set Theory B. Number Theory (Choose any one)	5:1:0	6x2=12
<i>MATH-H-DSE-T-04</i>	A. Mechanics B. Bio Mathematics (Choose any one)	5:1:0	
Total	4 courses	Total	24
Total (All semesters)	26 courses	Total	140

Detail Course & Contents of Mathematics (Honours) syllabus

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-I

Course: MATH-H-CC-T-01

Course title: Calculus, Geometry & Differential Equations

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits(5+1) (Theory + Tutorial)

Unit 1. Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, concavity and inflection points, envelopes, asymptotes, curve tracing in cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.

Unit 2. Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \sec^n x dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^m x dx$, parametric equations, parameterizing a curve, arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution, techniques of sketching conics.

Unit 3. Reflection properties of conics, rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics.

Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid.

Unit 4. Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Graphical Demonstration (Teaching Aid)

1. Plotting of graphs of function e^{ax+b} , $\log(ax + b)$, $1/(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $|ax + b|$ and to illustrate the effect of a and b on the graph.
2. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
3. Sketching parametric curves (Eg. trochoid, cycloid, epicycloids, hypocycloid).
4. Obtaining surface of revolution of curves.
5. Tracing of conics in Cartesian coordinates/ polar coordinates.

6. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using Cartesian coordinates.

SUGGESTED READINGS/REFERENCES:

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
4. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
5. Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
6. G.F. Simmons, Differential Equations, Tata Mcgraw Hill.
7. T. Apostol, Calculus, Volumes I and II.
8. S. Goldberg, Calculus and mathematical analysis.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-I

Course: MATH-H-CC-T-02

Course title: Algebra

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits(5+1) (Theory + Tutorial)

Unit 1. Polar representation of complex numbers, n th roots of unity, De Moivre's theorem for rational indices and its applications.

Theory of equations: Relation between roots and coefficients, transformation of equation, Descartes rule of signs, cubic and biquadratic equation.

Inequality: The inequality involving $AM \geq GM \geq HM$, Cauchy-Schwartz inequality.

Unit 2. Equivalence relations. Functions, composition of functions, Invertible functions, one to one correspondence and cardinality of a set. Well-ordering property of positive integers, division algorithm, divisibility and Euclidean algorithm. Congruence relation between integers. Principles of Mathematical induction, statement of Fundamental Theorem of Arithmetic.

Unit 3. Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation $Ax=b$, solution sets of linear systems, applications of linear systems, linear independence.

Unit 4. Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of \mathbb{R}^n , dimension of subspaces of \mathbb{R}^n , rank of a matrix, Eigen values, eigen vectors and characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

SUGGESTED READINGS/REFERENCES:

1. TituAndreescu and DorinAndrica, Complex Numbers from A to Z, Birkhauser, 2006.
2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.
3. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
4. K.B. Dutta, Matrix and linear algebra.
5. K. Hoffman, R. Kunze, Linear algebra.
6. W.S. Burnstine and A.W. Panton, Theory of equations.

B.A./B.Sc.. Other than Mathematics (Honours)

SEMESTER-I

Course: MATH-H-GE-T-01

Course title: Calculus, Geometry & Differential Equations

General Elective Course; Credit-6; Full Marks-75

Unit 1. Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, concavity and inflection points, envelopes, asymptotes, curve tracing in cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.

Unit 2. Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx$ dx, $\int \cos nx$ dx, $\int \tan nx$ dx, $\int \sec nx$ dx, $\int (\log x)^n$ dx, $\int \sin^n x \cos^m x$ dx, parametric equations, parameterizing a curve, arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution, techniques of sketching conics.

Unit 3. Reflection properties of conics, rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics.

Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid.

Unit 4. Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Graphical Demonstration (Teaching Aid)

1. Plotting of graphs of function e^{ax+b} , $\log(ax + b)$, $1/(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $|ax + b|$ and to illustrate the effect of a and b on the graph.

2. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
3. Sketching parametric curves (Eg. trochoid, cycloid, epicycloids, hypocycloid).
4. Obtaining surface of revolution of curves.
5. Tracing of conics in Cartesian coordinates/ polar coordinates.
6. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using Cartesian coordinates.

SUGGESTED READINGS/REFERENCES:

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
4. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
5. Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
6. G.F. Simmons, Differential Equations, Tata Mcgraw Hill.
7. T. Apostol, Calculus, Volumes I and II.
8. S. Goldberg, Calculus and mathematical analysis.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-II

Course: MATH-H-CC-T-03

Course title: Real Analysis

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits(5+1) (Theory + Tutorial)

Unit 1. Review of algebraic and order properties of \mathbb{R} , ε -neighborhood of a point in \mathbb{R} . Idea of countable sets, uncountable sets and uncountability of \mathbb{R} . Bounded above sets, bounded below sets, bounded sets, unbounded sets. Suprema and infima. Completeness property of \mathbb{R} and its equivalent properties. The Archimedean property, density of rational (and Irrational) numbers in \mathbb{R} , intervals. Limit points of a set, isolated points, open set, closed set, derived set, illustrations of Bolzano-Weierstrass theorem for sets, compact sets in \mathbb{R} , Heine-Borel Theorem.

Unit 2. Sequences, bounded sequence, convergent sequence, limit of a sequence, \liminf , \limsup . Limit theorems. Monotone sequences, monotone convergence theorem. Subsequences, divergence criteria. Monotone subsequence theorem (statement only), Bolzano Weierstrass theorem for sequences. Cauchy sequence, Cauchy's convergence criterion.

Unit 3. Infinite series, convergence and divergence of infinite series, Cauchy criterion, tests for convergence: comparison test, limit comparison test, ratio test, Cauchy's nth root test, integral test. Alternating series, Leibniz test. Absolute and conditional convergence.

Graphical Demonstration (Teaching aid)

1. Plotting of recursive sequences.
2. Study the convergence of sequences through plotting.
3. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
4. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
5. Cauchy's root test by plotting nth roots.
6. Ratio test by plotting the ratio of nth and (n+1)th term.

SUGGESTED READINGS/REFERENCES:

1. R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
2. Gerald G. Bilodeau , Paul R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones& Bartlett, 2010.
3. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis,Prentice Hall, 2001.
4. S.K. Berberian, a First Course in Real Analysis, Springer Verlag, New York, 1994.
5. T. Apostol, Mathematical Analysis, Narosa Publishing House
6. Courant and John, Introduction to Calculus and Analysis, Vol I, Springer
7. W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill
8. Terence, Tao, Analysis I, Hindustan Book Agency, 2006.
9. S. Goldberg, Calculus and mathematical analysis.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-II

Course: MATH-H-CC-T-04

Course title: Differential Equations & Vector Calculus

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits(5+1) (Theory + Tutorial)

Unit 1. Lipschitz condition and Picard's Theorem (Statement only). General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

Unit 2. Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients,

Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions.

Unit 3. Equilibrium points, Interpretation of the phase plane

Power series solution of a differential equation about an ordinary point, solution about a regular singular point.

Unit 4. Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions.

Graphical demonstration (Teaching aid)

1. Plotting of family of curves which are solutions of second order differential equation.
2. Plotting of family of curves which are solutions of third order differential equation.

SUGGESTED READINGS/REFERENCES:

1. Belinda Barnes and Glenn R. Fulford, Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.
2. C.H. Edwards and D.E. Penny, Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005.
3. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
4. Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
5. Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
6. Boyce and Diprima, Elementary Differential Equations and Boundary Value Problems, Wiley.
7. G.F. Simmons, Differential Equations, Tata McGraw Hill
8. Marsden, J., and Tromba, Vector Calculus, McGraw Hill.
9. Maity, K.C. and Ghosh, R.K. Vector Analysis, New Central Book Agency (P) Ltd. Kolkata (India).
10. M.R. Spiegel, Schaum's outline of Vector Analysis.

B.A./B.Sc.. Other than Mathematics (Honours)

SEMESTER-II

Course: MATH-H-GE-T-02

Course title: Algebra

General Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits(5+1) (Theory + Tutorial)

Unit 1. Polar representation of complex numbers, n th roots of unity, De Moivre's theorem for rational indices and its applications.

Theory of equations: Relation between roots and coefficients, transformation of equation, Descartes rule of signs, cubic and biquadratic equation.

Inequality: The inequality involving $AM \geq GM \geq HM$, Cauchy-Schwartz inequality.

Unit 2. Equivalence relations. Functions, composition of functions, Invertible functions, one to one correspondence and cardinality of a set. Well-ordering property of positive integers, division algorithm, divisibility and Euclidean algorithm. Congruence relation between integers. Principles of Mathematical induction, statement of Fundamental Theorem of Arithmetic.

Unit 3. Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation $Ax=b$, solution sets of linear systems, applications of linear systems, linear independence.

Unit 4. Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of R^n , dimension of subspaces of R^n , rank of a matrix, Eigen values, eigen vectors and characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

SUGGESTED READINGS/REFERENCES:

7. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006.
8. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.
9. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
10. K.B. Dutta, Matrix and linear algebra.
11. K. Hoffman, R. Kunze, Linear algebra.
12. W.S. Burnstine and A.W. Panton, Theory of equations.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-CC-T-05

Course title: Theory of Real Functions & Introduction to Metric Space

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits(5+1) (Theory + Tutorial)

Unit 1. Limits of functions ($\epsilon - \delta$ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.

Unit 2. Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem. Mean value theorem, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials.

Unit 3. Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, $\ln(1+x)$, $1/(ax+b)$ and $(x+1)^n$. Application of Taylor's theorem to inequalities.

Unit 4. Metric spaces: Definition and examples. open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, subspaces, dense sets, separable spaces.

SUGGESTED READINGS/REFERENCES:

1. R. Bartle and D.R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, 2003.
2. K.A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2004.
3. A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.
4. S.R. Ghorpade and B.V. Limaye, a Course in Calculus and Real Analysis, Springer, 2006.
5. T. Apostol, Mathematical Analysis, Narosa Publishing House
6. Courant and John, Introduction to Calculus and Analysis, Vol II, Springer
7. W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill
8. Terence Tao, Analysis II, Hindustan Book Agency, 2006
9. SatishShirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006
10. S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
11. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-CC-T-06

Course title: Group Theory 1

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits(5+1) (Theory + Tutorial)

Unit 1. Symmetries of a square, dihedral groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups.

Unit 2. Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups.

Unit 3. Properties of cyclic groups, classification of subgroups of cyclic groups. Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.

Unit 4. External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

Unit 5. Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms. First, Second and Third isomorphism theorems.

SUGGESTED READINGS/REFERENCES:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
4. Joseph J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.
5. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.
6. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-CC-T-07

Course title: Numerical Methods & Numerical Methods Lab

Core Course; Credit-6; Full Marks-75

Numerical Methods

COURSE CONTENT:

6 Credits (4+2) (Theory + Practical)

Unit 1. Algorithms. Convergence. Errors: relative, absolute. Round off. Truncation.

Unit 2. Transcendental and polynomial equations: Bisection method, Newton's method, secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Rate of convergence of these methods.

Unit 3. System of linear algebraic equations: Gaussian elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis. LU decomposition

Unit 4. Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

Numerical differentiation: Methods based on interpolations, methods based on finite differences.

Unit 5. Numerical Integration: Newton Cotes formula, Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ rule, Simpsons $3/8^{\text{th}}$ rule, Weddle's rule, Boole's Rule. Midpoint rule, Composite trapezoidal rule, composite Simpson's $1/3^{\text{rd}}$ rule, Gauss quadrature formula.

The algebraic eigen value problem: Power method.

Approximation: Least square polynomial approximation.

Unit 6. Ordinary differential equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four.

SUGGESTED READINGS/REFERENCES:

1. Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007.
3. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
4. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
5. John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.
6. Scarborough, James B., Numerical Mathematical Analysis, Oxford and IBH publishing co.
7. Yashavant Kanetkar, Let Us C , BPB Publications.
- 8.

Numerical Methods Lab

List of practical (using any software)

1. Calculate the sum $1/1 + 1/2 + 1/3 + 1/4 + \dots + 1/N$.
2. Enter 100 integers into an array and sort them in an ascending order.
3. Solution of transcendental and algebraic equations by
 - i) Bisection method
 - ii) Newton Raphson method.
 - iii) Secant method.
 - iv) RegulaFalsi method.
4. Solution of system of linear equations
 - i) LU decomposition method
 - ii) Gaussian elimination method
 - iii) Gauss-Jacobi method
 - iv) Gauss-Seidel method
5. Interpolation
 - i) Lagrange Interpolation
 - ii) Newton Interpolation
6. Numerical Integration
 - i) Trapezoidal Rule
 - ii) Simpson's one third rule
 - iii) Weddle's Rule
 - iv) Gauss Quadrature
7. Method of finding Eigenvalue by Power method
8. Fitting a Polynomial Function
9. Solution of ordinary differential equations
 - i) Euler method
 - ii) Modified Euler method
 - iii) RungeKutta method

Note: For any of the CAS (Computer aided software) Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

B.A./B.Sc.. Other than Mathematics (Honours)

SEMESTER-III

Course: MATH-H-GE-T-03

Course title: Real Analysis

General Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Review of algebraic and order properties of \mathbb{R} , ε -neighborhood of a point in \mathbb{R} . Idea of countable sets, uncountable sets and uncountability of \mathbb{R} . Bounded above sets, bounded below sets, bounded sets, unbounded sets. Suprema and infima. Completeness property of \mathbb{R} and its equivalent properties. The Archimedean property, density of rational (and Irrational) numbers in \mathbb{R} , intervals. Limit points of a set, isolated points, open set, closed set, derived set, illustrations of Bolzano-Weierstrass theorem for sets, compact sets in \mathbb{R} , Heine-Borel Theorem.

Unit 2. Sequences, bounded sequence, convergent sequence, limit of a sequence, \liminf , \limsup . Limit theorems. Monotone sequences, monotone convergence theorem. Subsequences, divergence criteria. Monotone subsequence theorem (statement only), Bolzano Weierstrass theorem for sequences. Cauchy sequence, Cauchy's convergence criterion.

Unit 3. Infinite series, convergence and divergence of infinite series, Cauchy criterion, tests for convergence: comparison test, limit comparison test, ratio test, Cauchy's nth root test, integral test. Alternating series, Leibniz test. Absolute and conditional convergence.

Graphical Demonstration (Teaching aid)

1. Plotting of recursive sequences.
2. Study the convergence of sequences through plotting.
3. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
4. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
5. Cauchy's root test by plotting nth roots.
6. Ratio test by plotting the ratio of nth and (n+1)th term.

SUGGESTED READINGS/REFERENCES:

1. R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
2. Gerald G. Bilodeau , Paul R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones& Bartlett, 2010.
3. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis, Prentice Hall, 2001.
4. S.K. Berberian, a First Course in Real Analysis, Springer Verlag, New York, 1994.
5. T. Apostol, Mathematical Analysis, Narosa Publishing House

6. Courant and John, Introduction to Calculus and Analysis, Vol I, Springer
7. W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill
8. Terence Tao, Analysis I, Hindustan Book Agency, 2006.
9. S. Goldberg, Calculus and mathematical analysis.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-SEC-T-1A

Course title: Logic and Sets

Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, quantifiers, binding variables and negations.

Unit 2. Sets, subsets, set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.

Unit 3. Difference and Symmetric difference of two sets. Set identities, generalized union and intersections. Relation: Product set. Composition of relations, types of relations, partitions, equivalence Relations with example of congruence modulo relation. Partial ordering relations, n- ary relations.

SUGGESTED READINGS/REFERENCES:

1. R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998.
2. P.R. Halmos, Naive Set Theory, Springer, 1974.
3. E. Kamke, Theory of Sets, Dover Publishers, 1950.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-SEC-T-1B

Course title: Computer Graphics

Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

2 Credits (2+0) (Theory + Tutorial)

Unit 1. Development of computer Graphics: Raster Scan and Random Scan graphics storages, displays processors and character generators, colour display techniques, interactive input/output devices.

Unit 2. Points, lines and curves: Scan conversion, line-drawing algorithms, circle and ellipse generation, conic-section generation, polygon filling anti-aliasing.

Unit 3. Two-dimensional viewing: Coordinate systems, linear transformations, line and polygon clipping algorithms.

SUGGESTED READINGS/REFERENCES:

1. D. Hearn and M.P. Baker, Computer Graphics, 2nd Ed., Prentice–Hall of India, 2004.
2. J.D. Foley, A van Dam, S.K. Feiner and J.F. Hughes, Computer Graphics: Principals and Practices, 2nd Ed., Addison-Wesley, MA, 1990.
3. D.F. Rogers, Procedural Elements in Computer Graphics, 2nd Ed., McGraw Hill Book Company, 2001.
4. D.F. Rogers and A.J. Admas, Mathematical Elements in Computer Graphics, 2nd Ed., McGraw Hill Book Company, 1990.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-CC-T-08

Course title: Riemann Integration and Series of Functions

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Riemann integration: inequalities of upper and lower sums, Darboux integration, Darboux theorem, Riemann conditions of integrability, Riemann sum and definition of Riemann integral through Riemann sums, equivalence of two definitions. Riemann integrability of monotone and continuous functions, properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions.

Intermediate Value theorem for Integrals; Fundamental theorem of Integral Calculus.

Unit 2. Improper integrals. Convergence of Beta and Gamma functions.

Unit 3. Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions;

Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.

Unit 4. Fourier series: Definition of Fourier coefficients and series, Riemann-Lebesgue lemma, Bessel's inequality, Parseval's identity, Dirichlet's condition. Examples of Fourier expansions and summation results for series.

Unit 5. Power series, radius of convergence, Cauchy-Hadamard theorem. Differentiation and integration of power series; Abel's theorem; Weierstrass approximation theorem.

SUGGESTED READINGS/REFERENCES:

1. K.A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
2. R.G. Bartle D.R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
3. Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition), 2011.
4. S. Goldberg, Calculus and mathematical analysis.
5. Santi Narayan, Integral calculus.
6. T. Apostol, Calculus I, II.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-CC-T-09

Course title: Multivariate Calculus

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Functions of several variables, limit and continuity of functions of two or more variables

Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems

Unit 2. Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar co-ordinates, Triple integrals, triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates. Change of variables in double integrals and triple integrals.

Unit 3. Definition of vector field, divergence and curl.

Line integrals, applications of line integrals: mass and work. Fundamental theorem for line integrals, conservative vector fields, independence of path.

Unit 4. Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.

SUGGESTED READINGS/REFERENCES:

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. E. Marsden, A.J. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer (SIE), Indian reprint, 2005.
4. James Stewart, Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001
5. T. Apostol, Mathematical Analysis, Narosa Publishing House
6. Courant and John, Introduction to Calculus and Analysis, Vol II, Springer
7. W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill
8. Marsden, J., and Tromba, Vector Calculus, McGraw Hill.
9. Maity, K.C. and Ghosh, R.K. Vector Analysis, New Central Book Agency (P) Ltd. Kolkata (India).
10. Terence Tao, Analysis II, Hindustan Book Agency, 2006
11. M.R. Spiegel, Schaum's outline of Vector Analysis.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-CC-T-10

Course title: Ring Theory and Linear Algebra I

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

Unit 2. Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit 3. Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms. Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

SUGGESTED READINGS/REFERENCES:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.
4. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
5. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
6. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
7. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India, 1999.
8. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.
9. D.A.R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998.
10. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra.

B.A./B.Sc.. Other than Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-GE-T-04

Course title: Linear Programming

General Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Introduction to linear programming problems. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison.

Unit 2. Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.

Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

Unit 3. Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games.

SUGGESTED READINGS/REFERENCES:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
2. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
3. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.

4. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-SEC-T-2A

Course title: Graph Theory

Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

2 Credits (2+0) (Theory + Tutorial)

Unit 1. Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bipartite graphs isomorphism of graphs.

Unit 2. Eulerian circuits, Eulerian graph, semi-Eulerian graph, theorems, Hamiltonian cycles, theorems

Representation of a graph by matrix, the adjacency matrix, incidence matrix, weighted graph,

Unit 3. Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm.

SUGGESTED READINGS/REFERENCES:

1. B.A. Davey and H.A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.
2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 2nd Edition, Pearson Education (Singapore) P. Ltd., Indian Reprint 2003.
3. Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-SEC-T-2B

Course title: Operating System (Linux)

Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

2 Credits (2+0) (Theory + Tutorial)

Unit 1. Linux – The operating system: Linux history, Linux features, Linux distributions, Linux's relationship to Unix, overview of Linux architecture, installation, start up scripts, system processes (an overview), Linux security.

Unit 2. The Ext2 and Ext3 file systems: General characteristics of the Ext3 file system, file permissions. User management: types of users, the powers of root, managing users (adding and deleting): using the command line and GUI tools.

Unit 3. Resource management in Linux: file and directory management, system calls for files process Management, signals, IPC: Pipes, FIFOs, System V IPC, message queues, system calls for processes, memory management, library and system calls for memory.

SUGGESTED READINGS/REFERENCES:

1. Arnold Robbins, Linux Programming by Examples The Fundamentals, 2nd Ed., Pearson Education, 2008.
2. Cox K, Red Hat Linux Administrator's Guide, PHI, 2009.
3. R. Stevens, UNIX Network Programming, 3rd Ed., PHI, 2008.
4. Sumitabha Das, UNIX Concepts and Applications, 4th Ed., TMH, 2009.
5. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, Linux in a Nutshell, 6th Ed., O'Reilly Media, 2009.
6. Neil Matthew, Richard Stones, Alan Cox, Beginning Linux Programming, 3rd Ed., 2004.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-CC-T-11

Course title: Partial Differential Equations & Applications

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Partial differential equations – Basic concepts and definitions. Mathematical problems. First- order equations: classification, construction and geometrical interpretation. Method of characteristics for obtaining general solution of quasi linear equations. Canonical forms of first-order linear equations. Method of separation of variables for solving first order partial differential equations.

Unit 2. Derivation of heat equation, wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order linear equations to canonical forms.

Unit 3. The Cauchy problem, Cauchy-Kowalewskaya theorem, Cauchy problem of an infinite string. Initial boundary value problems. Semi-infinite string with a fixed end, semi-infinite string with a free end. Equations with non-homogeneous boundary conditions. Non- homogeneous wave equation. Method of separation of variables, solving the vibrating string problem. Solving the heat conduction problem

Graphical Demonstration (Teaching aid)

1. Solution of Cauchy problem for first order PDE.
2. Finding the characteristics for the first order PDE.
3. Plot the integral surfaces of a given first order PDE with initial data.

4. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions:

(a) $u(x,0) = \phi(x), u_t(x,0) = \psi(x), x \in R, t > 0.$

(b) $u(x,0) = \phi(x), u_t(x,0) = \psi(x), u(0,t) = 0, x \in (0, \infty), t > 0$

5. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions:

(a) $u(x,0) = \phi(x), u(0,t) = a, u(l,t) = b, 0 < x < l, t > 0.$

$u(x,0) = \phi(x), x \in R, 0 < t < T.$

SUGGESTED READINGS/REFERENCES:

1. TynMyint-U and LokenathDebnath, Linear Partial Differential Equations for Scientists and Engineers, 4th edition, Springer, Indian reprint, 2006.
7. S.L. Ross, Differential equations, 3rd Ed., John Wiley and Sons, India, 2004.
8. Martha L Abell, James P Braselton, Differential equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
9. Sneddon, I. N., Elements of Partial Differential Equations, McGraw Hill.
10. Miller, F. H., Partial Differential Equations, John Wiley and Sons.
11. Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies, Loney Press .

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-CC-T-12

Course title: Group Theory II

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commutator subgroup and its properties.

Unit 2. Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental theorem of finite abelian groups.

Unit 3. Groups acting on themselves by conjugation, class equation and consequences, conjugacy in S_n , p -groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of A_n for $n \geq 5$, non-simplicity tests.

SUGGESTED READINGS/REFERENCES:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, 1999.
4. David S. Dummit and Richard M. Foote, Abstract Algebra, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2004.
5. J.R. Durbin, Modern Algebra, John Wiley & Sons, New York Inc., 2000.
6. D. A. R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998
7. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra.
8. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-DSE-T-1A

Course title: Linear Programming

Department Specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Introduction to linear programming problem. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison.

Unit 2. Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual. Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

Unit 3. Game theory: formulation of two persons zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games.

SUGGESTED READINGS/REFERENCES:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
2. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
3. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.
4. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-DSE-T-1B

Course title: Point Set Topology

Department Specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Countable and Uncountable Sets, Schroeder–Bernstein Theorem, Cantor’s Theorem. Cardinal numbers and cardinal arithmetic. Continuum Hypothesis, Zorns Lemma, Axiom of Choice. Well-ordered sets, Hausdorff’s maximal principle. Ordinal numbers.

Unit 2. Topological spaces, basis and Subbasis for a topology, subspace topology, interior points, limit points, derived set, boundary of a set, closed sets, closure and interior of a set. Continuous functions, open maps, closed maps and homeomorphisms. Product topology, quotient topology, metric topology, Baire category theorem.

Unit 3. Connected and path connected spaces, connected sets in \mathbb{R} , components and path components, local connectedness. Compact spaces, compact sets in \mathbb{R} . Compactness in metric spaces. Totally bounded spaces, Ascoli-Arzela theorem, the Lebesgue number lemma. Local compactness.

SUGGESTED READINGS/REFERENCES:

1. Munkres, J.R., Topology, A First Course, Prentice Hall of India Pvt.Ltd., New Delhi, 2000.

2. Dugundji, J., Topology, Allyn and Bacon, 1966.
3. Simmons, G.F., Introduction to Topology and Modern Analysis, McGraw Hill, 1963.
4. Kelley, J.L., General Topology, Van Nostrand Reinhold Co., New York, 1995.
5. Hocking, J., Young, G., Topology, Addison-Wesley Reading, 1961.
6. Steen, L., Seebach, J., Counter Examples in Topology, Holt, Reinhart and Winston, New York, 1970.
7. Abhijit Dasgupta, Set Theory, Birkhäuser.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-DSE-T-2A

Course title: Probability and Statistics

Department Specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.

Unit 2. Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient.

Unit 3. Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers. Central limit theorem for independent and identically distributed random variables with finite variance.

Unit 4. Random Samples, Sampling Distributions, Estimation of parameters, Testing of hypothesis.

SUGGESTED READINGS/REFERENCES:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, Introduction to Mathematical Statistics, Pearson Education, Asia, 2007.
2. Irwin Miller and Marylees Miller, John E. Freund, Mathematical Statistics with Applications, 7th Ed., Pearson Education, Asia, 2006.
3. Sheldon Ross, Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint, 2007.
4. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, Introduction to the Theory of Statistics, 3rd Ed., Tata McGraw- Hill, Reprint 2007
5. A. Gupta, Ground work of Mathematical Probability and Statistics, Academic publishers.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-DSE-T-2B

Course title: Differential Geometry

Department Specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Theory of space curves: Space curves. Planer curves, curvature, torsion and Serret-Frenet formula. Osculating circles, osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

Unit 2. Theory of surfaces: Parametric curves on surfaces. Direction coefficients. First and second Fundamental forms. Principal and Gaussian curvatures. Lines of curvature, Euler's theorem. Rodrigue's formula. Conjugate and asymptotic lines.

Unit 3. Developables: Developable associated with space curves and curves on surfaces. Minimal surfaces. Geodesics: Canonical geodesic equations. Nature of geodesics on a surface of revolution. Clairaut's theorem. Normal property of geodesics. Torsion of a geodesic. Geodesic curvature. Gauss-Bonnet theorem.

SUGGESTED READINGS/REFERENCES:

1. T.J. Willmore, An Introduction to Differential Geometry, Dover Publications, 2012.
2. B. O'Neill, Elementary Differential Geometry, 2nd Ed., Academic Press, 2006.
3. C.E. Weatherburn, Differential Geometry of Three Dimensions, Cambridge University Press 2003.
4. D.J. Struik, Lectures on Classical Differential Geometry, Dover Publications, 1988.
5. S. Lang, Fundamentals of Differential Geometry, Springer, 1999.
6. B. Spain, Tensor Calculus: A Concise Course, Dover Publications, 2003

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-CC-T-13

Course title: Metric Spaces and Complex Analysis

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Metric spaces: sequences in metric spaces, Cauchy sequences. Complete metric spaces, Cantor's theorem.

Unit 2. Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Compactness and connectedness in metric spaces.

Compactness: Sequential compactness, Heine-Borel property, totally bounded spaces, finite intersection property, and continuous functions on compact sets.

Homeomorphism..

Unit 3. Limits, limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings.

Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

Unit 4. Analytic functions, examples of analytic functions, exponential function, logarithmic function, trigonometric function, derivatives of functions, and definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula.

SUGGESTED READINGS/REFERENCES:

1. SatishShirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.
2. S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
3. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.
4. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.
5. Joseph Bak and Donald J. Newman, Complex Analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., NewYork, 1997.
6. S. Ponnusamy, Foundations of complex analysis.
7. E.M.Stein and R. Shakrachi, Complex Analysis, Princeton University Press.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-CC-T-14

Course title: Ring Theory and Linear Algebra II

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III, field of quotients. Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, and unique factorization in $\mathbb{Z}[x]$.

Unit 2. Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators. Eigen spaces of a linear operator.

Unit 3. Diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator, canonical forms, Inner product spaces and norms, Gram-Schmidt orthogonalisation process, orthogonal complements.

SUGGESTED READINGS/REFERENCES:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, 1999.
4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.
5. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
6. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
7. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India, 1999.
8. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.
9. S.H. Friedberg, A.L. Insel and L.E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., 2004

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-DSE-T-3A

Course title: Fuzzy Set Theory

Department Specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Interval numbers, arithmetic operations on interval numbers, distance between intervals, two level interval numbers.

Unit 2. Fuzzy versus crisp sets, Different types of fuzzy sets, α -cuts and its properties, representations of fuzzy sets, decomposition theorems, support, convexity, normality, cardinality, standard set-theoretic operations on fuzzy sets, Zadeh's extension principle.

Unit 3. Crisp versus fuzzy relations, fuzzy matrices and fuzzy graphs, composition of fuzzy relations, relational join, binary fuzzy relations.

Unit 4. Fuzzy numbers, arithmetic operations on fuzzy numbers (multiplication and division on \mathbb{R}^+ only), fuzzy equations.

SUGGESTED READINGS/REFERENCES:

1. Fuzzy Set Theory and Its Applications – H.-J. Zimmermann.
2. Introduction to Fuzzy Arithmetic Theory and Applications – A. Kaufmann and M.M. Gupta.
3. Fuzzy Set Theory – R. Lowen.

4. Fuzzy Set, Fuzzy Logic, Applications – G. Bojadziev and M. Bojadziev.

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-DSE-T-3B

Course title: Number Theory

Department Specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Linear diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues. Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

Unit 2. Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function, Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.

Unit 3. Order of an integer modulo n , primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption, the equation $x^2 + y^2 = z^2$, Fermat's Last theorem. (statement)

SUGGESTED READINGS/REFERENCES:

1. David M. Burton, Elementary Number Theory, 6th Ed., Tata McGraw-Hill, Indian reprint, 2007.
2. Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi, 2007

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-DSE-T-4A

Course title: Mechanics

Department Specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Co-planar forces. Astatic equilibrium. Friction. Equilibrium of a particle on a rough curve. Virtual work.. Forces in three dimensions. General conditions of equilibrium. Centre of gravity for different bodies. Stable and unstable equilibrium.

Unit 2. Central force. Constrained motion, varying mass, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law.

Unit 3. Equations of motion referred to a set of rotating axes. Motion of a projectile in a resisting medium. Stability of nearly circular orbits. Motion under the inverse square law. Slightly disturbed orbits. Motion of artificial satellites. Motion of a particle in three dimensions. Motion on a smooth sphere, cone, and on any surface of revolution.

Unit 4. Degrees of freedom. Moments and products of inertia. Momental Ellipsoid. Principal axes. D'Alembert's

Principle. Motion about a fixed axis. Compound pendulum. Motion of a rigid body in two dimensions under finite and impulsive forces. Conservation of momentum and energy.

SUGGESTED READINGS/REFERENCES:

1. I.H. Shames and G. Krishna Mohan Rao, Engineering Mechanics: Statics and Dynamics, (4th Ed.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009.
2. R.C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
3. Chorlton, F., Textbook of Dynamics.
4. Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies, Loney Press .
5. Loney, S. L., Elements of Statics and Dynamics I and II.
6. Ghosh, M. C, Analytical Statics.
7. Verma, R. S., A Textbook on Statics, Pothishala, 1962.
8. Matiur Rahman, Md., Statics.
9. Ramsey, A. S., Dynamics (Part I).

B.A./B.Sc.. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-DSE-T-4B

Course title: Bio Mathematics

Department Specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Unit 1. Mathematical biology and the 32arbour32r process: an overview. Continuous models: Malthus model, logistic growth, Allee effect, Gompertz growth, Michaelis-Menten Kinetics, Holling type growth, bacterial growth in a chemostat, harvesting a single natural population, Prey predator systems and LotkaVolterra equations, populations in competitions, epidemic models (SI, SIR, SIRS, SIC)

Unit 2. Activator-inhibitor system, insect outbreak model: Spruce Budworm. Numerical solution of the models and its graphical representation. Qualitative analysis of continuous models: Steady state solutions, stability and

linearization, multiple species communities and Routh-Hurwitz Criteria. Phase plane methods and qualitative solutions, bifurcations and limit cycles with examples in the context of biological scenario.

Spatial models: One species model with diffusion. Two species model with diffusion, conditions for diffusive instability, spreading colonies of microorganisms, Blood flow in circulatory system, travelling wave solutions, spread of genes in a population.

Unit 3. Discrete models: Overview of difference equations, steady state solution and linear stability analysis. Introduction to discrete models, linear models, growth models, decay models, drug delivery problem, discrete prey-predator models, density dependent growth models with harvesting, host-parasitoid systems (Nicholson-Bailey model), numerical solution of the models and its graphical representation. Case studies. Optimal exploitation models, models in genetics, stage structure models, age structure models.

SUGGESTED READINGS/REFERENCES:

1. L.E. Keshet, *Mathematical Models in Biology*, SIAM, 1988.
2. J. D. Murray, *Mathematical Biology*, Springer, 1993.
3. Y.C. Fung, *Biomechanics*, Springer-Verlag, 1990.
4. F. Brauer, P.V.D. Driessche and J. Wu, *Mathematical Epidemiology*, Springer, 2008.
5. M. Kot, *Elements of Mathematical Ecology*, Cambridge University Press, 2001.

Draft

SYLLABUS FOR B.Sc.

(GENERAL COURSE)

in

MATHEMATICS

Under

Choice Based Credit System (CBCS)



UNIVERSITY OF KALYANI

KALYANI-741235

WEST BENGAL

Preamble

In response to the notification (No.FCUG/KU-914/17-18 dt 16.11.2017) of University of Kalyani, the Undergraduate Board of Studies in Mathematics of University of Kalyani has revised and modified syllabi of **Mathematics courses for B.Sc. (General)** under Semester and Choice Based Credit System (CBCS) scheme following the recommendations and Guidelines of University Grant Commission (UGC) and West Bengal Higher Education Council (WBHEC). Content, structure and date of effect of this proposed syllabus will be decided by the appropriate authority of University of Kalyani after acceptance and approval.

The objectives and overview of the requirements have been stated by the WBHEC in the Introduction of their proposed draft syllabus which has been reiterated as “The main objective of framing this new syllabus is to give the students a holistic understanding of the subject giving substantial weightage to both the core content and techniques used in Mathematics. The ultimate goal of the syllabus is that the students at the end are able to secure a job. Keeping in mind and in tune with the changing nature of the subject, adequate emphasis has been given on new techniques and understanding of the subject.”

**SEMESTERIZED DRAFT UG-CBCS SYLLABUS IN MATHEMATICS (GENERAL) OF
UNIVERSITY OF KALYANI**

A. TOTAL Number of courses in UG-CBCS (B.A./B.Sc. GENERAL):

Types of course	Core course (CC)	Elective course		Ability Enhncemnt Course		T O T A L
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancmnt compulsory course(AECC)	Skill Enhancmnt course (SEC)	
No. of course	12	6(BSc)/4(BA/B.Com)	2((BA/B.Com)	2	2	24
Credit/course	6	6	6	2	2	120

TABLE-1: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.S.C. GENERAL

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC-1,2,3 (6)	3 (1A,2A,3A)	3 (1B,2B,3B)	3 (1C,2C,3C)	3 (1D,2D,3D)			12	72
DSE - 1,2,3 (6)	-	-	-	-	3 (1A,2A,3A)	3 (1B,2B,3B)	6	36
GE (6)	--	--	--	--	--	--	--	--
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Course/ Sem	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

TABLE-2: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN B.A./B.SC.(GENERAL)

(6 Credit: 75 Marks)

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
MATH-G-CC-T-01	Differential Calculus	5:1:0	6
Other Discipline		Core	6
Other Discipline		Core	6
AECC-T-01	Environmental Studies	2:0:0	2
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
MATH-G-CC-T-02	Differential Equations	5:1:0	6
Other Discipline		Core	6
Other Discipline		Core	6
AECC-T-02	English/Modern Indian Language	2:0:0	2
Total	4 courses	Total	20

SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
MATH-G-CC-T-03	Real Analysis	5:1:0	6
Other Discipline		Core	6
Other Discipline		Core	6
MATH-G-SEC-T-01	A. Logic and Sets B. Theory of Equations (Choose any one)	2:0:0	2
Total	5 courses	Total	20
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
MATH-G-CC-T-04	Algebra	5:1:0	6
Other Discipline		Core	6
Other Discipline		Core	6
MATH-G-SEC-T-02	A. Analytical Geometry B. Number Theory (Choose any one)	2:0:0	2
Total	5 courses	Total	20
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
MATH-G-DSE-T-01	A. Matrices and Linear Algebra B. Complex Analysis (Choose any one)	5:1:0	6
Other Discipline		DSE	6
Other Discipline		DSE	6
MATH-G-SEC-T-03	A. Integral Calculus B. Vector Calculus (Choose any one)	2:0:0	2
Total	4 courses	Total	20
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
MATH-G-DSE-T-02	A. Linear Programming B. Numerical Methods (Choose any one)	5:1:0	6
Other Discipline		DSE	6
Other Discipline		DSE	6
MATH-G-SEC-T-04	A. Probability and Statistics B. Boolean Algebra (Choose any one)	2:0:0	2
Total	4 courses	Total	20
Total (All semesters)	26 courses	Total	120

Detail Course & Contents of Mathematics (General) syllabus

B.A./B.Sc.. Mathematics (GENERAL)

SEMESTER-I

Course: MATH-G-CC-T-01

Course title: Differential Calculus

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Limit and Continuity (ϵ and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem On homogeneous functions.

Tangents and normal Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^n$, Maxima and Minima, Indeterminate forms.

SUGGESTED READINGS/REFERENCES:

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.

B.A./B.Sc.. Mathematics (GENERAL)

SEMESTER-II

Course: MATH-G-CC-T-02

Course title: Differential Equations

Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p . Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties.

Solving a differential equation by reducing its order.

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

SUGGESTED READINGS/REFERENCES:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, 1967.

**B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-III
Course: MATH-G-CC-T-03
Course title: Real Analysis
Core Course; Credit-6; Full Marks-75**

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of \mathbb{R} , Archimedean property of \mathbb{R} , intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

SUGGESTED READINGS/REFERENCES:

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia) P.Ltd., 2000.
3. E. Fischer, *Intermediate Real Analysis*, Springer Verlag, 1983.
4. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series-* Undergraduate Texts in Mathematics, Springer Verlag, 2003.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-III
Course: MATH-G-SEC-T-1A
Course title: Logic and Sets
Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation.

SUGGESTED READINGS/REFERENCES:

1. R.P. Grimaldi, *Discrete Mathematics and Combinatorial Mathematics*, Pearson Education, 1998.
2. P.R. Halmos, *Naive Set Theory*, Springer, 1974.
3. E. Kamke, *Theory of Sets*, Dover Publishers, 1950.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-III
Course: MATH-G-SEC-T-1B
Course title: Theory of Equations
Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

General properties of polynomials, Graphical representation of a polynomials, maximum and minimum values of a polynomials, General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

Symmetric functions, Applications symmetric function of the roots, Transformation of equations. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions.

SUGGESTED READINGS/REFERENCES:

1. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.
2. C. C. Mac Duffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-IV
Course: MATH-G-CC-T-04
Course title: Algebra
Core Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Definition and examples of groups, examples of abelian and non-abelian groups, the group Z_n of integers under addition modulo n and the group $U(n)$ of units under multiplication modulo n . Cyclic groups from number systems, complex roots of unity, circle group, the general linear group $GL_n(n, R)$, groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group $Sym(n)$, Group of quaternions.

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Z_n the ring of integers modulo n , ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions. Subrings and ideals, Integral domains and fields, examples of fields: Z_p , Q , R , and C . Field of rational functions.

SUGGESTED READINGS/REFERENCES:

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.
4. George E Andrews, *Number Theory*, Hindustan Publishing Corporation, 1984.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-IV
Course: MATH-G-SEC-T-2A
Course title: Analytical Geometry
Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

Techniques for sketching parabola, ellipse and hyperbola. Reflection properties of parabola, ellipse and hyperbola. Classification of quadratic equations representing lines, parabola, ellipse and hyperbola. spheres, Cylindrical surfaces. Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

SUGGESTED READINGS/REFERENCES:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) Pvt. Ltd., 2002.
3. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.
4. R. J.T. Bell, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-IV
Course: MATH-G-SEC-T-2B
Course title: Number Theory
Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic, prime counting function, statement of prime number theorem, Goldbach conjecture, binary and decimal representation of integers, linear congruences, complete set of residues.

Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Möbius inversion formula, the greatest integer function, Euler's phi-function.

SUGGESTED READINGS/REFERENCES:

1. David M. Burton, *Elementary Number Theory* 6th Ed., Tata McGraw-Hill Edition, Indian reprint, 2007.
2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, *Applications of Abstract Algebra with Maple*, CRC Press, Boca Raton, 2000.

3. Neville Robinns, *Beginning Number Theory*, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-V
Course: MATH-G-DSE-T-1A
Course title: Matrices and Linear Algebra
Discipline specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

6 Credits (5+1) (Theory + Tutorial)

Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.

Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial. Isomorphisms, Isomorphism

SUGGESTED READINGS/REFERENCES:

1. S. H. Friedberg, A. L. Insel and L. E. Spence, *Linear Algebra*, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
2. Richard Bronson, *Theory and Problems of Matrix Operations*, Tata McGraw Hill, 1989.
3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra*, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
4. David C. Lay, *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
5. S. Lang, *Introduction to Linear Algebra*, 2nd Ed., Springer, 2005.
6. Gilbert Strang, *Linear Algebra and its Applications*, Thomson, 2007.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-V
Course: MATH-G-DSE-T-1B
Course title: Complex Analysis
Discipline specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT: 6 Credits (5+1) (Theory + Tutorial)

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula.

Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples.

Laurent series and its examples, absolute and uniform convergence of power series.

SUGGESTED READINGS/REFERENCES:

1. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.
2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-V
Course: MATH-G-SEC-T-3A
Course title: Integral Calculus
Skill Enhancement course; Credit-2; Full Marks-25

COURSE CONTENT:

Integration by Partial fractions, integration of rational and irrational functions. Properties of definite integrals. Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic functions and of their combinations.

Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution. Double and Triple integrals.

SUGGESTED READINGS/REFERENCES:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

**B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-V****Course: MATH-G-SEC-T-3B****Course title: Vector Calculus****Skill Enhancement course; Credit-2; Full Marks-25****COURSE CONTENT:**

Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors.

Gradient, divergence and curl with applications

Vector integration. Line, Surface and Volume integrals.

SUGGESTED READINGS/REFERENCES:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.
3. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998.

**B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-VI****Course: MATH-G-DSE-T-2A****Course title: Linear Programming****Discipline specific Elective Course; Credit-6; Full Marks-75****COURSE CONTENT:**

6 Credits (5+1) (Theory + Tutorial)

Introduction to linear programming problems. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison.

Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.

Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games.

SUGGESTED READINGS/REFERENCES:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
2. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
3. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.
4. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

**B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-VI**

Course: MATH-G-DSE-T-2B

Course title: Numerical Methods

Discipline specific Elective Course; Credit-6; Full Marks-75

COURSE CONTENT:

Algorithms. Convergence. Errors: relative, absolute. Round off. Truncation.

Unit 2. Transcendental and polynomial equations: Bisection method, Newton's method, secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Rate of convergence of these methods.

Unit 3. System of linear algebraic equations: Gaussian elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis. LU decomposition

Unit 4. Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

Numerical differentiation: Methods based on interpolations, methods based on finite differences.

Unit 5. Numerical Integration: Newton Cotes formula, Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ rule, Simpson's $3/8^{\text{th}}$ rule, Weddle's rule, Boole's Rule. Midpoint rule, Composite trapezoidal rule, composite Simpson's $1/3^{\text{rd}}$ rule, Gauss quadrature formula.

The algebraic eigen value problem: Power method.

Approximation: Least square polynomial approximation.

Unit 6. Ordinary differential equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four.

SUGGESTED READINGS/REFERENCES:

1. Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007.
3. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
4. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
5. John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.
6. Scarborough, James B., Numerical Mathematical Analysis, Oxford and IBH publishing co.
7. Yashavant Kanetkar, Let Us C , BPB Publications.

B.A./B.Sc.. Mathematics (GENERAL)

SEMESTER-VI

Course: MATH-G-SEC-T-4A

Course title: Probability and Statistics

Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, continuous distributions: uniform, normal, exponential.

Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables.

SUGGESTED READINGS/REFERENCES:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, Pearson Education, Asia, 2007.
2. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Application*, 7th Ed., Pearson Education, Asia, 2006.
3. Sheldon Ross, *Introduction to Probability Model*, 9th Ed., Academic Press, Indian Reprint, 2007.

B.A./B.Sc.. Mathematics (GENERAL)
SEMESTER-VI
Course: MATH-G-SEC-T-4B
Course title: Boolean Algebra
Skill Enhancement Course; Credit-2; Full Marks-25

COURSE CONTENT:

Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, maximal and minimal elements, lattices as ordered sets, complete lattices, lattices as algebraic structures, sublattices, products and homomorphisms.

Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits.

SUGGESTED READINGS/REFERENCES:

1. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge University Press, Cambridge, 1990.
2. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

UG-CBCS Syllabus- Bengali (General)

SEMESTER & COURSEWISE CREDIT DEITRIBUTION IN B.A. (BENGALI GENERAL)

(6 Credits :75 ; 2 Credits :25 Marks)

SEMESTER-I			
Course Code	Course Title	Course Nature	Credit
		Core (Language 1)	6
BENG-G-CC-T-1	বাংলা সাহিত্যের ইতিহাস (আধুনিক যুগ) : গদ্যের বিকাশ থেকে সাময়িক পত্র	Core	6
		Core	6
BENG-G-AECC-T-1	Bengali ()	AECC	2
TOTAL	4 COURSES	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
BENG-G-LCC-T-1	সাহিত্যের ইতিহাস, সাহিত্যের রূপ-রীতি, বৈষ্ণব পদাবলী ও মঙ্গলকাব্য	Core (Language 2)	6
BENG-G-CC-T-2	ছন্দ , অলঙ্কার ও বাংলা ভাষাতত্ত্ব	Core	6
		Core	6
BENG-G-AECC-T-1	Bengali ()	AECC	2
TOTAL	4 COURSES	TOTAL	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
		(Language 1)	6
BENG-G-CC-T-3	বৈষ্ণব পদাবলী,কবিতা ও ছোটগল্প	Core	6
		Core	6
BENG-G- SEC-T-1	শ্রেণীকক্ষে সাহিত্য পাঠদান পদ্ধতি।	SEC	2
TOTAL	4 COURSES	TOTAL	20
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
BENG-G-LCC-T-2	কবিতা, উপন্যাস ও ছোটগল্প	Core (Language 1)	6
BENG-G-CC-T-4	বাংলা নাটক, উপন্যাস ও প্রবন্ধ।	Core	6
		Core	6
BENG-G- SEC-T-2	লোকগান	SEC	2
TOTAL	4 COURSES	TOTAL	20
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
BENG-G--DSE-T-1	সাহিত্যতত্ত্ব	DSE	6
		DSE	6
BENG-G—GE-T-1	পত্র-পত্রিকার ইতিহাস ও সম্পাদনা	GE	6
BENG-G- SEC-T-3	সাহিত্যের চলচ্চিত্রায়ন, নাট্যপ্রয়োগ	SEC	2
TOTAL	4 COURSES	TOTAL	20
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
BENG-G--DSE-T-2	আঞ্চলিক ভাষা সাহিত্য ও সংস্কৃতি	DSE	6
		DSE	6
BENG-G- GE -T-2	কিশোর সাহিত্য	Core	6
BENG-G- SEC-T-4	সংবাদ প্রতিবেদন রচনা, বিজ্ঞাপন রচনা	SEC	2
TOTAL	4 COURSES	TOTAL	20

UG-CBCS Syllabus- Bengali (General)

SEMESTER-I			
Course Code	Course Title	Course Nature	Credit
BENG-G-CC-T-1	বাংলা সাহিত্যের ইতিহাস (আধুনিক যুগ) : গদ্যের বিকাশ থেকে সাময়িক পত্র	Core	6

বাংলা সাহিত্যের ইতিহাস (আধুনিক যুগ) : গদ্যের বিকাশ থেকে সাময়িক পত্র

গদ্যরীতি ও প্রবন্ধ : শ্রীরামপুর মিশন, ফোর্ট উইলিয়াম কলেজ, রামমোহন রায়, ঈশ্বরচন্দ্র বিদ্যাসাগর, প্যারীচাঁদ মিত্র, কালীপ্রসন্ন সিংহ, বঙ্কিমচন্দ্র চট্টোপাধ্যায়, রবীন্দ্রনাথ ঠাকুর ও প্রমথ চৌধুরী। Marks-15

কাব্য-কবিতা : ঈশ্বরচন্দ্র গুপ্ত, রঙ্গলাল বন্দ্যোপাধ্যায়, মধুসূদন দত্ত, বিহারীলাল চক্রবর্তী, রবীন্দ্রনাথ ঠাকুর, সত্যেন্দ্রনাথ দত্ত, মোহিতলাল মজুমদার, নজরুল ইসলাম, জীবনানন্দ দাশ, সুকান্ত ভট্টাচার্য। Marks-15

নাটক : মধুসূদন দত্ত, দীনবন্ধু মিত্র, গিরিশচন্দ্র ঘোষ, দ্বিজেন্দ্রলাল রায়, রবীন্দ্রনাথ ঠাকুর, বিজন ভট্টাচার্য।

Marks-15

উপন্যাস ও ছোটগল্প : বঙ্কিমচন্দ্র চট্টোপাধ্যায়, রবীন্দ্রনাথ ঠাকুর, প্রভাতকুমার মুখোপাধ্যায়, শরৎচন্দ্র চট্টোপাধ্যায়, বিভূতিভূষণ বন্দ্যোপাধ্যায়, তারাশঙ্কর বন্দ্যোপাধ্যায়, মানিক বন্দ্যোপাধ্যায়, মীর মোশাররফ হোসেন।

Marks-15

সাময়িক পত্র : (দিগদর্শন, সমাচার চন্দ্রিকা, তত্ত্ববোধিনী, কল্লোল, বঙ্গদর্শন, ভারতী, সবুজপত্র)।

UG-CBCS Syllabus- Bengali (General)

SEMESTER-I			
Course Code	Course Title	Course Nature	Credit
BENG-G-AECC-T-1	Bengali ()	AECC	2

১) ভাষা :

Marks-15

ক) বোধপরীক্ষণ (কল্যাণী বিশ্ববিদ্যালয় থেকে প্রকাশিত আবশ্যিক বাংলা পাঠ সংকলন থেকে নির্বাচিত তিনটি প্রবন্ধ)

সভ্যতার সংকট---রবীন্দ্রনাথ ঠাকুর

ভাষার অত্যাচার---সুকুমার রায়

বসন্তের কোকিল---বঙ্কিমচন্দ্র চট্টোপাধ্যায়

খ) প্রতিবেদন :

Marks-5

(সংবাদপত্রে প্রকাশের উপযোগী করে কোনও ঘটনার প্রতিবেদন রচনা)

অথবা

পত্ররচনা

(যে কোনও ধরনের চিঠি লেখা)

গ) পরিভাষা :

Marks-5

(কল্যাণী বিশ্ববিদ্যালয় থেকে প্রকাশিত সংকলনে ২০০টি পরিভাষা সংকলিত আছে। এগুলিই পাঠ্য।)

UG-CBCS Syllabus- Bengali (General)

SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
BENG-G-LCC-T-1	সাহিত্যের ইতিহাস, সাহিত্যের রূপ-রীতি, বৈষ্ণব পদাবলী ও মঙ্গলকাব্য	Core (Language 2)	6

সাহিত্যের ইতিহাস, সাহিত্যের রূপ-রীতি, বৈষ্ণব পদাবলী ও মঙ্গলকাব্য

ক) সাহিত্যের ইতিহাস— Marks : 25

চর্যাপদ, শ্রীকৃষ্ণকীর্তন, চৈতন্যজীবনী, অনুবাদসাহিত্য, মঙ্গলকাব্য

খ) সাহিত্যের রূপ ও রীতি— Marks : 25

নাটক, কাব্য-কবিতা, উপন্যাস, ছোটগল্প (সাধারণ পরিচিতি ও স্থূল শ্রেণীবিন্যাস)

ঘ) চণ্ডীমঙ্গল (অভয়ামঙ্গলের 'আখ্যেটিক খণ্ড')----- কবিকঙ্কণ মুকুন্দ চক্রবর্তী Marks : 25

UG-CBCS Syllabus- Bengali (General)

SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
BENG-G-CC-T-2	ছন্দ , অলঙ্কার ও বাংলা ভাষাতত্ত্ব	Core	6

ছন্দ , অলঙ্কার ও বাংলা ভাষাতত্ত্ব

ছন্দ :

Marks-20

১. অক্ষর/দল, কলা/মাত্রা,পর্ব, পদ, পংক্তি/চরণ---সংজ্ঞা, শ্রেণীবিন্যাস, উদাহরণ।

২. বাংলা ছন্দের ত্রিধারা---সংজ্ঞা, উদাহরণ।

৩. ছন্দোলিপি প্রণয়ন।

অলঙ্কার : সংজ্ঞাসহ উদাহরণ

Marks-20

অনুপ্রাস, যমক, শ্লেষ, অপহুতি, বক্রোক্তি, উপমা, রূপক, উৎপ্রেক্ষা, সমাসোক্তি, ব্যাজস্ততি, ব্যতিরেক।

বাংলা ভাষাতত্ত্ব :

Marks-35

বাংলা ভাষার উদ্ভব ও ক্রমবিকাশ (প্রাচীন বাংলা, মধ্য বাংলা, সাম্প্রতিক বাংলা), সাধু ও চলিত বাংলা, বাংলা শব্দভাণ্ডার, বাংলা উপভাষাসমূহ, মৌলিক স্বরধ্বনি, শব্দার্থ পরিবর্তনের কারণ ও ধারা, ধ্বনি পরিবর্তনের ধারা (অপিনিহিত, অভিশ্রুতি, বর্ণবিপর্যয়, সমীভবন, ধ্বনিলোপ, স্বরভক্তি, ধ্বনির আগম, উন্মীভবন, নাসিকীভবন, স্বরসঙ্গতি), রূপতত্ত্ব (বচন, লিঙ্গ, পুরুষ, অনুসর্গ, কারক)।

UG-CBCS Syllabus- Bengali (General)

SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
BENG-G-AECC-T-1	Bengali ()	AECC	2

২) সাহিত্য :

ক) কবিতা :

Marks-10

(কল্যাণী বিশ্ববিদ্যালয় থেকে প্রকাশিত আবশ্যিক বাংলা পাঠ সংকলন থেকে নির্বাচিত ৫টি কবিতা)

অ. জন্মান্তর—রবীন্দ্রনাথ ঠাকুর

আ. সুরঞ্জনা---জীবনানন্দ দাশ

ই. ছাড়পত্র---সুকান্ত ভট্টাচার্য

ঈ. কলকাতার যীশু---নীরেন্দ্রনাথ চক্রবর্তী

খ) ছোটগল্প :

Marks-15

(কল্যাণী বিশ্ববিদ্যালয় থেকে প্রকাশিত আবশ্যিক বাংলা পাঠ সংকলন থেকে নির্বাচিত ৫টি গল্প)

অ. সুভা—রবীন্দ্রনাথ ঠাকুর

আ. কিম্বদন্তি---বিভূতিভূষণ বন্দ্যোপাধ্যায়

ই. প্রাগৈতিহাসিক---মানিক বন্দ্যোপাধ্যায়

ঈ. পুন্ড্রাম---প্রমোদ মিত্র

UG-CBCS Syllabus- Bengali (General)

SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
BENG-G-CC-T-3	বৈষ্ণব পদাবলী, কবিতা ও ছোটগল্প	Core	6

বৈষ্ণব পদাবলী, কবিতা ও ছোটগল্প

ক) বৈষ্ণব পদাবলী (নির্বাচিত)

Marks-20

নীরদ নয়নে নীর ঘন সিঞ্চনে

শ্রীদাম সুদাম দাম শোন ওরে বলরাম

রাধার কি হইল অন্তরে ব্যথা

কণ্টক গাড়ি কমলসম পদতল

আজু রজনী হাম ভাগে পোহায়লুঁ

সুখের লাগিয়া এ ঘর বাঁধিনু

অন্ধুর তপন তাপে যদি জারব

মাধব বহুত মিনতি করি তোয়

খ) সঞ্চয়িতা – রবীন্দ্রনাথ ঠাকুর (অহল্যার প্রতি, লীলাসঙ্গিনী, বাঁশি, ক্যামেলিয়া, অপমানিত) Marks-20

গ) কবিতা (নির্বাচিত) : বাংলা কবিতা ও প্রবন্ধ সংকলন (কল্যাণী বিশ্ববিদ্যালয় কর্তৃক প্রকাশিত) Marks-15

পথের দিশা-----কাজী নজরুল ইসলাম

ভয় করলেই ভয়----- নীরেন্দ্রনাথ চক্রবর্তী

মুখ ঢেকে যায় বিজ্ঞাপনে ----- শঙ্খ ঘোষ

শুধু কবিতার জন্য ----- সুনীল গঙ্গোপাধ্যায়

ঘ) ছোটগল্প : (নির্বাচিত) বাংলা গল্প ও সমালোচনা সংকলন (কল্যাণী বিশ্ববিদ্যালয় কর্তৃক প্রকাশিত)

Marks-20

নতুন পুতুল----- রবীন্দ্রনাথ ঠাকুর

সিঁদুরচরণ ----- বিভূতিভূষণ বন্দ্যোপাধ্যায়
 পোনাঘাট পেরিয়ে ----- প্রেমেন্দ্র মিত্র
 শিশুশিক্ষার পরিণাম ----- শিবরাম চক্রবর্তী
 বান ----- মহাশ্বেতা দেবী
 খগেনবাবু ----- শীর্ষেন্দু মুখোপাধ্যায়

UG-CBCS Syllabus- Bengali (General)

SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
BENG-G- SEC-T-1	শ্রেণীকক্ষে সাহিত্য পাঠদান পদ্ধতি	SEC	2

শ্রেণীকক্ষে সাহিত্য পাঠদান পদ্ধতি

Marks-25

UG-CBCS Syllabus- Bengali (General)

SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
BENG-G-LCC-T-2	কবিতা, উপন্যাস ও ছোটগল্প	Core (Language 1)	6

কবিতা, উপন্যাস ও ছোটগল্প

ক) কবিতা—

Marks : 15

জন্মভূমির প্রতি----- মাইকেল মধুসূদন দত্ত

সোনার তরী ----- রবীন্দ্রনাথ ঠাকুর

বিদ্রোহী ----- কাজী নজরুল ইসলাম

বনলতা সেন ----- জীবনানন্দ দাশ

খ) নাটক—

Marks : 20

নীলদর্পণ ----- দীনবন্ধু মিত্র

গ) উপন্যাস--

Marks : 20

কৃষ্ণকান্তের উইল ----- বঙ্কিমচন্দ্র চট্টোপাধ্যায়

ঘ) ছোটগল্প—

Marks : 20

শান্তি ----- রবীন্দ্রনাথ ঠাকুর

রাসময়ীর রসিকতা ----- প্রভাতকুমার মুখোপাধ্যায়

অভাগীর স্বর্গ ----- শরৎচন্দ্র চট্টোপাধ্যায়

তারিণী মাঝি ----- তারাশঙ্কর বন্দ্যোপাধ্যায়

সরীসৃপ ----- মানিক বন্দ্যোপাধ্যায়

UG-CBCS Syllabus- Bengali (General)

SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
BENG-G-CC-T-4	বাংলা নাটক, উপন্যাস ও প্রবন্ধ	Core	6

বাংলা নাটক, উপন্যাস ও প্রবন্ধ।

ক) ডাকঘর—রবীন্দ্রনাথ ঠাকুর

Marks-25

খ) দত্তা—শরৎচন্দ্র চট্টোপাধ্যায়

Marks-25

গ) প্রবন্ধ (নির্বাচিত): বাংলা কবিতা ও প্রবন্ধ সংকলন (কল্যাণী বিশ্ববিদ্যালয় কর্তৃক প্রকাশিত) Marks-25

বিবেচনা ও অবিবেচনা -----রবীন্দ্রনাথ ঠাকুর

পটুয়া শিল্প----- যামিনী রায়

বাংলা সাহিত্যের প্রগতি ----- বিষ্ণু দে

UG-CBCS Syllabus- Bengali (General)

SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
BENG-G- SEC-T-2	লোকগান	SEC	2

সব লোকে কয় লালন কি জাত সংসারে—লালন সাঁই

Marks-25

বরযাত্রী আসছে মাগো খাবো খাবো করে ----- বিয়ের গান

বড় দুঃখ বাংলার শিল্পী মরত্যাছে---- আলকাপের গান

ও বন্ধু কাজল ভোমরা রে ---- ভাওয়াইয়া

এই ধর্মের বিচার করো রে ভাই--- কুবীর গোসাঁই।

মেহেদির পাতা চিরল গোচারল ---- (মুসলিম বিবাহের গান)

UG-CBCS Syllabus- Bengali (General)

SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
BENG-G--DSE-T-1	সাহিত্যতত্ত্ব	DSE	6

সাহিত্যতত্ত্ব : অনুকৃতিবাদ, উঁচিঅ্যবাদ, বক্রোজ্জিবাদ, অলংকারবাদ, কাব্যে আনন্দ, চিত্রকাব্য, রীতিবাদ, কাব্যসত্য, কাব্যের উদ্দেশ্য, কাব্য-কল্পনা, রোমাণ্টিসিজম, রিয়ালিজম, ক্লাসিসিজম, সুররিয়ালিজম, ন্যাচারালিজম । Marks : 75

UG-CBCS Syllabus- Bengali (General)

SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
BENG-G—GE-T-1	পত্র-পত্রিকার ইতিহাস ও সম্পাদনা	GE	6

- ১) বাংলা পত্র-পত্রিকার ইতিবৃত্ত Marks : 25
 ২) পত্রিকা সম্পাদনা Marks : 25
 ৩) সংবাদপত্র ও বাংলা সাহিত্য Marks : 25

UG-CBCS Syllabus- Bengali (General)

SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
BENG-G- SEC-T-3	সাহিত্যের চলচ্চিত্রায়ন, নাট্যপ্রয়োগ	SEC	2

সাহিত্যের চলচ্চিত্রায়ন, নাট্যপ্রয়োগ, সৃজনশীল রচনা (গল্প, সংলাপ ও কবিতা) Marks : 25

UG-CBCS Syllabus- Bengali (General)

SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
BENG-G--DSE-T-2	আঞ্চলিক ভাষা সাহিত্য ও সংস্কৃতি	DSE	6

- ১) আঞ্চলিক ভাষা ও সাহিত্য (নদিয়া ও মুর্শিদাবাদ) Marks : 25
 ২) আঞ্চলিক লোকসংস্কৃতি (লোকসাহিত্য, লোকসঙ্গীত, লোককথা, লোকশিল্প) Marks : 50

UG-CBCS Syllabus- Bengali (General)

SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
BENG-G- GE -T-2	কিশোর সাহিত্য	Core	6

- ক) পৌরাণিক গল্প (নির্বাচিত) ----- উপেন্দ্রকিশোর রায় চৌধুরী Marks : 45
খ) পদি পিসির বর্মী বাক্স----- লীলা মজুমদার Marks : 45
গ) সত্যজিৎ রায়ের গোয়েন্দা গল্প (নির্বাচিত) Marks : 45

UG-CBCS Syllabus- Bengali (General)

SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
BENG-G- SEC-T-4	সংবাদ প্রতিবেদন রচনা, বিজ্ঞাপন রচনা	SEC	2

- সংবাদ প্রতিবেদন রচনা, বিজ্ঞাপন রচনা, প্রফ সংশোধন Marks : 25

UG-CBCS Syllabus- Bengali (Honours)

SEMESTER & COURSEWISE CREDIT DEIRIBUTION IN B.A. (BENGALI HONOURS) (6 Credits :75 ; 2 Credits :25 Marks)

SEMESTER - I			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-1	বাংলা সাহিত্যের ইতিহাস ও বাংলা ভাষাতত্ত্ব (১ম ভাগ)	CORE	6
BENG-H-CC-T-2	বাংলা সাহিত্যের ইতিহাস ও বাংলা ভাষাতত্ত্ব (২য় ভাগ)	CORE	6
BENG-H-GE-T-1	সাহিত্যের ইতিহাস, সাহিত্যের রূপ-রীতি, বৈষ্ণব পদাবলী ও মঙ্গলকাব্য	GE	6
BENG-H-AECC-T-1	Bengali ()	AECC	2
TOTAL	4 COURSES	TOTAL	20
SEMESTER - II			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-3	হন্দ, কৃত্তিবাসী রামায়ণ ও বৈষ্ণব পদাবলী	CORE	6
BENG-H-CC-T-4	অলঙ্কার, শাক্ত পদাবলী, অন্নদামঙ্গল ও বাংলা প্রবন্ধ সংশোধন	CORE	6
BENG-H-GE-T-2	বাংলা সাহিত্যের ইতিহাস (আধুনিক যুগ) : গদ্যের বিকাশ থেকে সাময়িক পত্র	GE	6
BENG-H-AECC-T-2	Bengali ()	AECC	2
TOTAL	4 COURSES	TOTAL	20
SEMESTER - III			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-5	বাংলা ছোটগল্প	CORE	6
BENG-H-CC-T-6	বাংলা উপন্যাস :	CORE	6
BENG-H-CC-T-7	বাংলা প্রবন্ধের রূপভেদ ও প্রবন্ধ পাঠ	CORE	6
BENG-H-GE-T-3	হন্দ , অলঙ্কার ও বাংলা ভাষাতত্ত্ব	GE	6
BENG-H-SEC-T-1	বাংলা সাহিত্য শিক্ষণ ও সমবেত শিক্ষা (GROUP STUDY)	SEC	2
TOTAL	5 COURSES	TOTAL	26
SEMESTER - IV			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-8	বাংলা সমালোচনা ও প্রবন্ধ সাহিত্য	CORE	6
BENG-H-CC-T-9	কাব্যের রূপভেদ ও কাব্য পাঠ	CORE	6
BENG-H-CC-T-10	বাংলা কাব্য-কবিতা	CORE	6
BENG-H-GE-T-4	আঞ্চলিক ভাষা সাহিত্য ও সংস্কৃতি	GE	6
BENG-H-SEC-T-2	সাহিত্যের প্রয়োগ বৈচিত্র্য	SEC	2
TOTAL	5 COURSES	TOTAL	26
SEMESTER -5 V			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-11	বাংলা উপন্যাস	CORE	6
BENG-H-CC-T-12	বাংলা রঙ্গমঞ্চ ও নাটক	CORE	6
BENG-H- DSE-T-1	বাংলাদেশের সাহিত্য	DSE	6
BENG-H- DSE-T-2	সাহিত্যতত্ত্ব ও সাহিত্য সমালোচনা	GE	6
TOTAL	4 COURSES	TOTAL	24
SEMESTER - V I			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-13	বাংলা নাটক পাঠ	CORE	6
BENG-H-CC-T-12	সংস্কৃত-ইংরেজি সাহিত্যের ইতিহাস ও লোকসাহিত্য	CORE	6
BENG-H- DSE-T-3	বাংলা ও প্রাদেশিক সাহিত্য	DSE	6
BENG-H- DSE-T-4	বাংলা শিশু কিশোর ও গৌয়েন্দা সাহিত্য	DSE	6
TOTAL	4 COURSES	TOTAL	24
Total (All Semester)	Total Course-26	Total	140

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SEMESTER -1			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-1	বাংলা সাহিত্যের ইতিহাস ও বাংলা ভাষাতত্ত্ব (১ম ভাগ)	CORE	6

বাংলা সাহিত্যের ইতিহাস (প্রাচীন ও মধ্যযুগ) :

Marks-50

সামাজিক ও রাজনৈতিক পটভূমিকায় বাংলা ভাষা, জাতি, সাহিত্য ও সংস্কৃতির সংক্ষিপ্ত পরিচয়। চর্যাপদ (দেশ-কাল-ভাষা-সাহিত্য-সমাজ-সংস্কৃতির চিত্র), তুর্কি আক্রমণ ও তাঁর প্রতিক্রিয়া (সমাজে ও সাহিত্যে), বড়ু চণ্ডীদাস ও শ্রীকৃষ্ণকীর্তন।

অনুবাদ সাহিত্য : বৈশিষ্ট্য, রামায়ণ, ভাগবত, মহাভারত।

বৈষ্ণব পদাবলী : পদাবলীর বৈশিষ্ট্য এবং বিশেষ গুরুত্বসহ বিদ্যাপতি, চণ্ডীদাস, বলরামদাস, জ্ঞানদাস, গোবিন্দদাস।

শ্রীচৈতন্যজীবন ও জীবনীসাহিত্য : শ্রীচৈতন্যজীবনকথা, সাহিত্য ও সমাজে শ্রীচৈতন্যপ্রভাব, জীবনীসাহিত্য, বিশেষ গুরুত্বসহ বৃন্দাবন দাস, কৃষ্ণদাস কবিরাজ।

মঙ্গলকাব্যের উদ্ভব ও বিবর্তন : সংজ্ঞা, বৈশিষ্ট্য, কাহিনি (মেনসামঙ্গল, চণ্ডীমঙ্গল, ধর্মমঙ্গল, শিবায়ন, ও অন্নদামঙ্গল), বিশেষ গুরুত্বসহ কবি নারায়ণদেব, বিজয়গুপ্ত, কবিকঙ্কণ মুকুন্দ চক্রবর্তী, রূপরাম চক্রবর্তী, ঘনরাম চক্রবর্তী, রামেশ্বর ভট্টাচার্য, রায়গুণাকর ভারতচন্দ্র।

মধ্যযুগের মুসলিম কবি ও কাব্য : দৌলত কাজী, অলাওল, শাহ মহম্মদ সগির।

শাক্ত পদাবলী : উদ্ভবের পটভূমি, রামপ্রসাদ সেন, কমলাকান্ত ভট্টাচার্য।

বাংলা ভাষাতত্ত্ব :

Marks-25

ক) ভাষা : সংজ্ঞা, বৈশিষ্ট্য, মানুষের ভাষা-মানবের প্রাণীর সংযোগ মাধ্যম।

খ) প্রাচীন ভারতীয় আর্থভাষা-মধ্যভারতীয় আর্থভাষা-নব্যভারতীয় আর্থভাষা (সময়কাল, নিদর্শন, বৈশিষ্ট্য), প্রাচীন ও মধ্যভারতীয় আর্থভাষার স্বর ও ব্যঞ্জন।

গ) বাঙালি জাতি ও বাংলা ভাষা, বাংলা ভাষার জন্ম ইতিহাস, বাংলা ও সংস্কৃত, বাংলা ও মাগধী প্রাকৃত, বাংলা ও গৌড়ীয় প্রাকৃত অপভ্রংশ।

ঘ) প্রাচীন বাংলা-মধ্য বাংলা-আধুনিক বাংলা-সাম্প্রতিক বাংলা (নিদর্শন, সময়কাল, বৈশিষ্ট্য)।

ঙ) বাংলা লিপির উদ্ভব-বিকাশ।

চ) বাংলা মৌলিক স্বরধ্বনি।

ছ) বাগ্‌যন্ত্র : সচিত্র বিবরণ ও কার্যাবলী।

জ) আন্তর্জাতিক ধ্বনিমূলক বর্ণমালা (আই.পি.এ.) : নিয়মাবলী ও রূপান্তর।

SEMESTER -1			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-2	বাংলা সাহিত্যের ইতিহাস ও বাংলা ভাষাতত্ত্ব (২য় ভাগ)	CORE	6

বাংলা সাহিত্যের ইতিহাস (আধুনিক যুগ) :

Marks-50

উনিশ-বিশ শতকের আর্থ-সামাজিক-সাংস্কৃতিক পটভূমি।

গদ্য ও প্রবন্ধ : শ্রীরামপুর মিশন, ফোর্ট উইলিয়াম কলেজ, উইলিয়াম কেরি, রামরাম বসু, মৃত্যুঞ্জয় বিদ্যালঙ্কার, রাজা রামমোহন রায়, ঈশ্বরচন্দ্র বিদ্যাসাগর, অক্ষয়কুমার দত্ত, প্যারীচাঁদ মিত্র, কালীপ্রসন্ন সিংহ, বঙ্কিমচন্দ্র চট্টোপাধ্যায়, মীর মোশাররফ হোসেন, রবীন্দ্রনাথ ঠাকুর, স্বামী বিবেকানন্দ, অবনীন্দ্রনাথ ঠাকুর, প্রমথ চৌধুরী, অন্নদাশংকর রায়।

সাময়িক পত্র: সাধারণ আলোচনা (দিগদর্শন, সমাচারদর্পণ, সংবাদ প্রভাকর, তত্ত্ববোধিনী, বঙ্গদর্শন, ভারতী, সাধনা, সবুজপত্র, প্রবাসী, ভারতবর্ষ)।

কাব্য ও কবিতা : ঈশ্বরচন্দ্র গুপ্ত, রঙ্গলাল বন্দ্যোপাধ্যায়, মধুসূদন দত্ত, হেমচন্দ্র বন্দ্যোপাধ্যায়, নবীনচন্দ্র সেন, বিহারীলাল চক্রবর্তী, অক্ষয়কুমার বড়াল, রবীন্দ্রনাথ ঠাকুর, দ্বিজেন্দ্রলাল রায়, কামিনী রায়, যতীন্দ্রনাথ সেনগুপ্ত, মোহিতলাল মজুমদার, নজরুল ইসলাম, সুকুমার রায়, বৃদ্ধদেব বসু, জীবনানন্দ দাশ, সুধীন্দ্রনাথ দত্ত, অমিয় চক্রবর্তী, বিষ্ণু দে, সুকান্ত ভট্টাচার্য, শক্তি চট্টোপাধ্যায়, সুনীল গঙ্গোপাধ্যায়, শঙ্খ ঘোষ, জয় গোস্বামী, মল্লিকা।

নাটক: মধুসূদন দত্ত, দীনবন্ধু মিত্র, গিরিশচন্দ্র ঘোষ, দ্বিজেন্দ্রলাল রায়, রবীন্দ্রনাথ ঠাকুর, মন্মথ রায়, বিজন ভট্টাচার্য, শম্ভু মিত্র, শিশির ভাদুড়ী, বাদল সরকার, মনোজ মিত্র।

উপন্যাস ও ছোটগল্প: বঙ্কিমচন্দ্র চট্টোপাধ্যায় (উপন্যাস), রবীন্দ্রনাথ ঠাকুর (উপন্যাস ও ছোটগল্প) প্রভাতকুমার মুখোপাধ্যায় (ছোটগল্প), শরৎচন্দ্র চট্টোপাধ্যায় (উপন্যাস), রাজশেখর বসু (ছোটগল্প), বিভূতিভূষণ বন্দ্যোপাধ্যায় (উপন্যাস), তারাশঙ্কর বন্দ্যোপাধ্যায় (গল্প-উপন্যাস), মানিক বন্দ্যোপাধ্যায় (গল্প-উপন্যাস), সতীনাথ ভাদুড়ী (উপন্যাস), সমরেশ বসু (উপন্যাস) আশাপূর্ণা দেবী (উপন্যাস), অমিয়ভূষণ মজুমদার (উপন্যাস), মহাশ্বেতা দেবী (গল্প-উপন্যাস), সৈয়দ মুস্তাফা সিরাজ (গল্প ও উপন্যাস)।

বাংলা ভাষাতত্ত্ব :

Marks-25

- ক) বাংলা ব্যাকরণের সাধারণ ধারণা (মানোএল-হ্যালহেড-উইলিয়াম কেরি-ইয়েটস-রামমোহন-রবীন্দ্রনাথ-সুনীতিকুমার)।
 খ) বাংলা উপভাষা : রাঢ়ী, বঙ্গালী, বরেন্দ্রী, ঝাড়খণ্ডী ও কামরূপী।
 গ) বাংলা ভাষার ধ্বনি পরিবর্তনের রীতি ও প্রকৃতি।
 ঘ) শব্দার্থ পরিবর্তনের কারণ ও ধারা।
 ঙ) বাংলা ভাষার শব্দভাণ্ডার।

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SEMESTER -1			
Course Code	Course Title	Course Nature	Credit
BENG-H-GE-T-1	সাহিত্যের ইতিহাস, সাহিত্যের রূপ-রীতি, বৈষ্ণব পদাবলী ও মঙ্গলকাব্য	GE	6

ক) সাহিত্যের ইতিহাস— Marks : 25

চর্যাপদ, শ্রীকৃষ্ণকীর্তন, চৈতন্যজীবনী, অনুবাদসাহিত্য, মঙ্গলকাব্য

খ) সাহিত্যের রূপ ও রীতি— Marks : 20

নাটক, কাব্য-কবিতা, উপন্যাস, ছোটগল্প (সাধারণ পরিচিতি ও স্থূল শ্রেণীবিন্যাস)

গ) বৈষ্ণব পদাবলী— Marks : 15

নীরদ নয়নে নীর ঘন সিঞ্চনে ----- গোবিন্দ দাস

আমার শপথি লাগে ----- যাদবেন্দ্র

রাধার কি হৈল অন্তরে ব্যথা ----- চণ্ডীদাস

রূপ লাগি আঁখি ঝরে ----- জ্ঞানদাস

কণ্টক গাড়ি কমলসম পদতল ----- গোবিন্দ দাস

আজু রজনী হাম ভাগে পোহায়লুঁ ----- কবিবল্লভ

এ সখি হামারি দুখের নাহি ওর ----- বিদ্যাপতি

মাধব বহুত মিনতি করি তোয় ----- বিদ্যাপতি

ঘ) চণ্ডীমঙ্গল (অভয়ামঙ্গলের 'আখ্যেটিক খণ্ড')----- কবিকঙ্কণ মুকুন্দ চক্রবর্তী Marks : 15

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SEMESTER -1			
Course Code	Course Title	Course Nature	Credit
BENG-H-AECC-T-1	Bengali ()	AECC	2

১) ভাষা :

Marks-15

ক) বোধপরীক্ষণ (কল্যাণী বিশ্ববিদ্যালয় থেকে প্রকাশিত আবশ্যিক বাংলা পাঠ সংকলন থেকে নির্বাচিত তিনটি প্রবন্ধ)

সভ্যতার সংকট---রবীন্দ্রনাথ ঠাকুর

ভাষার অত্যাচার---সুকুমার রায়

বসন্তের কোকিল---বঙ্কিমচন্দ্র চট্টোপাধ্যায়

খ) প্রতিবেদন : (সংবাদপত্রে প্রকাশের উপযোগী করে কোনও ঘটনার প্রতিবেদন রচনা) Marks-5

অথবা

পত্ররচনা (যে কোনও ধরনের চিঠি লেখা)

গ) পরিভাষা : (কল্যাণী বিশ্ববিদ্যালয় থেকে প্রকাশিত সংকলনে ২০০টি পরিভাষা সংকলিত আছে। এগুলিই পাঠ্য।)

Marks-5

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SEMESTER - I I			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-3	ছন্দ, কৃত্তিবাসী রামায়ণ ও বৈষ্ণব পদাবলী	CORE	6

ছন্দ, কৃত্তিবাসী রামায়ণ ও বৈষ্ণব পদাবলী

Total Marks -75

ছন্দ : ছন্দ ও ছান্দসিকদের (রবীন্দ্রনাথ, সত্যেন্দ্রনাথ, মোহিতলাল, প্রবোধচন্দ্র) সম্বন্ধে সাধারণ আলোচনা, দল/অক্ষর/কলা/মাত্রা/যতি/যতিলোপ/পর্ব/পংক্তি/চরণ/ছত্র/পদ।

বাংলা ছন্দের ত্রিধারা : অক্ষরবৃত্ত (পয়ার, অমিত্রাক্ষর, মুক্তক, গদ্যছন্দ), মাত্রাবৃত্ত, স্বরবৃত্ত (সংজ্ঞা, বৈশিষ্ট্য, উদাহরণসহ আলোচনা)।

ছন্দোলিপি : নির্ণয় ও বিশ্লেষণ।

Marks-25

কৃত্তিবাসী রামায়ণ (উত্তরকাণ্ড) : পাঠ ও বিশ্লেষণ

Marks- 25

বৈষ্ণব পদাবলী(নির্বাচিত) : পর্যায় ও পদ বিশ্লেষণ

Marks- 25

- ১) নীরদ নয়নে নীর ঘন সিঞ্চনে----- গোবিন্দদাস
- ২) শ্রীদাম সুদাম দাম ----- বলরাম দাস
- ৩) হাথক দরপণ মাথক ফুল ----- বিদ্যাপতি
- ৪) রূপ লাগি আঁখি বুঝে ----- জ্ঞানদাস
- ৫) ঘরের বাহিরে দণ্ডে শতবার-----চণ্ডীদাস
- ৬) সেই কেবা শুনাইল শ্যামনাম----- চণ্ডীদাস
- ৭) আলো মুঞি জানো না-----জ্ঞানদাস
- ৮) যাঁহা যাঁহা নিকসয়ে-----গোবিন্দদাস
- ৯) সখি কি পুছসি অনুভব মোয়-----কবিবল্লভ
- ১০) মাধব কি কহব-----গোবিন্দদাস
- ১১) চির চন্দন উরে-----বিদ্যাপতি
- ১২) তাতল সৈকত----- বিদ্যাপতি

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SEMESTER - I I			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-4	অলঙ্কার, শাক্ত পদাবলী, অন্নদামঙ্গল ও বাংলা প্রক সংশোধন	CORE	6

অলঙ্কার (সংজ্ঞা, উদাহরণ, অলঙ্কার নির্ণয়) :

শব্দালঙ্কার : অনুপ্রাস, শ্লেষ, বক্রোক্তি, যমক।

অর্থালঙ্কার : উপমা, রূপক, সমাসোক্তি, উৎপ্রেক্ষা, সন্দেহ, ব্যতিরেক, বিরোধ, অর্থান্তরন্যাস, ব্যাজস্ততি, অপহুতি, অতিশয়োক্তি। Marks-15

ভারতচন্দ্রের অন্নদামঙ্গল (১ম ভাগ) : বিষয়বস্তু ও বিশ্লেষণ

Marks-25

শাক্ত পদাবলী(নির্বাচিত) : পাঠ ও বিশ্লেষণ।

Marks-25

- ১) গিরি, আবার আমার উমা এলে—রামপ্রসাদ
- ২) আমি কি হেরিলাম নিশি-স্বপনে—কমলাকান্ত
- ৩) ওহে গিরিরাজ, গৌরী অভিমান করেছে—কমলাকান্ত
- ৪) তুমি তো মা ছিলে ভুলে—গিরিশচন্দ্র ঘোষ
- ৫) ওরে নবমী নিশি—কমলাকান্ত

- ৬) যেয়ো না রজনী, আজি লয়ে তারাদলে—মধুসূদন দত্ত
 ৭) শুকনা তরু মুঞ্জরে না—কমলাকান্ত
 ৮) মা আমায় ঘুরাবি কত—রামপ্রসাদ
 ৯) আমি কি দুখে ডরাই—রামপ্রসাদ
 ১০) উলঙ্গিনী নাচে রণ-রঙ্গে—রবীন্দ্রনাথ
 ১১) বল গিরি এ দেহে কি প্রাণ রহে আর----- ঈশ্বর গুপ্ত
 ১২) দোষ কারও নয় গো মা -----দাশরথী রায়।
 ১৩) চরণ ধরে আছি পড়ে ----- দ্বিজেন্দ্রলাল রায়
 ১৪) বলরে জবা বল ----- কাজী নজরুল ইসলাম

বাংলা পুঁথি পরিচয়, পুঁথি সংশোধন ও পুঁথি পাঠ

Marks : 10

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SEMESTER - I I			
Course Code	Course Title	Course Nature	Credit
BENG-H-GE-T-2	বাংলা সাহিত্যের ইতিহাস (আধুনিক যুগ) : গদ্যের বিকাশ থেকে সাময়িক পত্র	GE	6

গদ্যরীতি ও প্রবন্ধ : শ্রীরামপুর মিশন, ফোর্ট উইলিয়াম কলেজ, রামমোহন রায়, ঈশ্বরচন্দ্র বিদ্যাসাগর, প্যারীচাঁদ মিত্র, কালীপ্রসন্ন সিংহ, বঙ্কিমচন্দ্র চট্টোপাধ্যায়, রবীন্দ্রনাথ ঠাকুর ও প্রথম চৌধুরী।
Marks-15

কাব্য-কবিতা : ঈশ্বরচন্দ্র গুপ্ত, রঙ্গলাল বন্দ্যোপাধ্যায়, মধুসূদন দত্ত, বিহারীলাল চক্রবর্তী, রবীন্দ্রনাথ ঠাকুর, সত্যেন্দ্রনাথ দত্ত, মোহিতলাল মজুমদার, নজরুল ইসলাম, জীবনানন্দ দাশ, সুকান্ত ভট্টাচার্য।
Marks-15

নাটক : মধুসূদন দত্ত, দীনবন্ধু মিত্র, গিরিশচন্দ্র ঘোষ, দ্বিজেন্দ্রলাল রায়, রবীন্দ্রনাথ ঠাকুর, বিজন ভট্টাচার্য।
Marks-15

উপন্যাস ও ছোটগল্প : বঙ্কিমচন্দ্র চট্টোপাধ্যায়, রবীন্দ্রনাথ ঠাকুর, প্রভাতকুমার মুখোপাধ্যায়, শরৎচন্দ্র চট্টোপাধ্যায়, বিভূতিভূষণ বন্দ্যোপাধ্যায়, তারাশঙ্কর বন্দ্যোপাধ্যায়, মানিক বন্দ্যোপাধ্যায়, মীর মোশাররফ হোসেন।
Marks-15

সাময়িক পত্র : (দিগ্‌দর্শন, সমাচার চন্দ্রিকা, তত্ত্ববোধিনী, কল্লোল, বঙ্গদর্শন, ভারতী, সবুজপত্র)।
Marks-15

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SEMESTER - I I			
Course Code	Course Title	Course Nature	Credit
BENG-H-AECC-T-2	Bengali ()	AECC	2

২) সাহিত্য :

ক) কবিতা :

Marks-10

(কল্যাণী বিশ্ববিদ্যালয় থেকে প্রকাশিত আবশ্যিক বাংলা পাঠ সংকলন থেকে নির্বাচিত ৫টি কবিতা)

অ. জন্মান্তর—রবীন্দ্রনাথ ঠাকুর

আ. সুরঞ্জনা—জীবনানন্দ দাশ

ই. ছাড়পত্র—সুকান্ত ভট্টাচার্য

ঈ. কলকাতার যীশু—নীরেন্দ্রনাথ চক্রবর্তী

খ) ছোটগল্প :

Marks-15

(কল্যাণী বিশ্ববিদ্যালয় থেকে প্রকাশিত আবশ্যিক বাংলা পাঠ সংকলন থেকে নির্বাচিত ৫টি গল্প)

অ. সুভা—রবীন্দ্রনাথ ঠাকুর

আ. কিন্নরদল—বিভূতিভূষণ বন্দ্যোপাধ্যায়

ই. প্রাগৈতিহাসিক—মানিক বন্দ্যোপাধ্যায়

ঈ. পুন্ড্রাম—প্রেমেন্দ্র মিত্র

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SEMESTER - III			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-5	বাংলা ছোটগল্প	CORE	6

বাংলা ছোটগল্প :

ক) কথাসাহিত্যের রূপভেদ: রোমান্স, উপন্যাস (ঐতিহাসিক, সামাজিক, রাজনৈতিক, আঞ্চলিক, মনস্তাত্ত্বিক, কারা উপন্যাস), ছোটগল্প। Marks : 25

খ) ছোটগল্প: (গল্পগুচ্ছ : একরাত্রি, অনধিকার প্রবেশ, জীবিত ও মৃত, অধ্যাপক, সমাপ্তি, নষ্টনীড়, স্ত্রীর পত্র, শান্তি) Marks : 20

গ) প্রাক্-চল্লিশ বাংলা ছোটগল্প: (নির্বাচিত) বাংলা গল্প ও সমালোচনা সংকলন (কল্যাণী বিশ্ববিদ্যালয় কর্তৃক প্রকাশিত) Marks : 15

দেবী----- প্রভাতকুমার মুখোপাধ্যায়

লক্ষকর্ণ ----- পরশুরাম

পুল্লম ----- প্রেমেন্দ্র মিত্র

নারী ও নাগিনী ----- তারাশঙ্কর বন্দ্যোপাধ্যায়

শশাঙ্ক কবিরাজের স্ত্রী-----জগদীশ গুপ্ত

চুয়াচন্দন ----- শরদিন্দু বন্দ্যোপাধ্যায়

উদ্বেগ -----বিমল কর

ঘ) উত্তর-চল্লিশ বাংলা ছোটগল্প : বাংলা গল্প ও সমালোচনা সংকলন (কল্যাণী বিশ্ববিদ্যালয় কর্তৃক প্রকাশিত) Marks : 15

শিল্পী -----মানিক বন্দ্যোপাধ্যায়

তাসের ঘর -আশাপূর্ণা দেবী

হাড় ----- নারায়ণ গঙ্গোপাধ্যায়

ভুখা ভগবান—মণীশ ঘটক

কৌন্তেয় ----- সুবোধ ঘোষ

সহায়ক গ্রন্থ :

১) সাহিত্য সন্দর্ভ-----শ্রীশচন্দ্র দাস

২) সাহিত্য-শিল্প ও নন্দনতত্ত্ব-----ড. সুবোধ চৌধুরী

৩) সাহিত্যের রূপ-রীতি ও অন্যান্য প্রসঙ্গ----- ড. কুন্তল চট্টোপাধ্যায়

৪) রবীন্দ্রনাথের ছোটগল্প----- প্রমথনাথ বিশী

৫) রবীন্দ্রনাথের ছোটগল্প ও উপন্যাস ----- উপেন্দ্রনাথ ভট্টাচার্য

৬) রবীন্দ্র-ছোটগল্পের শিল্পরূপ ----- তপোব্রত ঘোষ

৭) সাহিত্যে ছোটগল্প ----- নারায়ণ গঙ্গোপাধ্যায়

৪) বাংলা গল্প বিচিত্রা ----- ঐ

৯) ছোটগল্পের সীমারেখা ----- ঐ

১০) ছোটগল্পের কথা ----- রথীন্দ্রনাথ রায়

১১) বাংলা ছোটগল্প ----- ড. ভূদেব চৌধুরী

১২) বাংলা ছোটগল্প ----- শিশিরকুমার দাস

১৩) কালের পুত্তলিকা ----- ড. অরুণকুমার মুখোপাধ্যায়

১৪) বাংলা ছোটগল্পের রূপরেখা ----- ড. কুতুবুদ্দিন মোল্লা ও ড. রিজওয়ানা নাসিরা

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SEMESTER - III			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-6	বাংলা উপন্যাস :	CORE	6

বাংলা উপন্যাস :

- রাজসিংহ -----বঙ্কিমচন্দ্র চট্টোপাধ্যায় Marks : 25
 ঘরে বাইরে ----- রবীন্দ্রনাথ ঠাকুর Marks : 25
 শ্রীকান্ত (প্রথম পর্ব) – শরৎচন্দ্র চট্টোপাধ্যায় Marks : 25

সহায়ক গ্রন্থ :

- ১) বঙ্গসাহিত্যে উপন্যাসের ধারা ----- ড.শ্রীকুমার বন্দ্যোপাধ্যায়
- ২) বাংলা উপন্যাসের কালান্তর ----- ড. সরোজ বন্দ্যোপাধ্যায়
- ৩) উপন্যাসে সমাজরীতি : বঙ্কিমচন্দ্র ও রবীন্দ্রনাথ ----- জয়ন্ত বন্দ্যোপাধ্যায়
- ৪) আধুনিকতা ও বাংলা উপন্যাস ----- ড. অশ্রুকুমার শিকদার
- ৫) কালের প্রতিমা ----- অরুণকুমার মুখোপাধ্যায়
- ৬) শরৎ সাহিত্যে ব্যক্তি ও সমাজ ----- জয়ন্ত বন্দ্যোপাধ্যায়
- ৭) উপন্যাসে সময় ----- ড. তপোধীর ভট্টাচার্য
- ৮) বাংলা উপন্যাস ও তার আধুনিকতা ----- ড. সত্যেন্দ্রনাথ রায়
- ৯) মধ্যাহ্ন থেকে সায়াহ্ন : বিশ শতকের বাংলা উপন্যাস ---- ড. অরুণকুমার মুখোপাধ্যায়
- ১০) রবীন্দ্রনাথের ছোটগল্প ও উপন্যাস ----- উপেন্দ্রনাথ ভট্টাচার্য
- ১১) দুই বিশ্বযুদ্ধ মধ্যবর্তী বাংলাসাহিত্য ----- ড. গোপিকানাথ রায়চৌধুরী
- ১২) বঙ্কিম সরণী ----- প্রমথনাথ বিশী
- ১৩) বঙ্কিম উপন্যাস : শিল্পরীতি ----- ক্ষেত্র গুপ্ত
- ১৪) শরৎচন্দ্র ----- সুবোধচন্দ্র সেনগুপ্ত
- ১৫) শরৎচন্দ্র : জীবন ও সাহিত্য ----- অজিতকুমার ঘোষ

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Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-7	বাংলা প্রবন্ধের রূপভেদ ও প্রবন্ধ পাঠ	CORE	6

ক) প্রবন্ধ-নিবন্ধের রূপভেদ: (প্রবন্ধ, রম্যরচনা, পত্রসাহিত্য, জীবনীসাহিত্য, ভ্রমণসাহিত্য, ডায়েরি, বস্তুনিষ্ঠ সমালোচনা সাহিত্য) Marks-25

খ) আমার জীবন----- রাসসুন্দরী দাসী Marks-25

গ) কমলকান্তের দণ্ডর - বঙ্কিমচন্দ্র চট্টোপাধ্যায়
 (আমার মোণ, আমার দুর্গোৎসব, একা কে গায় ওই, মনুষ্য ফল, বাঙ্গালীর মনুষ্যত্ব) Marks-25

সহায়ক গ্রন্থ :

- ১) সাহিত্য সন্দর্ভ-----শ্রীশচন্দ্র দাস
- ২) সাহিত্য-শিল্প ও নন্দনতত্ত্ব-----ড. সুবোধ চৌধুরী
- ৩) সাহিত্যের রূপ-রীতি ও অন্যান্য প্রসঙ্গ----- ড. কুন্তল চট্টোপাধ্যায়
- ৪) বাংলা প্রবন্ধ সাহিত্যের ধারা ----- ড. অধীর দে
- ৫) চিন্তনায়ক বঙ্কিমচন্দ্র ----- ভবতোষ দত্ত
- ৬) অন্দরে অন্তরে উনিশ শতকের বাঙালি ভদ্রমহিলা ----- সমুদ্র চক্রবর্তী।
- ৭) বাঙালি মেয়ের ভাবনামূলক গদ্য ----- সুতপা ভট্টাচার্য।

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SEMESTER - III			
Course Code	Course Title	Course Nature	Credit
BENG-H-GE-T-3	ছন্দ , অলঙ্কার ও বাংলা ভাষাতত্ত্ব	GE	6

ছন্দ :

Marks-20

১. অক্ষর/দল, কলা/মাত্রা,পর্ব, পদ, পংক্তি/চরণ---সংজ্ঞা, শ্রেণীবিভাগ, উদাহরণ।
২. বাংলা ছন্দের ত্রিধারা---সংজ্ঞা, উদাহরণ।
৩. ছন্দোলিপি প্রণয়ন।

অলঙ্কার : সংজ্ঞাসহ উদাহরণ

Marks-20

অনুপ্রাস, যমক, শ্লেষ, অপহুতি, বক্রোক্তি, উপমা, রূপক, উৎপ্রেক্ষা, সমাসোক্তি, ব্যাজস্ততি, ব্যতিরেক।

বাংলা ভাষাতত্ত্ব :

Marks-35

বাংলা ভাষার উদ্ভব ও ক্রমবিকাশ (প্রাচীন বাংলা, মধ্য বাংলা, সাম্প্রতিক বাংলা), সাধু ও চলিত বাংলা, বাংলা শব্দভাণ্ডার, বাংলা উপভাষাসমূহ, মৌলিক স্বরধ্বনি, শব্দার্থ পরিবর্তনের কারণ ও ধারা, ধ্বনি পরিবর্তনের ধারা (অপিনিহিত, অভিশ্রুতি, বর্ণবিপর্যয়, সমীভবন, ধ্বনিলোপ, স্বরভক্তি, ধ্বনির আগম, উন্নীভবন, নাসিকীভবন, স্বরসঙ্গতি), রূপতত্ত্ব (বচন, লিঙ্গ, পুরুষ, অনুসর্গ, কারক)।

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SEMESTER - III			
Course Code	Course Title	Course Nature	Credit
BENG-H-SEC-T-1	বাংলা সাহিত্য শিক্ষণ ও সমবেত শিক্ষা (GROUP STUDY)	SEC	2

- ১) বাংলা সাহিত্য শিক্ষণ ও সমবেত শিক্ষা (GROUP STUDY)- Total Marks : 25

শ্রেণীকক্ষে সাহিত্য পাঠদান পদ্ধতি, আলোচনাচক্র, গ্রন্থ সমালোচনা।

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SEMESTER - IV			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-8	বাংলা সমালোচনা ও প্রবন্ধ সাহিত্য	CORE	6

- ক) বাংলা গল্প ও সমালোচনা সংকলন (কল্যাণী বিশ্ববিদ্যালয় কর্তৃক প্রকাশিত) Marks-25

কাব্যের উপেক্ষিতা --রবীন্দ্রনাথ ঠাকুর

আধুনিকতা ও রবীন্দ্রনাথ ----- আবু সয়ীদ আইয়ুব

পড়ুয়ার নোট ----- সতীনাথ ভাদুড়ী

উত্তমর্ণ-অধমর্ণ-সংবাদ—ড. অসিতকুমার বন্দ্যোপাধ্যায়

- খ) বাংলা কবিতা ও প্রবন্ধ সংকলন (কল্যাণী বিশ্ববিদ্যালয় কর্তৃক প্রকাশিত) Marks-25

বর্তমান সমাজ ও সংস্কৃতি ----- নীরদ সি চৌধুরী

বাঙালির আত্মপরিচয়----- আনিসুজ্জামান

বর্তমান সমস্যা --স্বামী বিবেকানন্দ

রবীন্দ্রনাথ ও বাংলাদেশ—সন্জিদা খাতুন

- গ) সাহিত্যের পথে – রবীন্দ্রনাথ ঠাকুর (তথ্য ও সত্য, সাহিত্য, আধুনিক সাহিত্য, সাহিত্যের তাৎপর্য, সাহিত্যতত্ত্ব)

Marks-25

সহায়ক গ্রন্থ :

- ১) সাহিত্যতত্ত্বে রবীন্দ্রনাথ ----- সত্যেন্দ্রনাথ রায়
 ২) সাহিত্য জিজ্ঞাসায় রবীন্দ্রনাথ ----- অসিতকুমার বন্দ্যোপাধ্যায়
 ৩) সাহিত্য-শিল্প ও নন্দনতত্ত্ব-----ড. সুবোধ চৌধুরী

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SEMESTER - IV			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-9	কাব্যের রূপভেদ ও কাব্য পাঠ	CORE	6

কাব্যের রূপভেদ ও কাব্য পাঠ

ক) কাব্যের সংজ্ঞা ও রূপভেদ: (মহাকাব্য, গীতিকাব্য, পত্রকাব্য, সনেট, ক্লাসিসিজম, রোমান্টিসিজম, সুররিয়ালিজম)

Marks-25

খ) বীরাঙ্গনা—মাইকেল মধুসূদন দত্ত (দশরথের প্রতি কেকয়ী, সোমের প্রতি তারা, দুঃস্বপ্নের প্রতি শকুন্তলা, নীলোৎপলের প্রতি জনা, পুরুরবার প্রতি উর্বশী)

Marks-25

গ) যতীন্দ্রনাথ সেনগুপ্তের নির্বাচিত কবিতা (দুঃখবাদী, ঘুমের ঘোরে, কচি ডাব, বাইশে শাবন ১৩৪৮, বহিস্কৃতি, ফেমিন রিলিফ)।

Marks-25

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SEMESTER - IV			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-10	বাংলা কাব্য-কবিতা	CORE	6

বাংলা কাব্য-কবিতা

Total Marks-75

ক) সঞ্চয়িতা—রবীন্দ্রনাথ ঠাকুর (নির্বরের স্বপ্নভঙ্গ, বসুন্ধরা, সন্ধ্যারাগে ঝিলিমিলি, জীবনদেবতা, প্রার্থনা (নেবেদ্য কাব্য), ভারততীর্থ, ঐকতান)

Marks-25

খ) সঞ্চয়িতা -কাজী নজরুল ইসলাম (জীবনবন্দনা, সাম্যবাদী, ফরিয়াদ, আমার কৈফিয়ৎ, দারিদ্র্য)

Marks-25

গ) বাংলা কবিতা ও প্রবন্ধ সংকলন (কল্যাণী বিশ্ববিদ্যালয় কর্তৃক প্রকাশিত)

Marks-25

নির্বাচিত কবিতা:

পাল্কির গান----- সত্যেন্দ্রনাথ দত্ত।

দুঃখের কবি - মোহিতলাল মজুমদার

আট বছর আগে একদিন - জীবনানন্দ দাশ

বৃষ্টি - অমিয় চক্রবর্তী

তোমাকে পাওয়ার জন্য হে স্বাধীনতা—শামসুর রহমান

সংসারে সন্ন্যাসী লোকটা - শক্তি চট্টোপাধ্যায়

ফিরে এসো চাকা—বিনয় মজুমদার

আমার নাম ভারতবর্ষ—অমিতাভ দাশগুপ্ত

সহায়ক গ্রন্থ :

১) আধুনিক কবিতার দিগ্বলয়-----অশ্রুকুমার শিকদার

২) আধুনিক বাংলা কাব্য পরিচয় ----- দীপ্তি ত্রিপাঠী

৩) রবীন্দ্রানুসারী কবিসমাজ ----- অরুণকুমার মুখোপাধ্যায়

৪) বাংলা কবিতার কালান্তর ----- সরোজ বন্দ্যোপাধ্যায়

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SEMESTER - IV			
Course Code	Course Title	Course Nature	Credit
BENG-H-GE-T-4	আঞ্চলিক ভাষা সাহিত্য ও সংস্কৃতি	GE	6

- ১) আঞ্চলিক ভাষা ও সাহিত্য (নদিয়া ও মুর্শিদাবাদ) Marks : 25
 ২) আঞ্চলিক পত্র-পত্রিকা (নদিয়া ও মুর্শিদাবাদ) Marks : 25
 ৩) আঞ্চলিক লোকসংস্কৃতি (লোকসাহিত্য, লোকসঙ্গীত, লোককথা, লোকশিল্প) Marks : 25

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SEMESTER - IV			
Course Code	Course Title	Course Nature	Credit
BENG-H-SEC-T-2	সাহিত্যের প্রয়োগ বৈচিত্র্য	SEC	2

- সাহিত্যের প্রয়োগ বৈচিত্র্য Total Marks : 25
 সংবাদ প্রতিবেদন রচনা, বিজ্ঞাপন রচনা, প্রুফ সংশোধন।

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SEMESTER - V			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-11	বাংলা উপন্যাস	CORE	6

- ক) হাঁসুলিবাঁকের উপকথা -- তারাশঙ্কর বন্দ্যোপাধ্যায় Marks-25
 খ) ইছামতী -----বিভূতিভূষণ বন্দ্যোপাধ্যায় Marks-25
 গ) মায়ামুদঙ্গ - সৈয়দ মুস্তাফা সিরাজ Marks-25

সহায়ক গ্রন্থ :

- ১) বঙ্গসাহিত্যে উপন্যাসের ধারা ----- ড.শ্রীকুমার বন্দ্যোপাধ্যায়
 ২) বাংলা উপন্যাসের কালান্তর ----- ড. সরোজ বন্দ্যোপাধ্যায়
 ৩) মধ্যাহ্ন থেকে সায়াহ্ন : বিশ শতকের বাংলা উপন্যাস ---- ড. অরুণকুমার মুখোপাধ্যায়
 ৪) দুই বিশ্বযুদ্ধ মধ্যবর্তী বাংলাসাহিত্য ----- ড. গোপিকানাথ রায়চৌধুরী
 ৫) তারাশঙ্কর ----- হরপ্রসাদ মিত্র

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SEMESTER - V			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-12	বাংলা রঙ্গমঞ্চ ও নাটক	CORE	6

- ক) নাটকের রূপভেদ (ট্রোজেডি, কমেডি, প্রহসন, মেলোড্রামা, রূপক-সাংকেতিক, পৌরাণিক ঐতিহাসিক, সামাজিক, অ্যাবসার্ড, একাঙ্ক) Marks-25

খ) বঙ্গরঙ্গমঞ্চ ও থিয়েটারের ধারা:

লেবেডেফের বেঙ্গলী থিয়েটার, নবীন বসুর থিয়েটার, আশুতোষ দেবের থিয়েটার, বেলগাছিয়া নাট্যশালা, পাথুরিয়াঘাটা বঙ্গনাট্যালয়, জোড়াসাঁকো নাট্যশালা, বাগবাজার অ্যামেচার থিয়েটার (শ্যামবাজার নাট্যসমাজ) ন্যাশনাল থিয়েটার, নাট্যনিয়ন্ত্রণ বিল, শ্রীরঙ্গম, গ্রুপ থিয়েটার, খার্ড থিয়েটার।

Marks-25

গ) অচলায়তন—রবীন্দ্রনাথ ঠাকুর

Marks-25

সহায়ক গ্রন্থ :

- ১) বঙ্গীয় নাট্যশালার ইতিহাস ----- ব্রজেন্দ্রনাথ বন্দ্যোপাধ্যায়
- ২) বঙ্গ রঙ্গমঞ্চ ও বাংলা নাটক ----- পুলিন দাস
- ৩) বাংলা থিয়েটারের ইতিহাস ----- দর্শন চৌধুরী
- ৫) Persecution of Drama and Stage ----- P. Das
- ৬) রবীন্দ্রনাট্য প্রবাহ ----- প্রমথনাথ বিশী
- ৭) রবীন্দ্রনাট্য পরিক্রমা ----- উপেন্দ্রনাথ ভট্টাচার্য
- ৮) বাংলা নাটকের ইতিহাস ----- ড. আশুতোষ ভট্টাচার্য
- ৯) বাংলা নাটকের ইতিহাস ----- ড. অজিতকুমার ঘোষ
- ১১) বাংলা একাঙ্ক নাটক : রূপ ও রূপকার -----ড. সনাতন গোস্বামী

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SEMESTER - V			
Course Code	Course Title	Course Nature	Credit
BENG-H- DSE-T-1	বাংলাদেশের সাহিত্য	CORE	6

১) কবিতা (বাংলা দেশের কবিতা—রণজিৎ দাস ও সাজ্জাদ সফি সম্পাদিত)

Marks : 15

ক) স্বাধীনতা তুমি----- শামসুর রহমান

খ) মানুষ ----- নির্মলেন্দু গুণ

গ) তোমার দূরত্ব নিত্য আমার ক্রোধের দিনে ----- দাউদ হায়দার

২) ছোটগল্প (বাংলাদেশের গল্প—সেলিনা হোসেন সম্পাদিত)

Marks : 15

ক) কেয়া----- সৈয়দ ওয়ালীউল্লাহ

খ) জননী----- হাসান আজিজুল হক

গ) নিরুদ্দেশ যাত্রা ----- আখতারুজ্জামান ইলিয়াস

৩) প্রবন্ধ (বাঙালি ও বাংলাদেশ-----অরুণ সেন ও আবুল হাসনাৎ সম্পাদিত)

Marks : 15

ক) বাঙালির আত্মপরিচয়ের সূত্রপাত—আবু জাফর সামসুদ্দিন

খ) ভাষা সংস্কার ও বাঙালি

গ) মার্চের স্বপ্ন—মুনতাসীর মামুন

৪) উপন্যাস

যাপিত জীবন ----- সেলিনা হোসেন

Marks : 15

৫) নাটক

কবর -----মুনীর চৌধুরী

Marks : 15

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SEMESTER - V			
Course Code	Course Title	Course Nature	Credit
BENG-H- DSE-T-2	সাহিত্যতত্ত্ব ও সাহিত্য সমালোচনা	GE	6

২) সাহিত্যতত্ত্ব ও সাহিত্য সমালোচনা :

সাহিত্যতত্ত্ব : অনুকৃতিবাদ, উচিতবাদ, অলংকারবাদ, কাব্যে আনন্দ, চিত্রকাব্য, রীতিবাদ, কাব্যসত্য, কাব্যের উদ্দেশ্য, কাব্য-কল্পনা । Marks : 45

সাহিত্য সমালোচনা : বঙ্কিমচন্দ্র, রবীন্দ্রনাথ, মোহিতলাল । Marks : 30

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SEMESTER - VI			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-13	বাংলা নাটক পাঠ	CORE	6

ক) কারাগার—মন্মথ রায় Marks : 25

খ) পাগলা ঘোড়া---- বাদল সরকার Marks : 25

গ) চাঁদ বণিকের পালা----- শম্ভু মিত্র Marks : 25

সহায়ক গ্রন্থ :

- ১) বাংলা নাটকের ইতিহাস ----- ড. আশুতোষ ভট্টাচার্য
- ২) বাংলা নাটকের ইতিহাস ----- ড. অজিতকুমার ঘোষ
- ৩) বাংলা একাঙ্ক নাটক : রূপ ও রূপকার -----ড. সনাতন গোস্বামী
- ৪) The Theatre of the Absurd ----- Martin Esslin

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SEMESTER - VI			
Course Code	Course Title	Course Nature	Credit
BENG-H-CC-T-12	সংস্কৃত-ইংরেজি সাহিত্যের ইতিহাস ও লোকসাহিত্য	CORE	6

ক) সংস্কৃত সাহিত্যের ইতিহাস (কালিদাস, ভবভূতি, ভাস, বাণভট্ট, শূদ্রক, জয়দেব) Marks-25

খ) ইংরেজি সাহিত্যের ইতিহাস : শেক্সপীয়র (নাটক), মিলটন (মহাকাব্য), ওয়ার্ডসওয়ার্থ বায়রণ, শেলী , কীটস, চার্লস ডিকেন্স, এলিয়ট, বার্নার্ড শ। Marks-25

গ) লোকসাহিত্য : লোকগীতি, গীতিকা, ছড়া, প্রবাদ-প্রবচন, খাঁধা, Marks-25

সহায়ক গ্রন্থ :

- ১) সংস্কৃত সাহিত্যের ইতিহাস ----- জাহ্নবী কুমার চক্রবর্তী
- ২) ইংরেজি সাহিত্যের ইতিহাস ----- সত্যপ্রসাদ সেনগুপ্ত
- ৩) ইংরেজি সাহিত্যের ইতিহাস ----- কুন্ডল চট্টোপাধ্যায়

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SEMESTER - VI			
Course Code	Course Title	Course Nature	Credit
BENG-H- DSE-T-3	বাংলা ও প্রাদেশিক সাহিত্য	CORE	6

৩) বাংলা ও প্রাদেশিক সাহিত্য

ছোটগল্প

Marks-30

- ক) সদগতি ----- মুন্সী প্রেমচন্দ
 খ) নির্বাচিত গল্প ----- ফণিশ্বরনাথ রেণু
 গ) অসমিয়া গল্প (নির্বাচিত)
 ঘ) উড়িয়া গল্প (নির্বাচিত)

উপন্যাস

Marks-45

- ক) মৃত্যঞ্জয় ----- বীরেন্দ্রকুমার ভট্টাচার্য (উষারঞ্জন ভট্টাচার্য কর্তৃক অনূদিত)
 খ) দাড়িবুড়া----- গোপীনাথ মুগ্ধ (মালয়ালাম)
 গ) ময়লা আঁচল-----ফণিশ্বরনাথ রেণু

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SEMESTER - VI			
Course Code	Course Title	Course Nature	Credit
BENG-H- DSE-T-4	বাংলা শিশু কিশোর ও গোয়েন্দা সাহিত্য	GE	6

- ঠাকুরমার ঝুলি (নির্বাচিত ৪টি) -----দক্ষিণারঞ্জন মিত্র মজুমদার Marks : 15
 আবোল তাবোল (নির্বাচিত ৪টি) ----- সুকুমার রায় Marks : 15
 প্রোফেসর শঙ্কু (নির্বাচিত ৪টি) ----- সত্যজিৎ রায় Marks : 15
 লীলা মজুমদারের গল্প (নির্বাচিত ৪টি)----- লীলা মজুমদার Marks : 15
 ব্যোমকেশের গল্প (নির্বাচিত ৪টি) ----- শরদিন্দু বন্দ্যোপাধ্যায় Marks : 15

**SEMESTERIZED DRAFT UG-CBCS SYLLABUS
IN
PHILOSOPHY (HONS.) IN THE UNIVERSITY OF KALYANI**

A. TOTAL Number of courses in UG-CBCS (B.A. in Philosophy Hons.):

Types of course	Core course (CC)	Elective course		Ability Enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

TABLE-1: DETAILS OF COURSES & CREDIT OF B.A.in Philosophy.(HONOURS) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory+ Tutorial
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (14 papers)	14x4 = 56	14x5 = 70
1.B.	Core Course (Practical/Tutorial)*(14 papers)	14x2 = 28	14x1 = 14
2.	Elective Courses: (8 papers)		
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x4 = 16	4x5 = 20
2.B.	DSE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
2.C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x4 = 16	4x5 = 20
2.D.	GE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester			
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
Total Credit:		140	140
## Wherever there is a practical, there will be no tutorial and vice- versa.			

TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.A. B.A.in Philosophy.(HON)

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1			--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

❖ **COURSE CODE & COURSE TITLE:**

❖ *Each paper of any course denoted by-(2-4 letters Subject Code--Honours/General (H/G)--Course Type(CC/GE/DSE)-(Theory/Tutorial/Practical)-Number of course. Ex.-Chemistry-CHEM-H-CC-T-1)*

A. Core courses (CC)

PHIL-H-CC-T-01	Outline of Indian Philosophy – 1
PHIL-H-CC-T-02	Outline of western Philosophy – 1
PHIL-H-CC-T-03	Outline of Indian Philosophy – 2
PHIL-H-CC-T-04	Outline of Western Philosophy – 2
PHIL-H-CC-T-5	Indian Ethics
PHIL-H-CC-T-6	Western Ethics
PHIL-H-CC-T-7	Indian logic
PHIL-H-CC-T-8	Western Logic - 1
PHIL-H-CC-T-9	Psychology
PHIL-H-CC-T-10	Philosophy of religion
PHIL-H-CC-T-11	Social – Political Philosophy
PHIL-H-CC-T-12	Western logic – 2
PHIL-H-CC-T-13	Western Epistemology
PHIL-H-CC-T-14	Western Metaphysics

B. Discipline specific elective courses (DSE)

PHIL-H-DSE-T-1	Vedantasara (Text)
PHIL-H-DSE-T-2	An Enquiry Concerning Human Understanding
PHIL-H-DSE-T-3	Western Logic
PHIL-H-DSE-T-4	Nayabindu

C. Generic elective courses (GE):

PHIL-G-GE-T-01	Epistemology and Metaphysics (Indian and Western)
PHIL-G-GE-T-02	Logic (Indian & Western)
PHIL-G-GE-T-03	Ethics (Indian & Western)
PHIL-G-GE-T-04	Philosophy of Religion & Social and Political Philosophy

D. Ability enhancement compulsory courses (AECC)

1. AECC-01:

2. AECC-02:

E. Skill enhancement courses (SEC)

PHIL-H-DSE-T-1	Vedantasara (Text)	DSE
PHIL-H-DSE-T-2	An Enquiry Concerning Human Understanding	DSE
PHIL-H-DSE-T-3	Western Logic	DSE
PHIL-H-DSE-T-4	Nayabindu	DSE

**TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN IN B.A. in Philosophy.(Hons.)
(6 Credit: 75 Marks)**

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
PHIL-H-CC-T-01	Outline of Indian Philosophy – 1	Core	6(5L+1T)
PHIL-H-CC-T-02	Outline of western Philosophy - 1	Core	6
PHIL-G-GE-T-01	Epistemology and Metaphysics (Indian and Western)	GE	6
AECC-01	English Communication	AECC	2
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
PHIL-H-CC-T-03	Outline of Indian Philosophy – 2	Core	6
PHIL-H-CC-T-04	Outline of Western Philosophy - 2	Core	6
PHIL-G-GE-T-02	Logic (Indian & Western)	GE	6
AECC-02	Environmental Science	AECC	2
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
PHIL-H-CC-T-5	Indian Ethics	Core	6
PHIL-H-CC-T-6	Western Ethics	Core	6
PHIL-H-CC-T-7	Indian logic	Core	6
PHIL-G-GE-T-03	Ethics (Indian & Western)	GE	6
PHIL-H-SEC-T&P-1	Logical Rules and Fallacies(Indian)	SEC	2
Total	5 courses	Total	26
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
PHIL-H-CC-T-8	Western Logic - 1	Core	6
PHIL-H-CC-T-9	Psychology	Core	6
PHIL-H-CC-T-10	Philosophy of religion	Core	6
PHIL-G-GE-T-04	Philosophy of Religion & Social and Political Philosophy	GE	6
PHIL-H-SEC-T&P-2	Logical Rules and Fallacies(Western)	SEC	2
Total	5 courses	Total	26
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
PHIL-H-CC-T-11	Social – Political Philosophy	Core	6
PHIL-H-CC-T-12	Western logic - 2	Core	6
PHIL-H-DSE-T-1	Vedantasara (Text)	DSE	6x2=12
PHIL-H-DSE-T-2	An Enquiry Concerning Human Understanding	DSE	
Total	4 courses	Total	24
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
PHIL-H-CC-T-13	Western Epistemology	Core	6
PHIL-H-CC-T-14	Western Metaphysics	Core	6
PHIL-H-DSE-T-3	Western Logic	DSE	6x2=12
PHIL-H-DSE-T-4	Nayabindu	DSE	
Total	4 courses	Total	24
Total (All semesters)	26 courses	Total	140

**Detail Course & Contents of each subject specific syllabus will be given as per existing standard format as provided below.*

B.A./B.Com/B.Sc.. Philosophy (Honours)
SEMESTER-I/II/.....
Course: UG—HCC/DSE/..-01/02/..Course title:
Core/Generic/---- Course; Credit-6/2; Full Marks-75/50

COURSE OBJECTIVES:

COURSE CONTENT:

PHIL-H-CC-T-01		
Outline of Indian Philosophy – 1		
Prescribed Course:		Total 56 Credits
Section ‘A’	General Introduction	06 Credits
Section ‘B’	Cārvāka	08 Credits
Section ‘C’	Jainism	10 Credits
Section ‘D’	Buddhism	14 Credits
Section ‘E’	Nyāya – Vaiśeṣika	18 Credits
Unit-Wise Division:		
Section ‘A’ Detailed Introduction		
Unit: I	Distinctive Features of Indian Philosophy.	03 Credits
Unit: II	Basics concepts of Vedic and the Upanisadic World Views. Rta (The Cosmic Order); rna (Duty/Obligation) Atman; Jagrat , Svapna , Susupti , Turiya; Sreyas ,Preyas ,Karma.	03 Credits
Section ‘B’ Cārvāka		
Unit: I	Cārvāka School : It’s epistemology.	04 Credits
Unit: II	Metaphysics and Ethics.	04 Credits
Section ‘C’ Jainism		

Unit: I	Jainism: Concepts of sat, dravya, guna, paryaya, jiva, and ajiva.	05 Credits
Unit: II	Anekantavada, syadvada and saptabhanginaya.	05 Credits
Section 'D' Buddhism		
Unit: I	Four Noble Truths, <i>pratītyasamutpāda</i> , <i>kṣaṇabhangavāda</i> , <i>nairātmyavāda</i> .	07 Credits
Unit: II	Schools of Buddhism: Vaibhasika, Sautrantika, Jogacara ,Madhyamika.	07 Credits
Section 'E' Nyāya – Vaisesika		
Unit: I	Nyāya Epistemology: Four Pramanas: Perception, Inference, Comparison and Testimony; Nature of Cause, Classification of Causes: samavayi , asamavayi , nimitta , asatkaryavada , the Idea of God and proofs for His Existence.	09 Credits
Unit: II	Vaiśeṣika Metaphysics, <i>paramāṇuvāda</i> , Seven Categories.	09 Credits
Section 'F' Sāmkhya		
Unit: I	Sakhya Duality : prakṛti and it's constituents , proofs for the existence of prakṛti,	05 Credits
Unit: II	purusa: It's nature and arguments for it's existence, plurality of purusa.	05 Credits

Suggested Reading

- S. C. Chatterjee & D. M. Dutta : *An Introduction to Indian Philosophy*, Calcutta University Press, Kolkata 700019, 2004
- Kalikrishna Bandyopadhyay : *Nyayatattva Parikrama*, Papyrus, Kolkata, 1984
- Karuna Bhattacharya : *Nyaya-Vaiśeṣika Darśan*
- Panchanan Shastri : *Cārvāk Darśan*
- Panchanan Shastri : *Bauddha Darśan*
- M. Hiriyanna : *Outline of Indian Philosophy*
- Chandradhar Sharma : *A Critical Survey of Indian Philosophy*
- S.N. Dasgupta : *A History of Indian Philosophy*
- J. N. Sinha : *Indian Philosophy* (Vols. 1-4)

- D.M. Datta : *Six Ways of Knowing*
- Samiran Chandra Chakraborti : *The Concept of Purusarthas*
- Nabanaraan Bandhopadhyaya (ed) : *Ancient Indian Views on Truth and Falsity*
- Anil kr. Roy Chowdhury : *The Doctrine of Maya*
- Sayan Madhava (translated and elucidated in Bengali by Satyajoti Chakraborty) : *Sarba Darsana Samagraha*
- Debabrata Sen : *Bharatiya Darsan* (in Bengali)
- Pradyot Kr. Mondal : *Bharatiya Darsan* (in Bengali)
- Nirod Baran Chakraborty : *Bharatiya Darsan* (in Bengali)
- Deepak Kr. Bagchi : *Bharatiya Darsan* (in Bengali)
- Dakshina Ranjan Sastri : *Chavaka Darsan* (in Bengali)
- Debiprasad Chattopadhyay : *Bharatiya Darsane Bastubad* (in Bengali)
- Satish Chandra Nyayacharya : *Jaina Darsaner Digdarsan*
- Pradyat Kr. Mondal : *Vaisesika Darsan* (in Bengali)
- Narayan Ch. Goswami : *Samkhya Tattva Kaumudi* (in Bengali)
- Bidhubhusan Bhattacharya : *Samkhya Darsaner Bibaran* (in Bengali)
- Dinesh Chandra Bhattacharya Sastri: *Sad – Darsana : Yoga* (in Bengali)
- Bhutnath Saptatirtha : *Mimamsa Darsanam* (in Bengali)
- Asuthosh Sastri : *Vedanta Darsan : Advaitavad* (in Bengali)
- Rama Chowdhury : *Vedanta Darsan* (in Bengali)
- Swami Viswarupananda (ed.) : *Vedanta Darsanam – Vol-1*(in Bengali)
- Damodar Asaram O Shyamapad Mishra : *Prasasthapadabhasya* (in Bengali)
- Sadannda Bhadury : *Studies in Vaisesika Metaphysics*
- S . Radhakrishnan : *Indian Philosophy* Vols. 1 & 2
- T. R. V. Murti : *Central Philosophy of Buddhism.*
- J.N. Mohanty: *Reason and Tradition in Indian Thought*
- R. D. Ranade : *A Constructive Survey of Upanisadic Philosophy*
- P.T. Raju : *Structural Depths of Indian Thought.*
- K.C. Bhattacharyya : *Studies in Philosophy*
- A.K. Warder: *Indian Buddhism*
- R. Puligandla : *Fundamentals of Indian Philosophy*
- T.M.P. Mahadevan : *An Outline of Hinduism*

PHIL-H-CC-T-02		
Outline of western Philosophy - 1		
Prescribed Course:		Total 56 Credits
Section 'A'	Introduction : Early Greek Philosophy	02 Credits
Section 'B'	Plato	10 Credits
Section 'C'	Aristotle	10 Credits
Section 'D'	Descartes	12 Credits
Section 'E'	Spinoza	10 Credits
Section 'F'	Leibniz	12 Credits
Unit-Wise Division:	Section 'A'	
Unit: I	Introduction : Early Greek Philosophy:	02 Credits
	Ionian School , Parmenides , Protagoras,	

Heraclitus.		
Section 'B' Plato		
Unit: I	Theory of Knowledge.	05 Credits
Unit: II	Theory of Ideas or form.	05 Credits
Section 'C' Aristotle		
Unit: I	Refutation of Plato's Theory of Ideas.	05 Credits
Unit: II	Theory of Causation, Form and Matter.	05 Credits
Section 'D' Descartes		
Unit: I	Method of Descartes, <i>Cogito Ergo Sum</i> , Types of Ideas , Criterion of Truth, substance.	06 Credits
Unit:II	Proofs for the existence of God , Mind and Body Relation.	06 Credits
Section 'E' Spinoza		
Unit: I	The Doctrine of Substance, Attributes and Modes, The Concept of God or Nature , Pantheism,	05 Credits
Unit: II	Mind - Body Relation. Degrees of Knowledge, Intellectual Love of God	05 Credits
Section 'F' Leibniz		
Unit-I	Doctrine of Monads and Pre-established Harmony, God: Nature and Proofs for His existence.	06 Credits
Unit-II	Truths of Reason and Truths of Fact, Theory of Knowledge: Principles of Non-contradiction, Sufficient Reason and the Identity of Indiscernibles.	06 Credits

Suggested Reading

- Y. Masih : *A Critical History of Western Philosophy*, Motilal Banarsidass Publishers Private limited., Delhi
- F. Copleston : *A History of Philosophy* [Vols. I, IV, V, & VII], Continuum Publishers, London
- B. Russell : *History of Western Philosophy*, George Allen & Unwin Ltd., London, 1946

- R. Falckenberg : *History of Modern Philosophy*, Progressive Publishers, Calcutta, 1962
- W.T. Stace : *A Critical History of Greek Philosophy*, MacMillan and St. Martine's Press Inc,1967
- W.K. Wright: *A History of Modern Philosophy*,The Macmillan Company, New York, 1958
- Anders Wedberg : *A History of Philosophy*, Vol.-I & II, Clarendon Press,Oxford,1982
- Tom Sorell & G. A. J. Rogers (ed.): *Analytic Philosophy and History of Philosophy*,Clarendon Press,Oxford,2005
- D. J. O. Conner (ed.) : *A Critical History of Western Philosophy*
- S.S. Barlingay & Padma Kulkarni : *A Critical History of Western Philosophy*
- John Cottingham : *The Rationalists* (Oxford , 1988)
- J.L. Ackrill. : *Aristotle the Philosopher*
- R. S. Woolhouse : *The Empiricist*
- Jonathan Barnes : *Aristotle : A very Short Introduction* (Oxford University Press)
- Roger Scruton : *A History of Philosophy From Descartes to Wittgenstein*
- Roger Scruton : *Spinoza : A very Short Introduction* (Oxford University Press)
- G.M. Ross : *Leibniz* (Oxford 1984)
- Jhon Caird : *Spinoza*
- Chandradaya Bhattacharya : *Paschatya Darsaner Itihas* (2 Vol.) in Bengali
- Sapna Sarkar : *Paschatya Darsaner Samiksa* in Bengali
- Nirod Baran Chakraborty : *Paschatya Darsaner Itihas* (Plato and Hume)
- Susanta Chakraborty : *Paschatya Darsaner Itihas*
- Samerendra Bhattacharya : *Paschatya Darsaner Itihas* (in Bengali)
- Prahlad Sarkar (ed.) : *Rene Descartes er Darsan* (in Bengali)
- Satyajit Dasgupta & Sarmistha Roy (trns.) : *Paschatya Darsaner Itihas* (in Bengali) A Bengali translation of Russell's " *A History of Western Philosophy* "
- Debobrata Sen : *Paschatya Darsaner Itihas* (Plato to Aristotle)
- Barnard Williams : *Descartes : Project of Pure Enquiry*
- A.K.Rogers : *A Student-s History of Philosophy*

PHIL-G-GE-T-01		
Epistemology and Metaphysics (Indian and Western)		
Prescribed Course:		Total 56 Credits
Section 'A'	Indian Epistemology and Metaphysics	28 Credits
Section 'B'	Western Epistemology and Metaphysics	28 Credits
Unit-Wise Division:		
Section 'A'		
Indian Epistemology and Metaphysics		
Unit: I	Cārvāka Epistemology: Pratakṣa as the only source of knowledge; refutation of Anumāna.	04 Credits
Unit: II	Nyāya Epistemology: Pratakṣa, Anumāna.	05 Credits
Unit: III	Jaina view of Syādvāda.	04 Credits

Unit: IV	Buddhist view of Pratītyasamudpāda, Nairatmyavāda.	04 Credits
Unit: V	Vaisesika Metaphysics: Seven Padārtha-s,	06 Credits
Unit: VI	Advaita Metaphysics : Brahman, Māyā.	04 Credits
Section 'B' Western Epistemology and Metaphysics		
Unit: I	Knowledge: Definition and kinds: Propositional knowledge its necessary and sufficient conditions.	05 Credits
Unit: II	Sources of knowledge: Rationalism, Empiricism, Kant's Critical theory.	05 Credits
Unit: III	Nature of Metaphysics: Realism, Naive Realism, Subjective Idealism (Berkeley.)	05 Credits
Unit: IV	Causality : The Regularity and the entailment theory of causation ; Substance ; Universals	05 Credits
Unit: V	Skepticism	03 Credits
Unit: VI	God: Nature ; Proofs for existence	05 Credits

Suggested Readings :

- S.C. Chatterjee: *The Nyaya Theory of Knowledge.*
- S.K. Maitra: *Fundamental Questions of Indian Metaphysics and Logic*
- N. Hirianna: *Outlines of Indian Philosophy*
- S.C. Chatterjee And D.M.Dutta: *An Introduction to Indian Philosophy*
- N.B. Chakraborty: *Bharatiya Darsan*
- C.D. Sharma: *A Critical Survey of Indian Philosophy*
- Karuna Bhatarcharya: *Nyaya-Vaisesika Darsan*
- Pradyot Kr. Mondal: *Bharatiya Darsan*
- Dipak Bagchi: *Bharatiya Darsan*
- John Hospers: *An Introduction to Philosophical Analysis.*
- A.C.Ewing: *Fundamental Questions of Philosophy*
- Ram Chandra Pal: *Darsan Parichaya.*

Ramaprasad Das: *Paschatya Darsan O Juktibijnan*

Devika Saha: *Darsanik Samasyabali*

J Hospers: *An Itroduction to Philosophical Analysis*

Sibapada Chakraborty: *An Introduction to Philosophy*

Sarasvati Chenakesavam: *Concepts of Indian Philosophy*

W. H. Walsh: *Metaphysics*

B. Russell: *The Problems of Philosophy*

D.W. Hamlyn: *Theory of Knowlegde*

D.W. Hamlyn: *Metaphysics*

PHIL-H-CC-T-03		
Outline of Indian Philosophy – 2		
Prescribed Course:		Total 56 Credits
Section ‘A’	Sankhya	10 Credits
Section ‘B’	Yoga	12 Credits
Section ‘C’	Pūrva Mīmāṃsā	12 Credits
Section ‘D’	Advaita Vedānta	12 Credits
Section ‘E’	Viśiṣṭādvaita Vedānta	10 Credits
Unit-Wise Division:		
Section ‘A’		
Sāṃkhya		
Unit: I	Sakhya Duality : prakṛti and it’s constituents , proofs for the existence of prakṛiti,	05 Credits
Unit: II	purusa : It’s nature and arguments for it’s existence. plurality of purusa.	05 Credits
Section ‘B’		
Yoga		
Unit: I	<i>citta, cittabhūmi, cittavṛtti</i>	06 Credits
Unit: II	<i>eightfold path (astanga yoga) and īśvara.</i>	06 Credits

Section ‘C’ Pūrva Mīmāṃsā		
Unit: I	Vidhi, nisedha. <i>pramāṇa-s</i> with special reference to <i>arthāpatti</i> and <i>anupalabdhi</i> ,	06 Credits
Unit: II	Theories of error: <i>Akhyativāda</i> (prabhakara), <i>Anyathakhyativāda</i> (Bhātta)	06 Credits
Section ‘C’ Advaita Vedānta		
Unit: I	Nature of Brahman, Adhyasa, <i>vivartavāda</i> ,	06 Credits
Unit: II	<i>māyā</i> , three grades of satta, <i>jīva</i> and <i>jagat</i> .	06 Credits
Section ‘D’ Viśiṣṭādvaita Vedānta:		
Unit: I	Distinction between <i>advaitavāda</i> and <i>viśiṣṭādvaitavāda</i> , , Ramanuja’s Criticism of Saṃkara’s Doctrine of <i>māyā</i> .	05 Credits
Unit: II	<i>Relation between jīva and jagat</i> , Nature of Brahman .	05 Credits

References:

- S. C. Chatterjee & D. M. Dutta : *An Introduction to Indian Philosophy*, Calcutta University Press, Kolkata 700019, 2004
- Kalikrishna Bandyopadhyay : *Nyayatattva Parikrama*, Papyrus, Kolkata, 1984
- Karuna Bhattacharya : *Nyaya-Vaiśeṣika Darśan*
- Panchanan Shastri : *Cārvāk Darśan*
- Panchanan Shastri : *Bauddha Darśan*
- M. Hiriyanna : *Outline of Indian Philosophy*
- Chandradhar Sharma : *A Critical Survey of Indian Philosophy*
- S.N. Dasgupta : *A History of Indian Philosophy*
- J. N. Sinha : *Indian Philosophy* (Vols. 1-4)
- D.M. Datta : *Six Ways of Knowing*
- Samiran Chandra Chakraborti : *The Concept of Purusarthas*
- Nabanaraan Bandhopadhyaya (ed) : *Ancient Indian Views on Truth and Falsity*
- Anil kr. Roy Chowdhury : *The Doctrine of Maya*

Unit: II	Refutation of Abstract Ideas. Role of God.	
Section 'C' Hume		
Unit: I	Impressions and Ideas, Association of Ideas, Judgments Concerning Relations of Ideas, Judgments Concerning Matters of Fact.	07Credits
Unit: II	Theory of Causality, Theory of Self and Personal Identity, Humean Skepticism.	07 Credits
Section 'D' Kant		
Unit: I	Conception of Critical Philosophy, Copernican Revolution in Philosophy, Classification of Judgments: Analytic, Synthetic, a priori, a posteriori; Possibility of Synthetic a-priori Judgments,	07 Credits
Unit: II	Forms of Sensibility: Space and Time. Categories of the understanding.	07 Credits

Suggested Reading

- Y. Masih : *A Critical History of Western Philosophy*, Motilal Banarsidass Publishers Private limited., Delhi
- F. Copleston : *A History of Philosophy* [Vols. I, IV, V, & VII], Continuum Publishers, London
- B. Russell : *History of Western Philosophy*, George Allen & Unwin Ltd., London, 1946
- R. Falckenberg : *History of Modern Philosophy*, Progressive Publishers, Calcutta, 1962
- W.T. Stace : *A Critical History of Greek Philosophy*, MacMillan and St. Martine's Press Inc, 1967
- W.K. Wright: *A History of Modern Philosophy*, The Macmillan Company, New York, 1958
- Anders Wedberg : *A History of Philosophy*, Vol.-I & II, Clarendon Press, Oxford, 1982
- Tom Sorell & G. A. J. Rogers (ed.): *Analytic Philosophy and History of Philosophy*, Clarendon Press, Oxford, 2005
- D. J. O. Conner (ed.) : *A Critical History of Western Philosophy*
- S.S. Barlingay & Padma Kulkarni : *A Critical History of Western Philosophy*

- R. S. Woolhouse : *The Empiricist*
- Chandradaya Bhattacharya : *Paschatya Darsaner Itihas* (2 Vol.) in Bengali
- Sapna Sarkar : *Paschatya Darsaner Samiksa* in Bengali
- Nirod Baran Chakraborty : *Paschatya Darsaner Itihas* (Plato and Hume)
- Susanta Chakraborty : *Paschatya Darsaner Itihas*
- Samerendra Bhattacharya : *Paschatya Darsaner Itihas* (in Bengali)
- Prahlad Sarkar (ed.) : *Rene Descartes er Darsan* (in Bengali)
- Satyajit Dasgupta & Sarmistha Roy (trns.) : *Paschatya Darsaner Itihas* (in Bengali) A Bengali translation of Russell's " A History of Western Philosophy "
- C. R. Morris : *Locke Berkeley Hume*
- Jonathan Bennett : *Locke Berkeley and Hume*
- R. S. Woolhouse : *The Empiricist*
- J. Dunn : *John Locke* (Oxford University , 1984)
- K.P. Wrinkler : *Berkeley : An Introduction* (Oxford , 1989)
- A.J. Ayer : *Hume : A Very Short Introduction* (Oxford University Press)
- J.N. Mohanty, ed. : *David Hume : An Enquiry Concerning Human Understanding*
- Roger Scruton : *Kant ; A Very Short Introduction*
- N.K. Smith : *Immanuel Kant ; Critique of Pure Reason* (trans.)
- Rasvihari Das : *A Handbook to Kant's Critique of Pure Reason*
- Paul Guyer : *Kant*
- Nirod Baran Chakraborty : *Paschatya Darsaner Itihas* (Locke , : Berkeley)
- Prahlad Sarkar (ed.) : *Locke Berkeley and Hume – Abhijnatabader Tin Pakriti* (in Bengali)
- Prahlad Sarkar : *Kant er Darsan* (in Bengali)
- Rasvihari Das : *Kant er Darsan* (in Bengali)
- A. Wood : *Kant*
- S. Korner : *Kant*
- John Cottingham : *The Rationalists*

PHIL-G-GE-T-02 Logic (Indian and Western)		
Prescribed Course:		Total 56 Credits
Section 'A'	Indian Logic	28 Credits
Section 'B'	Western Logic	28 Credits
Unit-Wise Division:		
Section 'A' Indian Logic		
Unit: I	Nature of anumana, paksa ,Sadhya,hetu	05 Credits
Unit: II	Vyapti ,Vyaptigraha, Paramarsa.	08 Credits
Unit: III	Svarthanumiti,pararthanumiti,kevalanvayi,kevalavyatire ki and anvaya-vayatireki anumiti	08 Credits
Unit: IV	Hetvabhasa	07 Credits
Section 'B' Western Logic		
Unit: I	Introductory topics: Sentence, Proposition, (traditional and modern interpretation), argument: truth, validity, soundness.	02 Credits

Unit: II	Aristotelian classification of categorical proposition, Distribution of terms.	04 Credits
Unit: III	Immediate inference based on the square of opposition ; conversion , obversion	03 Credits
Unit: IV	Categorical syllogism; figure, mood, rules of validity; Fallacies.	03 Credits
Unit: V	Symbolic Logic: Use of Symbols.	02 Credits
Unit: VI	Truth-Functions ; negation ,conjunction, disjunction, implication, equivalence	03 Credits
Unit: VII	Tautology,Contradiction, Contingency.	03 Credits
Unit: VIII	Decision Procedure : Truth Table	04 Credits
Unit: IX	Using Truth Tables for testing the validity of arguments;Venn Diagram for testing validity ; Fallacies.	04 Credits

Suggested Readings :

C.Bhattacharya: *Elements of Indian Logic and Epistemology.*

S.S. Barlingay: *A Modern Introduction to Indian Logic.*

S.C. Chatterjee: *The Nyaya Theory of Knowledge.*

Gopinath Bhattacharya (Elucidated): *Tarka Samgraha with Dipika*

Indira Mukhopadhyay: *(Translated) Tarka Samgraha with Dipika*

Kanailal Poddar (ed.): *Tarka Samgraha with Dipika*

I.M. Copi & C. Cohen: *Introduction to Logic(13th edn.)*

Indra Kumar Roy: *Pratiki Nyaya*

Rama Pradas Das: *Paschatya Darsan O Juktivijnan*

S.K. Moitra: *Fundamental questions of Indian Metaphysics & Logic*

Panchanan Sastri: *Bhasaparichhed*

Gopal Mukhopadhyay: *Bhasaparichhed*

Ashutosh Sastri: *Vedanta Darsan Advaitavad*

R.C. Jeffrey: *Formal Logic – its scope and limits*

W. Hodges: *Logic*

W.Salman: *Logic*

PHIL-H-CC-T-05 Indian Ethics		
Prescribed Course:		Total 56 Credits
Section 'A'	1. <i>Introduction:</i> presuppositions and determination , theory of Karma; Niskama Karma	08 Credits
Section 'B'	2. Dharma: It's meaning and definition; vedic concepts of savadharma, sadharana Dharma , Asrama Dharma , Visesa Dharma; varna Dharma.	16 Credits
Section 'C'	3. <i>puruṣārtha</i> and their interrelation	08 Credits
Section 'D'	4. Buddhist Ethics : <i>pañcaśīla</i> and <i>brahmavihārabhāvanā</i>	08 Credits
Section 'E'	5. Jaina Ethics: <i>triratna</i> , <i>anuvrata</i> and <i>mahāvratā</i>	08 Credits
Section 'F'	6. <i>Joga Ethics</i> : <i>ahimsa</i> , <i>yama</i> , <i>niyama</i>	08 Credits

Suggested Reading

- I. C. Sharma : *Ethical Philosophies of India*, George Allen & Unwin Ltd., London,1965
- Samiran Ch. Charaborty : *The concept of purusarthas*
- Davjanaananda Vargava : *Jaina Ethics*
- Stevenson : *The Heart of Jainism*
- Syed Ameer Ali : *The spirit of Islam* (English and Bengali Verson)
- Laugaksibhaskara : *Arthasamgraha* (Edited by Swami Bhargananda)
- Prasastapada: (Ed. By Brahmacavi Medhacaitanya (2nd Vol.): *Padarthadharmā Samgraha* (guna Prakarana)
- S.K.Maitra : *The Ethics of Hindus*
- Surama Dasgupta : *Development of Moral Philosophy*

- M.Hiriyanna : *The Indian Conception of Values*
- P.V. Kane : *History of Dharma Sastra Vol -1*

PHIL-H-CC-T-06 Western Ethics		
Prescribed Course:		Total 56 Credits
Section 'A'	Nature and scope of ethics or moral philosophy. Non-moral action, object of moral philosophy- motive or intention.	10 Credits
Section 'B'	Teleological Ethics : Egoism , Hedonism , Utilitarianism (Utilitarianism : Act- Utilitarianism ; General Utilitarianism ; Rule Utilitarianism)	12 Credit
Section 'C'	Deontological Ethics: Kant (Utilitarianism : Act- Utilitarianism ; General Utilitarianism ; Rule Utilitarianism)	12 Credits
Section ' D'	Practical Ethics: Killing, Euthanasia , Suicide. Theories of punishment.	12 Credits
Section 'E'	Virtue ethics : Aristotle	10 Credits

Suggested Reading

- W. Lillie : *An Introduction to Ethics*, University Paperbacks, London,1955
- W. Frankena: *Ethics*, 2nd ed., Prentice Hall of India Private Limited, Delhi, 1973
- Samarendra Bhattacharya : *Tattvagata Nitividya O Vyavaharika Nitividya*
- Aristotle : *The Nichomachean Ethics* (Trans. Devid Ross Revused by J.L. Ackrill and J. Urmson)
- Mrinal Kanti Bhadra : *Nitividya*, The University of Burdwan , Burdwan,1991
- David Bostock : *Aristotle's Ethics*
- Julia Driver : *Ethics – The Fundamentals*
- Fred Feldman : *Introductory Ethics*
- W. Frankena : *Ethics*
- W. Lillie : *An Introduction to Ethics*
- J.D. Mabbott : *Introduction to Ethics*

- J.Hospers: *Human Conduct*
- Rosalind Hursthouse: *Virtue Ethics*
- Kant: *Groundwork of the Metaphysics of Morals*
- J.S.Mill: *Utilitarianism*
- W.D.Hudson: *Modern Moral Philosophy*
- Phillappa Foot (Ed.): *Theories of Ethics*
- R.M. Hare: *The Language of Morals*
- H.J. Paton: *The Moral Law*
- Plato: *Charimedes nand Protagoras*
- Aristotle: *Nichomachean Ethics*
- Bernard Williams: *Morality: An Introduction to Ethics*
- J.L. Mackie: *Ethics: Inventing Right and Wrong*
- Bernard William and J.J.C. Smart: *Utilitarianism: For and Against*
- C.D. Broad: *Five Types of Ethical Theory*

PHIL-H-CC-T-08		
Indian Logic		
Prescribed Course:		Total 56 Credits
Section 'A'	Tarkasamgraha with Dipika – Annambhatta. <i>Sarvavyavahara heturgunah buddhirjnanam to Nigrahasthanantaramiti nabina.</i>	

Suggested Reading

- Gopinath Bhattacharyya (tr. & elucidated) *Tarkasamgrahadīpikā on Tarkasamgraha*, Progressive Publishers, Calcutta
- Dharmakirti: *Nyayabindu*
- Narayan Chandra Goswami : *Tarkasamgraha of Annambhatta with D ipika* [From “ sarvavyavaharaheturgunah buddhirjnanam to samrtirapi dvididha yathartha ayatharthasceti.]
- Anamika Roychoudhury : *Tarkasamgraha*
- S. Kupswami Sastri : *A Primer of Indian Logic*
- Panchanan Sasri : *Tarkasamgraha* (in Bengali)
- Kantilal Poddar : *Tarkasamgraha*(in Bengali)
- Indira Mukhopadyay : *Annambhatta – Krita Tarkasamgraha O Tarkasamgraha Dipika* (Bengali Trans. Of Gopinath Bhattacharyya’s English exposition.
- Yasovijaya: *Jaina tarka Bhasa*
- S.S. Berlingay: *A Modern Introduction To Indian Logic*
- B. K. Matilal: *Logic, Language and Reality*

- S. K. Maitra: *Fundamental Question of Indian Metaphysics and Logic*
- C. Bhattacharya: *Elements of Indian Logic and Epistemology*
- S. Chatterjee: *Nyaya Theory of Knowledge*

PHIL-G-GE-T-03 Ethics (Indian & Western)		
Prescribed Course:		Total 56 Credits
Section 'A'	Ethics (Indian)	28 Credits
Section 'B'	Ethics (Western)	28 Credits
Unit-Wise Division:		
Section 'A' Ethics (Indian)		
Unit: I	Purūsārtha (A General View)	04 Credits
Unit: II	Vidhi , Nisedha	04 Credits
Unit: III	Dharma and Karma (Sakāma and Nişkāma)	04 Credits
Unit: IV	Swadharma and Sadharana Dharma	04 Credits
Unit: V	Buddhist Ethics: The Four Noble Truths and The Eight –fold Path.	06 Credits
Unit: VI	Jaina Ethics:, Anubrata, Mahabrata,	06 Credits
Section 'B' Ethics (Western)		
Unit: I	The nature of Ethics : its concerns.	04 Credits
Unit: II	The notion of Good , Right , Duty/ Obligation.	04 Credits
Unit: III	Object of Moral Judgments	04 Credits
Unit: IV	Teleological Ethics : Hedonism , Utilitarianism	04 Credits
Unit: V	Deontological Ethics : Kant	04 Credits
Unit: VI	Virtue Ethics : Aristotle	04 Credits
Unit: VII	Theories of Punishment	04 Credits

Suggest Readings :

Bhagvad Gita: *Relevant Chapters*

I.C. Sharma: *Ethical Philosophies of India*

S.K. Maitra: *The Ethics of the Hindus.*

Surama Dasgupta: *Development of Moral Philosophy of India*

W. Frankena: *Ethics*

W.Lillie: *An Introduction to Ethics*

S.C. Chatterjee: *Fundamentals of Hinduism*

Somnath Chakraborty: *Nitividyar tattvakatha*

Dikshit Gupta: *Nitisastra*

Samarendra Bhattacharya: *Nitividya*

Sibapada Chakraborty : *Nitividya*

Night & Night: *An Introduction to Psychology.*

Prasanta Bhattacharya: *A text book of Philosophy*

Ira Sengupta: *Manovidya*

Jagadishwar Sanyal: *Manovidya J*

Uliah Driver: *Ethics*

M.Hiriyanna: *The Indian Conception of Values*

J.D. Mabbot: *Introduction to Ethics.*

J.Hospers: *Human Conduct*

Roselind Hursthouse: *Virtue Ethics*

Aristotle: *Nicomachean Ethics.*

PHIL-H-SEC-T-01 Logical Rules and Fallacies (Indian)		
Prescribed Course:		Total 56 Credits
	Definition and classification of Anumāna (a) The Nyāya model (chala, jāti, nigrahasthāna, vāda, jalpa, vitandā) (b) The Buddhist model (prasanga)	

	Aid to Anumāna: (a) tarka (b) avayava (c) dr̥ṣṭānta (d) siddhānta	
	Nature of Hetu and Hetvābhāsa	

Suggested Readings:

- Phanibhushan Tarkabagish: Nyāya Parichaya
- Th. Stcherbatsky: Buddhist Logic, Vol.-I
- Bimal Krishna Matilal: The Character of Logic in India
- B. N. Singh: Indian Logic
- S. C. Chatterjee: Nyāya Theory of Knowledge References:
- Bimal Krishna Matilal: Perception, Chap. 3 (OUP,1986)
- J.N. Mohanty: Reason and Tradition in Indian Thought (Oxford, 1998) . Challenging interpretations of many key doctrines
- Marie-Helene Gorisse and Peter Van Ormondt: A Day of Indian Logic

PHIL-H-CC-T-08 Western Logic - 1		
Prescribed Course:		Total 56 Credits
Section 'A'	Introduction to Logic	08 Credits
Section 'B'	Deduction	36 Credits
Section 'C'	Induction	12 Credits
Unit-Wise Division:		
Section 'A' Introduction to Logic		
Unit - I	1.Sentence and Proposition; Logical form 2. Truth, Validity and Soundness 3. Laws of Thought	08 Credits
Section 'B' Deduction		
Unit: II	1. Aristotelian Classification of Categorical Proposition; Square of Opposition and the question of existential input; Conversion, obversion, contra position, inversion. 2. Categorical Syllogism: figures and moods; rules of validity; fallacies 3. Boolean interpretation of propositions; venn diagram technique for testing the validity of syllogisms 4. Truth function: negation, conjunction, disjunction, implication, equivalence;	36 Credits

	dagger and stroke functions; inter-definability of truth-function 5. Arguments and argument forms; decision procedures: truth tables; <i>reductio ad absurdum</i> ; normal forms 6. Techniques of symbolization; proof construction: direct, indirect and conditional proofs 7. Quantification theory: singular and single – general propositions; rules of quantification	
	Section C Induction	
Unit III	1. Analogy 2. Mills method of experimental enquiry 3. Scientific hypothesis 4. Elementary probability calculus	12 Credits

Suggested Reading

- I.M. Copi, C. Cohen, P. Jetli & M. Prabhakar : *Introduction to Logic* (13th Edition) [Chapters 3 to 8], Pearson Education, Inc, New Delhi, 2009
- A. H. Basson and D.J. O'Connor: *Introduction to Symbolic Logic*
- H. Kyburg Jr.: *Probability and Induction*
- W.V. Quine: *Methods of Logic*
- Richard Jeffrey: *Formal Logic: Its Scope and Limits*
- W. Kneale: *Probability and Induction*
- I.M. Copi : *Symbolic Logic*
- Chanda Chakraborty : *Logic : Internal Symbolic and Inductive*
- Stan Baronett and Madhuchanda Sen : *Logic*

PHIL-H-CC-T-09 Psychology		
Prescribed Course:		Total 56 Credits
Section 'A'	Psychology	8 Credits
Section 'B'	Methods of Psychology	8 Credits
Section 'C'	Psychological Process	8 Credits
Section 'D'	Unconscious and Dream	8 Credits

Unit-Wise Division:		
Section 'A' Psychology		
Unit: I	Nature and Scope of Psychology.	04 Credits
Section 'B' Methods of Psychology		
Unit: I	Introspection , Extrospection Experimental and observation.	14 Credits
Section 'C' Psychological Process		
Unit: I	Perception: Classical approach, Gestalt approach, Wertheimer Koffka & Kohler. Memory, Imagination, Learning: Thorndike's connectionism , Pavlov's classical conditioning, Gestalt Theory , Skinner's theory of operant conditioning.	20 Credits
Section 'D' Consciousness		
Unit - 1	Levels of Mind : Conscious , Sub-Conscious , Unconscious.	09 Credits
Unit - II	Proofs for the existence of unconsciousness; Freud's theory of dream.	09 Credits

Suggested Reading

- G. F. Stout : *A Manual of Psychology*, Hinds, Noble & Eldridge, 1915
- Woodworth & Marquis : *Psychology*, Holt, New York, 1947
- R. S. Woodworth : *Contemporary Schools of Psychology*, Methuen & Co.Ltd., Great Britain, 1931
- E. B. Titchener : *A Text- book of Psychology*, Macmillan, 1921
- Baron & Misra : *Psychology*, Pearson, 5th Edition, 2014
- C.T. Morgan : *Introduction to Psychology*
- Ren Knight & M. Knight : *A Modern Introduction to Psychology*
- E.B. Harlock : *Developmental Psychology*
- Pareshnath Bhattacharya : *A Text Book of Psychology*
- J.Shaffer : *Philosophy of Mind Individuals*
- Prity Bhusan Chattopadhyay : *Monovidya*
- Pareshnath Bhattacharya : *Monovidya*
- M.N. Mitra O Puspa Misra : *Manosamiksha*
- M.N. Mitra O P. Sarkar : *Monodarsan Sarirvada O tar vikalpa*

- Ira Sengupta : *Adhunik Monovijnan*
- Aurabinda Basu O Nivedita Chakraborty : *Monodarsan*
- Susil Roy : *Shikshrayi Monovidya*
- E.B. Murlock: *Developmental Psychology*
- A.F. Witting and G. William: *Psychology an Introduction*
- Worchel and Shekilaka: *Psychology*
- Swami Abhedananda: *Yoga Psychology*
- P.N. Bhattacharyya: *A Text Book of Psychology (vol. 1-3)*

PHIL-H-CC-T-10 Philosophy of Religion		
Prescribed Course:		Total 56 Credits
Section 'A'	Nature and Scope of Philosophy	02 Credits
Section 'B'	Religion: Origin and Development of Religion, Religion without God, Atheism, Deism, Theism, Pantheism Monotheism , Polytheism , Henotheism	20 Credit
Section 'C'	Hinduism, Christianity, Islam, Buddhism : Basic Tenets.	08 Credits
Section 'D'	Argument for the Existence of God,: Ontological , Cosmological , Teleological.	10 Credits
Section 'E'	Arguments against the Existence of god	10 Credits
Section 'F'	Reason , Faith , Revelation	06 Credits

Suggested Reading

- D. Mahanta: *Dharma Darsaner Katipay Samasya*, Nababharati Prakashani, Kolkata, 2010
- P.B.Chatterjee : *Studies in Comparative Religion*, Dasgupta & Co. Private Ltd., Calcutta, 1971
- J. Hick : *Philosophy of Religion*, Prentice Hall of india, 3rd ed., 1988
- Kalidas Bhattacharyya : *Possibility of Different Types of Religion*, The Asiatic Society, Calcutta, 1975
- K.N.Tiwari : *Comparative Religion*, Motilal Banarsidass, Delhi, 1987
- D.A. Trueblood: *Philosophy of Religion*
- Mc Phearson: *The Philosophy of Religion*
- John Dewey: *A Common Faith*
- Chemparathy: *Indian Rational Theology*
- D.M. Edwards: *The Philosophy of Religion*
- N.K. Brahma: *The Philosophy of Hidu Sadhana*
- K.S. Murthy: *The Realm of Between*
- S. Radhakrishnan: *Eastern Religion and Western Thought*
- L. Pojman (Ed.): *Philosophy of Religion*
- R. Swineburne: *The Existence of God*

- D.P. Cattopadhyay: *Indian Atheism*

PHIL-G-GE-T-04		
Philosophy of Religion and Social and Political Philosophy		
Prescribed Course:		Total 56 Credits
Section 'A'	Philosophy of Religion	28 Credits
Section 'B'	Social and Political Philosophy	28 Credits
Unit-Wise Division:		
Section 'A'		
Philosophy of Religion		
Unit: I	Philosophy of Religion : Nature and Concern	05 Credits
Unit: II	Arguments for and against the Existence of God (Indian and Western)	06 Credits
Unit: III	Reason and Faith ; Jnana and Bhakti	06 Credits
Unit: IV	Religious Pluralism	06 Credits
Unit: V	Religious Experience.	05 Credits
Section 'B'		
Social and Political Philosophy		
Unit: I	Nature and scope of social and political philosophy Their relation to Sociology, Social psychology , Politics and Ethics	06 Credits
Unit: II	Individual, Society, State, Nation.	05 Credits
Unit: III	Social Institutions: Family, Marriage, Property, Education and Religion	06 Credits
Unit: IV	Political Ideologies : Democracy , Socialism , Fascism, Theocracy, Communism , Anarchism, Sarvodaya.	06 Credits
Unit: V	Methods of Political Action: Constitutionalism, Revolutionism , Terrorism , Satyagraha	05 Credits

Suggested Readings:

Bhagvat Gītā: *Relevant Chapters*
 Galloway: *Philosophy of Religion*
 John Hick: *Philosophy of Religion*

Gisbert: *Fundamentals of Sociology*
 N.V.Joshi: *Social and Political Philosophy*
 A.K.Sinha: *Outlines of Social Philosophy*
 G.R.Madam: *Theoretical Sociology*
 D.D. Raphael: *Problems of Political Philosophy*
 K.G. Mashruwalla: *Gandhi and Marx*
 K.Roy & C. Gupta (ed): *Essays in Social and Political Philosophy*
 Rabindranath Das: *Dharmadarsan*
 Susil Kumarz: *Dharmadarsan*
 Brian Davies: *An Introduction to the Philosophy of Religion*
 James Churchill & Davids V. Jones: *An Introductory Reader in the Philosophy of Religion*
 D.A. Trueblood: *Philosophy of Religion*
 Chemparathy: *Indian Rational Theology* (This book contains an English Translation of Udayanas Nyayakusumanjali.
 John Hick (Ed): *Classical and Contemporary Readings in Philosophy of Religion*
 D.M. Edwards: *The Philosophy of Religion*
 N. K. Brahma: *Philosophy of Hindu Sadhana*
 S. Radhakrishnan: *The Idealist View of Life*
 S. Radhakrishnan: *The Hindu View of Life*

PHIL-H-SEC-P-02 Logical Rules and Fallacies(Western)		
Prescribed Course:		Total 56 Credits
	1. Argument: deductive and inductive	
	2. Deductive Argument: Immediate inference , Categorical Syllogism, truth functional argument and quantificational argument	
	3. Opposition of propositions: Rules and Fallacies	
	4. Immediate inference: Rules and Fallacies	
	5. . Categorical Syllogisms : Rules and Fallacies, Venn diagram	
	6. Truth functional Argument : Rules and Fallacies 23	
	7. Quantificational Argument : Rules and Fallacies	
	8. Inductive Argument : Rules and Fallacies	
	9. Reasoning	

Recommended Texts :

1. M. Copi, C. Cohen, P. Jetli & M. Prabhakar : *Introduction to Logic* (14th Edition)
2. R. S. Aggarwal: *A Modern Approach to Logical Reasoning*, Paperback, 2007

3. Bo Bennett : Logically Fallacious: The Ultimate Collection of Over 300 Logical Fallacies (Academic Edition) (This ebook is available in the downloadable formats: pdf (for reading on PC or MAC), epub (iPad, Nook, and most e-book readers), mobi (Amazon Kindle)
4. Ramaprasad Das: *Pāschātya Darśan O Yuktivijñān*

PHIL-H-CC-T-11 Social and Political Philosophy		
Prescribed Course:		Total 56 Credits
Section 'A'	Nature and Scope of Social Philosophy and Political Philosophy	04 Credits
Section 'B'	Basic Concepts	10 Credits
Section 'C'	Theories about the relations between individual and society	06 Credits
Section 'D'	Political Ideology	10 Credits
Section 'E'	Social change	08 Credits
Section 'F'	Concepts of Gandhi	10 Credits
Section 'G'	Feminism	06 Credits
Section 'B' Basics Concepts		
Unit: I	Society , Social group , community , Association , State, Nation, Instruction , Custom.	10 Credits
Section 'C' Theories about the relations between individual and society		
Unit: I	Individualistic Theory, Organic Theory, Idealistic Theory	06 Credits
Section 'D' Political Ideology		
Unit: I	Democracy and its different forms. Socialism and Utopia, Fascism, Theocracy, Communism, Scientific Anarchism, Sarvodaya	10 Credits
Section 'E' Social Change		
Unit: I	Marx and Gandhi.	08 Credits
Section 'F' Concepts of Gandhi		
Unit: I	Swaraj , Satyagraha , Sarvodaya.	10 Credits

Suggested Reading

- R. M. MacIver & C. H. Page : *Society, Macmillan & CO LTD., London, 1957*
- Morris Ginsberg : *Sociology, Oxford University Press, 1950*
- Tom Bottomore : *Sociology, A Guide to Problems and Literature, Blackie & Son (India) Ltd., Bombay, 1972*
- P. Gisbert : *Fundamentals of Sociology, Oriental Longmans Private Ltd. 1959, Calcutta 13*
- F. Engles : *Socialism : Utopian and Scientific, Resistance Books, 1999*
- Satyabrata Chakraborty (Etd.) : *Bharatbarsha : Rastrabhabana, Ekushe, Kolkata, 2003*
- Amal Kumar Mukhopadhyay : 'Secularism in the Present Indian Society' in *Bulletin of the Ramkrishna Mission Institute of Culture, Vol. LVII No. II*
- D.E. Smith : *India as A Secular State, Princeton University Press, 2015*
- P. Gisbert : *Fundamental of Sociology*
- Bhuddhadeb Bhattacharya : *The Evolution of Political Philosophy of Gandhi*
- D.D.Raphael : *Problems of Political Philosophy*
- Kyamlicka .W. : *Contemporary Political Philosophy an Introduction*
- Wolff , J. : *An Introduction to Political Philosophy*
- C.E.m. Joad : *Introduction to Modern Political Theory*
- Amal Kumar Mukhopadhyay : *Rastra Darsaner Dhara*
- Amelendu Mukhopadhyay : *Samajik O Rajnitik Tattver Nity*
- Shovanlal Duttagupta : *Marxiya Rastrachinta*
- Dilip Kr. Chattopadhyay : *Adhunik Rastriya Matabader Bhumika (A Bengali translation of Joad's An Introduction to Modern Political Theory)*
- Nirmal Kr. Sen : *Rastrachintar Itihas*
- M.K.Gandhi : *Hind Swaraj*
- Jayantanuja Bandhopadhyay : *Social & Political Thought of Gandhi Karl Marx And Fredrick Engels : Communist Manifesto*
- Pritibhusan Chattopadhyay : *Samaj Darsan Dipika*
- Parimal Bhusan Kar : *Samaj Tattva*
- Samarendra Bhattacharya : *Samaj Darsan O Rastra Darsan*
- F. Engles : *Samaj Tantra : Kalpanik O Vaijnanik*
- Marx O Engles : *Samyader Itihas*
- Robert N. Beck : *Handbook in Social Philosophy*
- J. Fierg : *Social Philosophy*
- W.E Moore : *Social Change*
- N.V. Joshi : *Social and Political Philosophy*
- A.K. Sinha : *Outlines of Social Philosophy*
- D.D Raphael : *Problems of Political Philosophy*
- K.G. Mashruwalla : *Gandhi and Marx.*
- T.S. Devadoss : *Sarvadaya and the Problem of Political Sovereignty*
- K. Roy and C. Gupta (eds) : *Essays in Social and Political Philosophy*
- Peter Singer: *Practical Ethics*
- Rosemarie Tong : *Feminist Thought : a comprehensive introduction*
- Mary Evans : *Introducing Contemporary Feminist Thought*
- S. I. Benn and R . S . Peters: *Social Principles and the Democratic State*
- Leo Strauss : *What is Political Philosophy*

PHIL-H-CC-T-12 Western Logic - II		
Prescribed Course		Total 56 Credits
Section 'A'	Introduction to Logic – P. Suppes Chapter – 9 & 10	56 Credits

Suggested Reading

P. Suppes: *Introduction to Logic*
Kantil Das and Ahmed Ali: *An Handbook of Set Theory*

PHIL-H-DSE-T-01 Vedantasara (Text)

Suggested Readings:

Kalibar Vedantavagis : *Vedantasara*
Medha Caitanya : *Vedantasara*
Swami Nikhilananda : *Vedantasara (Eng. Trans.)*

PHIL-H-DSE-T-2 An Enquiry Concerning Human Understanding

Suggested Readings:

David Hume : *An Enquiry Concerning Human Understanding*
N. K. Smith: *The Problem of David Hume*
Tapan Kr. Chakraborty: *Hume's Theory of Causality*
Rama Prasad Das: *Hume er Enqury Ekti Upasthapana*

PHIL-H-CC-T-13		
Western Epistemology		
Prescribed Course		Total 56 Credits
Section 'A'	Knowledge	11 Credits
Section 'B'	Scepticism and Justification of Knowledge Claims	11 Credits
Section 'C'	Theories of Knowledge	11 Credits
Section 'D'	A-Priori Knowledge	11 Credits
Section 'E'	Theories of Truth	12 Credits
Section 'A' Knowledge		
Unit: I	Definition and Kind, Different Use of the word 'Know', Propositional and non-Propositional Knowledge, Knowing how and Knowing that, Knowledge by Acquaintance , Knowledge by Description , Necessary and Sufficient Conditions of Propositional Knowledge.	11 Credits
Section 'B' Scepticism and Justification of Knowledge Claims		
Unit: I	Truth ,Belief , justification ; Philosophical Scepticism , Foundationalism and Coherentism .	
Section 'C' Theories of Knowledge		
Unit: I	Rationalism , Empiricism . Kantian Theory	
Section 'D' A-Priori Knowledge		
Unit: I	A-Priori and A-Posteriori , Types of A –Priori; analytic and synthetic , The Problem of Synthetic a-priori.	05 Credits
Section 'E' Theories of Truth		
Unit: I	Correspondence , Coherence , Pragmatic	12 Credits

Suggested Reading

John. Hospers : *An Introduction to Analytic Philosophy*
 Ramaprasad Das: *Darsanik Jijnasa (in Bengali) (4 Vols.)*
 Samir Kr. Samanta: *Darsanik Bishlesaner Ruparekha (Vol 1 & 2) (in Bengali)*
 Dikshit Gupta: *Bishlesanio Darsaner Bhumika (in Bengali)*
 Rabindranath Das: *Darsanik Bishlesaner Bhumika (in Bengali)*

PHIL-H-CC-T-14		
Western Metaphysics		
Prescribed Course:		Total 56 Credits
Section 'A'	Metaphysics	08 Credits
Section 'B'	Substance and Property	08 Credits
Section 'C'	Idealism	08 Credits
Section 'D'	Space and Time	08 Credits
Section 'E'	Causality	08 Credits
Section 'F'	Mind – Body Relation	08 Credits
Section 'G'	Freedom and Determinism	08 Credits
Section 'A' Metaphysics		
Unit: I	It's Nature , Necessity and Methods.	08 Credits
Section 'C' Idealism		
Unit: I	Idealism , Materialism, Dualism, Monism, Pluralism.	08 Credits

Suggested Reading

John. Hospers : *An Introduction to Analytic Philosophy*
 Ramaprasad Das : *Darsanik Jijnasa (in Bengali) (4 Vols.)*
 Samir Kr. Samanta : *Darsanik Bishlesaner Ruparekha (Vol 1 & 2) (in Bengali)*
 Dikshit Gupta : *Bishlesanio Darsaner Bhumika (in Bengali)*
 Rabindranath Das : *Darsanik Bishlesaner Bhumika (in Bengali)*

PHIL-H-DSE-T-03		
Western Logic(Text)		
Prescribed Course		Total 56 Credits
Half-I :	I.M Copi : Symbolic Logic (5 th ed.) Sections- 3.4, 3.5, 3.6, & 3.7 R. Jeffry : Formal Logic (1 st ed.) It's Scope and Limits Chapter- 4 W.V.O Quine : Methods of Logic (3 rd ed.)	

	Chapter- 18,19 P.Suppes : Introduction to Logic (Indian edition) Chapter-9 , Section – 9.1 to 9.7	
Half – II	H.W.B. Joseph : An Introduction to Logic Chapter-II & IV (Terms and their principle distinctions , The predicables) H.W.B. Joseph : An Introduction to Logic Chapter- V (The Rules of Definition and Division : Classification and Dichotomy)	

Suggested Readings:

- M. Copi, C. Cohen, P. Jetli & M. Prabhakar : Introduction to Logic (14th Edition)
- R. S. Aggarwal: A Modern Approach to Logical Reasoning, Paperback, 2007 References:
- Bo Bennett : Logically Fallacious: The Ultimate Collection of Over 300 Logical Fallacies (Academic Edition) (This ebook is available in the downloadable formats: pdf (for reading on PC or MAC), epub (iPad, Nook, and most e-book readers), mobi (Amazon Kindle)

Ramaprasad Das: Pāschātya Darśan O Yuktivijñān

PHIL-H-DSE-T-04
Nyayabindu

Suggested Readings:

Sanjit Sadhukhan: Nyayabindu

Satyajit Chakraborty: Nyayabindu

UNIVERSITY OF KALYANI



**CBCS CURRICULUM FOR THREE YEARS UNDER-GRADUATE COURSE
IN
PHYSICAL EDUCATION (GENERAL)**

**WITH EFFECT FROM THE ACADEMIC SESSION
2018-19**

INTRODUCTION:

The University Grants Commission (UGC) has taken various measures by means of formulating regulations and guidelines and updating them, in order to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions in India. The various steps that the UGC has initiated are all targeted towards bringing equity, efficiency and excellence in the Higher Education System of country. These steps include introduction of innovation and improvements in curriculum structure and content, the teaching-learning process, the examination and evaluation systems, along with governance and other matters. The introduction of Choice Based Credit System is one such attempt towards improvement and bringing in uniformity of system with diversity of courses across all higher education institutes in the country. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising of core, elective, skill enhancement or ability enhancement courses. The courses shall be evaluated following the grading system, is considered to be better than conventional marks system. This will make it possible for the students to move across institutions within India to begin with and across countries for studying courses of their choice. The uniform grading system shall also prove to be helpful in assessment of the performance of the candidates in the context of employment.

Outline of the Choice Based Credit System being introduced:

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. Ability Enhancement Courses/ Skill Enhancement Courses:

3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

B.A./B.SC. PROGRAM IN PHYSICAL EDUCATION

A. TOTAL Number of courses in UG-CBCS (B.A./B.Sc. Program in Physical Education):

Types of course	Core course (CC)	Elective course		Ability Enhancement Course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course(AECC)	Skill Enhancement course (SEC)	
No. of course	12	6(BSc)/4(BA/B.Com)	2((BA/B.Com)	2	2	24
Credit/course	6	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF (B.A./B.Sc. Program in Physical Education) UNDER CBCS :

S. No.	Particulars of Course	Credit Point	
1.	Core Course: 14 Papers	Theory + Practical	Theory + Tutorial
1.A.	Core Course: Theory (12 papers)	12x4 = 48	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x2 = 24	12x1 = 12
2.	Elective Courses: (6 papers)		
A.	DSE (6 papers for B.Sc./ 4 papers for B.A. & B.Com.)	6x4 = 24	4x5 = 20
B.	DSE(Pract./ Tutor.)* (6 papers for B.Sc./4 for B.A. &B.Com.)	6x2 = 12	4x1 = 4
C.	GE (Interdisciplinary) (2 papers for B.A. & B.Com.)	--	2x5 = 10
D.	GE (Pract./Tutor.)* (4 papers) (2 papers for B.A. & B.Com.)	--	2x1 = 2
#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester			
3.	Ability Enhancement Courses		
A.	AECC(2 papers of 2 credits each) ENVS, English Communication / MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (4 papers of 2 credits each)-----	4x2 = 8	4x2 = 8
Total Credit:		120	120
## Wherever there is a practical, there will be no tutorial and vice-versa.			

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN (B.A./B.Sc. Program in Physical Education):

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC-1,2 (6)	2(1A,2A)	2 1B,2B)	2 (1C,2C)	2 (1D,2D)			8	48
Language CC - 1,2 (6)	1 (L1-1)	1 (L2-1)	1 (L1-2)	1 (L2-2)			4	24
DSE (6)	-	-	-	-	2(1A,2A)	2 (1B,2B)	4	24
GE (6)					1(GE-1)	1(GE-2)	2	12
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Courses/ Sem.	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

B.A./B.Sc. Program in Physical Education

1st Semester

Course Code	Course Title	Course Type	LTP	Credit	Marks
CC1A	Foundation and History of Physical Education	Core course	4-0-2	6	75
CC2A	Discipline-2 (Core-1) other than Physical Education	Core course		6	75
CC (Language)	Language 1A / L1-1	Core course Language	5-1-0	6	75
AECC 1	Environmental Studies	AECC-1 compulsory	2-0-0	2	50
SEMESTER TOTAL				20	275

B.A./B.Sc. Program in Physical Education

2nd Semester

Course Code	Course Title	Course Type	LTP	Credit	Marks
CC1B	Management of Physical Education and Sports	Core course	4-0-2	6	75
CC2B	Discipline-2(Core-2) other than Physical Education	Core course		6	75
CC(Language)	Language 2A/ L2-1	Core course Language	5-1-0	6	75
AECC-2	communicative ENG or MIL	AECC-2 Compulsory	2-0-0	2	50
SEMESTER TOTAL				20	275

B.A./B.Sc. Program in Physical Education

3rd Semester

Course Code	Course Title	Course Type	LTP	Credit	Marks
CC1C	Anatomy, Physiology and Exercise Physiology	Core course	4-0-2	6	75
CC2C	Discipline-2 (Core-3) other than Physical Education	Core course		6	75
CC (Language)	Language 1B/ L1-2	Core course Language	5-1-0	6	75
SEC (1)	Track and Field	SEC	0-0-2	2	50
SEMESTER TOTAL				20	275

B.A./B.Sc. Program in Physical Education

4th Semester

Course Code	Course Title	Course Type	LTP	Credit	Marks
CC1D	Health Education, Physical Fitness and Wellness	Core course	4-0-2	6	75
CC2D	Discipline-2 (Core-4) other than Physical education	Core course		6	75
CC (Language)	Language 2B/ L2-2	Core course Language	5-1-0	6	75
SEC (2)	Gymnastics and Yoga	SEC	0-0-2	2	50
SEMESTER TOTAL				20	275

B.A./B.Sc. Program in Physical Education

5th Semester

Course Code	Course Title	Course Type	LTP	Credit	Marks
DSE 1	DSE (Any one from Discipline-1 and any one from Discipline-2)				
	Discipline-1 (any one)	DSE		6	75
	Tests, Measurements and Evaluation in Physical Education		4-0-2		
	Sports Training		4-0-2		
	Discipline-2(Other than physical Education)			6	75
	1		5-0-1		
	2		5-0-1		
GE 1	GE -1 (for the students other than Phy. Edn.)	GE		6	75
	Modern trends in Physical Education and Sports Sciences		6-0-0		
SEC 3	SEC 3	SEC		2	50
	Indian Games (any one)- Kabaddi / Kho-Kho And Racket Sports (Any one)- Badminton/ Table Tennis		0-0-2		
		SEMESTER TOTAL		20	275

B.A./B.Sc. Program in Physical Education

6th Semester

Course Code	Course Title	Course Type	LTP	Credit	Marks
DSE 2	DSE (Any one from Discipline-1 and any one from Discipline-2)				
	Discipline-1(Any one)	DSE		6	75
	Psychology in Physical Education and Sports		4-0-2		
	Project work		2-0-4		
	Discipline-2(Other than physical Education)			6	75
	1		5-0-1		
	2		5-0-1		
GE 2	GE 2 (for the students other than Phy. Edn.)	GE		6	75
	Health Education and Tests & Measurements in Physical Education		6-0-0		
			4-0-2		
SEC 4	SEC4	SEC		2	50
	Ball Games (any two) Football/Handball/Basketball/ Volleyball/ Netball/ Throwball		0-0-2		
		SEMESTERTOTAL		20	275

SEMESTER- 1

CORE PAPER-1: Foundation and History of Physical Education

Course Code- CC1A

Total number of classes - 60

Unit- I: Introduction

LH - 12

- 1.1. Meaning and definition of Physical Education.
- 1.2. Aim and objectives of Physical Education.
- 1.3. Misconcepts and Modern concept of Physical Education.
- 1.4. Importance of Physical Education in modern society.

Unit- II: Biological and Sociological Foundations of Physical Education

LH - 18

- 2.1. Biological Foundation- Meaning and definition of growth and development. Factors affecting growth and development. Differences of growth and development. Principles of growth and development.
- 2.2. Age- Chronological age, anatomical age, physiological age and mental age.
- 2.3. Sociological Foundation- Meaning and definition of Sociology, Society, Socialization and Physical Education.
- 2.4. Role of games and sports in National and International harmony.

Unit- III: History of Physical Education

LH - 18

- 3.1 Historical development of Physical Education and Sports in India- Pre-Independence period and Post-Independence period.
- 3.2 Olympic Movement- Ancient and Modern Olympic Games.
- 3.3 Brief historical background of Asian Games, Commonwealth Games and SAF Games.
- 3.4 National Sports Awards- Arjuna Award, Rajiv Gandhi Khel Ratna Award, Dronacharya Award and Dhyanchand Award

Unit- IV: Yoga Education

LH - 12

- 4.1 Meaning and definition of the term Yoga, types, aim, objectives and importance of Yoga.
- 4.2 History of Yoga.
- 4.3 Astanga Yoga
- 4.4 Hatha Yoga

FIELD PRACTICAL

1. Learn and demonstrate the technique of Suryanamaskar.
2. Development of physical fitness through Callisthenics and Aerobic activities (Any one).

REFERENCES

1. Graham, G. (2001) Teaching Children Physical Education: Becoming a Master Teacher. Human Kinetics, Champaign, Illinois, USA.
2. Kamlesh, M.L. & Singh, M.K. (2006) Physical Education (Naveen Publication).
3. Lau, S.K. (1999) Great Indian Players, New Delhi, Sports.
4. Lumpkin, A. (2007) Introduction to Physical Education, Exercise Science and Sports Studies, McGraw Hill, New York, USA.
5. Siedentop, D. (2004) Introduction to Physical Education, Fitness and Sport, McGraw Hill Companies Inc., New York, USA.
6. Shaffer, D.R. (2002) Development Psychology: Childhood and Adolescence. Thomson, Sydney, Australia.
7. Shukla, (2000) Mother on Education, National Council of Teacher Education, New Delhi.
8. Singh, A. et al. (2000) Essential of Physical Education, Kalyani Publishers, Ludhiana, Punjab.
9. Wuest, D.A. & C.A. Bucher (2006) Foundation of Physical Education, Exercise Science, and Sports. McGraw Hill Companies Inc.; New York, USA.

SEMESTER- 2

CORE PAPER- 2: Management of Physical Education and Sports

Course Code- CC1B

Total number of classes - 60

Unit- I: Introduction

LH - 12

- 1.1. Concept and definition of Sports Management.
- 1.2. Importance of Sports Management.
- 1.3. Principles of Sports Management.
- 1.4. Sports Manager and his Duties.

Unit- II: Tournaments

LH – 18

- 2.1. Tournaments: Meaning and definition and types of tournaments (Knock-out, League, Combination, Challenge).
- 2.2. Procedure of drawing fixture.
- 2.3. Methods of organizing Annual Athletic Meet and Play Day.
- 2.4. Methods of organization of Intramural and Extramural competition.

Unit- III: Facilities and Equipments

LH - 18

- 3.1 Method of Standard Athletic Track marking.
- 3.2 Care and maintenance of play ground and gymnasium.
- 3.3 Importance, care and maintenance of sports equipments.
- 3.4 Time Table: Meaning, importance and factors affecting school's Physical Education Time Table.

Unit- IV: Leadership

LH - 12

- 4.1. Meaning and definition of leadership.
- 4.2. Qualities of good leader in Physical Education.
- 4.3. Types of Leadership
- 4.4. Principles of leadership activities.

FIELD PRACTICAL

Lay out, knowledge and Officiating ability-

1. Track and Field events (any one).
2. Games: Football, Kabaddi, Kho-Kho and Volleyball (any one).

REFERENCES

1. Broyles, F. J. & Rober, H. D. (1979). Administration of sports, Athletic programme: A Managerial Approach. New York: Prentice hall Inc.
2. Bucher, C. A. (1983). Administration of Physical Education and Athletic programme. St. Louis: The C.V. Mosby Co.
3. Kozman, H.C. Cassidy, R. & Jackson, C. (1960). Methods in Physical Education. London: W.B. Saunders Co.
4. Pandey, L.K. (1977). Methods in Physical Education. Delhi: Metropolitan Book Depot.
5. Sharma, V.M. & Tiwari, R.H.: (1979). Teaching Methods in Physical Education. Amaravati: Shakti Publication.
6. Thomas, J. P. (1967). Organization & administration of Physical Education. Madras: Gyanodayal Press.
7. Tirunaryanan, C. & Hariharan, S. (1969). Methods in Physical Education. Karaikudi: South India Press.
8. Voltmer, E. F. & Esslinger, A. A. (1979). The organization and administration of Physical Education. New York: Prentice Hall Inc.
9. Singh, A. et al. (2010) Essential of Physical Education. Kalyayani Publishers.

SEMESTER- 3

CORE PAPER- 3: Anatomy, Physiology and Exercise Physiology

Course Code- CC1C

Total number of classes - 60

Unit- I: Introduction

LH – 12

- 1.1. Meaning and definition of Anatomy, Physiology and Exercise Physiology.
- 1.2. Importance of Anatomy, Physiology and Exercise Physiology in Physical Education.
- 1.3. Human Cell- Structure and function.
- 1.4. Tissue- Types and functions.

Unit- II: Musculo-skeletal System

LH - 18

- 2.1. Skeletal System- Structure of Skeletal System. Classification and location of bones and joints. Anatomical differences between male and female.
- 2.1. Muscular System- Types of Muscles. Location, Structure and function of Skeletal muscle.
- 2.3. Types of muscular contraction.
- 2.4. Effect of exercise and training on muscular system.

Unit- III: Circulatory System

LH – 18

- 3.1 Blood- Composition and function.
- 3.2 Heart- Structure and functions. Mechanism of blood circulation through heart.
- 3.3 Blood Pressure, Athletic Heart and Bradycardia.
- 3.4 Effect of exercise and training on circulatory system.

Unit- IV: Respiratory System

LH – 12

- 4.1 Structure and function of Respiratory organs.
- 4.2 Mechanism of Respiration.
- 4.3 Vital Capacity, O₂ Debt and Second Wind.
- 4.4 Effect of exercise and training on respiratory system.

LAB PRACTICAL

1. Assessments of BMI and WHR (Waist-to-hip ratio).
2. Assessment of Heart rate, Blood Pressure, Respiratory Rate, and Pick Flow Rate (any two).

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1. Amrit Kumar, R, Moses. (1995). Introduction to Exercise Physiology. Madras: Poompugar Pathipagam.
2. Clarke, D.H. (1975). Exercise Physiology. New Jersey: Prentice Hall Inc., Englewood Cliffs.
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7. Shaver, L. (1981). Essentials of Exercise Physiology. New Delhi: Subject Publications.
8. Vincent, T. Murche. (2007). Elementary Physiology. Hyderabad: Sports Publication.
9. William, D. Mc Aradle. (1996). Exercise Physiology, Energy, Nutrition and Human Performance. Philadelphia: Lippincott Williams and Wilkins Company.

SEMESTER- 3

Track and Field

Course code: SEC 1

1. Track Events

- 1.1. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block.
- 1.2. Acceleration with proper running techniques.
- 1.3. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug.
- 1.4. Relay Race: Starting, Baton Holding/Carrying, Baton Exchange in between zone, and Finishing.

2. Field events (any two)

- 2.1. Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing.
- 2.2. High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing.
- 2.3. Shot put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique).
- 2.4. Discus Throw: Holding the Discus, Initial Stance, Primary Swing, Turn, Release and Recovery (Rotation in the circle).
- 2.5. Javelin Throw: Grip, Carry, Release and Recovery (3/5 Impulse stride).

SEMESTER- 4

CORE PAPER- 4: Health Education, Physical Fitness and Wellness

Course Code- CC1D

Total number of classes - 60

Unit- I: Introduction

LH – 18

- 1.1. Concept, definition and dimension of Health.
- 1.2. Definition, aim, objectives and principles of Health Education.
- 1.3. Activities of Health Agencies- World Health Organization (WHO), United Nations Educational Scientific and Cultural Organization (UNESCO) and United Nations International Children's Emergency Fund (UNICEF) .
- 1.4. School Health Program- Health Service, Health Instruction, Health Supervision, Personal Hygiene and Health Record.

Unit- II: Health Problems in India- Prevention and Control

LH - 18

- 2.1. Communicable Diseases- Malaria, Dengue, Chicken Pox and Diarrhoea.
- 2.2. Non-communicable Diseases- Obesity, Diabetes and Asthma.
- 2.3. Nutrition- Nutritional requirements for daily living. Preparation of Balance Diet chart. Health disorders due to deficiency of Protein, Vitamins and Minerals.
- 2.4. Postural deformities- Causes and corrective exercise of Kyphosis, Lordosis, Scoliosis, Bow-Legs, Knock Knees and Flat Foot.

Unit- III: Physical Fitness and Wellness

LH - 12

- 3.1 Physical Fitness- Meaning, definition and Importance of Physical Fitness.
- 3.2 Components of Physical Fitness- Health and Performance related Physical Fitness.
- 3.3 Concept of Wellness. Relationship between Physical activities and Wellness.
- 3.4 Ageing- Physical activities and its importance.

Unit- IV: Health and First-aid Management

LH - 12

- 4.1 First aid- Meaning, definition, importance and golden rules of First-aid.
- 4.2 Concept of sports injuries- Sprain, Strain, Wound, Fracture and Dislocation.
- 4.3 Management of sports injuries through the application of Hydro-therapy and Thermo-therapy.
- 4.4 Management of sports injuries through the application of Exercise and Massage therapy.

LAB PRACTICAL

1. First-aid Practical- Triangular Bandage: Slings (Arm Sling, Collar & Cuff Sling), Roller Bandages: Simple Spiral, Reverse Spiral, Figure of Eight, Spica splint
2. Practical knowledge on application of Hydro-therapy and Thermo-therapy.

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1. Bucher, Charles A. "Administration of Health and Physical Education Programme".
2. Delbert, Oberteuffer, et. al." The School Health Education".
3. Ghosh, B.N. "Treaties of Hygiene and Public Health".
4. Hanlon, John J. "Principles of Public Health Administration" 2003.
5. Turner, C.E. "The School Health and Health Education".
6. Moss et. al. "Health Education" (National Education Association of U.T.A.).
7. Nemir A. "The School Health Education" (Harber and Brothers, New York).
8. Nutrition Encyclopedia, edited by Delores C.S. James, The Gale Group, Inc.

SEMESTER- 4

Gymnastics and Yoga

Course code: SEC 2

GYMNASTICS

1. Compulsory

- 1.1. Forward Roll
- 1.2. T-Balance
- 1.3. Forward Roll with Split leg
- 1.4. Backward Roll
- 1.5. Cart-Wheel

[Note: Perform the above Gymnastic skills continuously in the same sequence]

2. Optional (any two)

- 2.1. Dive and Forward Roll
- 2.2. Hand Spring
- 2.3. Head Spring
- 2.4. Neck Spring
- 2.5. Hand Stand and Forward Roll
- 2.6. Summersault

YOGA

3. Asanas

3.1. Standing Posture

- 3.1.1. Ardhashandrasana
- 3.1.2. Brikshasana
- 3.1.3. Padahasthasana

3.2. Sitting Posture

- 3.2.1. Ardhakurmasana
- 3.2.2. Paschimottanasana
- 3.2.3. Gomukhasana

3.3. Supine Posture

- 3.3.1. Setubandhasana
- 3.3.2. Halasana
- 3.3.3. Matsyasana

3.4 Prone Posture

- 3.4.1 Bhujangasana
- 3.4.2 Salvasana
- 3.4.3 Dhanurasana

3.5 Inverted Posture

- 3.5.1 Sarbangasana
- 3.5.2 Shirsasana
- 3.5.3 Bhagrasana

[Note: One Asana is compulsory from each Posture]

4. Pranayama (any two)

- 4.1. Kapalbhathi
- 4.2. Bhramri
- 4.3. Anulam Vilom.

SEMESTER- 5

Tests, Measurement and Evaluation in Physical Education

Course code: DSE 1A

Total number of classes – 60

Unit- I: Introduction

LH - 12

- 1.1. Concept of test, measurement & Evaluation.
- 1.2. Criteria of good test.
- 1.3. Principles of Evaluation.
- 1.4. Importance of Test, Measurement and Evaluation in Physical Education and Sports.

Unit- II: Measurement of Body Compositions and Somatotype Assessment LH - 18

- 2.1. Body Mass Index (BMI)- Concept and method of measurement.
- 2.2. Body Fat- Concept and method of measurement.
- 2.3. Lean Body Mass (LBM)- Concept and method of measurement.
- 2.4. Somatotype- Concept and method of measurement.

Unit- III: Fitness Test

LH - 18

- 3.1 Kraus-Weber Muscular Strength Test
- 3.2 AAHPER Health Related Fitness Test
- 3.3 Queens College Step Test
- 3.4 J.C.R. Test

Unit- IV: Sports Skill Test

LH - 12

- 4.1 Lockhart and McPherson Badminton Skill Test
- 4.2 Johnson Basketball Test Battery
- 4.3 McDonald Soccer Test
- 4.4 Brady Volleyball Test

LAB & FIELD PRACTICAL

1. Assessment of somatotype and % body fat (any one).
2. Assessment of AAHPER Youth Fitness Test and Queens College Step Test (any one).

REFERENCES

1. Authors Guide (2013) ACSM's Health Related Physical Fitness Assessment Manual, USA: ACSM Publications.
2. Collins, R.D., & Hodges P.B. (2001) A Comprehensive Guide to Sports Skills Tests and Measurement (2nd edition) Lanham: Scarecrow Press.
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4. Getchell B (1979) Physical Fitness A Way of Life, 2nd Edition New York.
5. John Wiley and Sons, Inc Jenson, Clayne R and Cyntha, C. Hirst (1980) Measurement in Physical Education and Athletics, New York, Macmillan Publishing Co. Inc.
6. Kansal D.K. (1996), "Test and Measurement in Sports and Physical Education, New Delhi: DVS Publications.
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9. Wilmore JH and Costill DL. (2005) Physiology of Sport and Exercise: 3rd Edition. Champaign IL: Human Kinetics.
10. Yobu, A (2010), Test, Measurement and Evaluation in Physical Education in Physical Education and Sports. New Delhi; Friends Publications

SEMESTER- 5

Sports Training

Course code: DSE 1A

Total number of classes – 60

Unit- I: Introduction

LH - 12

- 1.1. Meaning and definition of Sports Training.
- 1.2. Aim and characteristics of Sports Training.
- 1.3. Principles of Sports Training.
- 1.4. Importance of Sports Training.

Unit- II: Methods of Training and Conditioning in Sports

LH - 18

- 2.1. Warming up and Cooling down- Meaning, types and methods.
- 2.2. Conditioning- Concept of Conditioning and its principles.
- 2.3. Training Methods- Circuit Training, Interval Training, Weight Training.
- 2.4. Periodisation- Meaning, types, aim and contents of different periods.

Unit- III: Training Load and Adaptation

LH - 18

- 3.1 Training Load- Meaning, definition, types and factors of training load.
- 3.2 Components of training load.
- 3.3 Over Load- Meaning, causes, symptoms and tackling of over load.
- 3.4 Adaptation- Meaning and conditions of adaptation, Supercompensation

Unit- IV: Training Techniques

LH - 12

- 4.1 Strength- Means and methods of strength development.
- 4.2 Speed- Means and methods of speed development.
- 4.3 Endurance- Means and methods of endurance development.
- 4.4 Flexibility- Means and methods of flexibility development.

FIELD PRACTICAL

1. Practical Experience of Weight Training and Circuit Training (any one).
2. Measurement of Speed, Strength (Grip/Leg), Explosive Strength (Leg) and Flexibility (any two).

REFERENCES

1. Bunn, J.N. (1998) Scientific Principles of Coaching, New Jersey Engle Wood Cliffs, Prentice Hall Inc.
2. Cart, E. Klafs & Daniel, D. Arnheim (1999) Modern Principles of Athletic Training St. Louis C. V. Mosphy Company.
3. Daniel, D. Arnheim (1991) Principles of Athletic Training, St. Luis, Mosby Year Book.
4. David R. Mottram (1996) Drugs in Sport, School of Pharmacy, Liverpool: John Moore University.
5. Gary, T. Moran (1997) – Cross Training for Sports, Canada : Human Kinetics Hardayal.
6. Singh (1991) Science of Sports Training, New Delhi, DVS Publications.
7. Jensen, C.R. & Fisher A.G. (2000) Scientific Basic of Athletic Conditioning, Philadelphia.
8. Ronald, P. Pfeiffer (1998) Concepts of Athletics Training 2nd Edition, London: Jones and Bartlett Publications.
9. Yograj Thani (2003), Sports Training, Delhi : Sports Publications

SEMESTER- 5

Modern Trends and Practices in Physical Education Exercise Sciences **(For the students other than Physical Education)**

Course code: GE1

Total number of classes - 60

Unit- I: Introduction

LH - 12

- 1.1. Meaning, definition and importance of physical Education and Sports.
- 1.2. Aims, objectives and scope of Physical Education.
- 1.3. Types of sports and their utility in Health and Fitness.
- 1.4. Meaning, definition and importance of Physical fitness and Motor fitness. Difference between physical fitness and motor fitness. Components of Physical fitness.

Unit- II: Biological, Psychological and Sociological Foundations of Physical Education **LH - 18**

- 2.1. Biological Foundation- Meaning and definition of growth and development. Factors affecting growth and development. Differences of growth and development. Principles of growth and development.
- 2.2. Meaning and definition of Psychology. Importance of Psychology in Physical Education. Psychological factors effecting in Physical Activity and Sports.
- 2.3. Sociological Foundation- Meaning and definition of Sociology. Social values and their Importance. Socialization through Sports
- 2.4. Role of games and sports in National Integration and International Understanding.

Unit- III: History of Physical Education

LH - 12

- 3.1 Historical development of Physical Education and Sports in India- Pre-Independence period and Post-Independence period.
- 3.2 Ancient Olympic Games
- 3.3 Modern Olympic Games.
- 3.4 Asian Games and Commonwealth Games

Unit- IV: Exercise Sciences

LH - 18

- 4.1 Meaning, definition and importance Exercise and Exercise Physiology.
- 4.2 Effects of short and long term exercise on Muscular systems.
- 4.3 Effects of short and long term exercise on Circulatory System.
- 4.4 Effects of short and long term exercise on Respiratory System.

REFERENCES

1. Kamlesh, M.L. & Singh, M.K. (2006) Physical Education (Naveen Publication).
2. Lumpkin, A. (2007) Introduction to Physical Education, Exercise Science and Sports Studies, McGraw Hill, New York, USA.
3. Siedentop, D. (2004) Introduction to Physical Education, Fitness and Sport, McGraw Hill Companies Inc., New York, USA.
4. Shaffer, D.R. (2002) Development Psychology: Childhood and Adolescence. Thomson, Sydney, Australia.
5. Shukla, (2000) Mother on Education, National Council of Teacher Education, New Delhi.
6. Singh, A. et al. (2000) Essential of Physical Education, Kalyani Publishers, Ludhiana, Punjab.
7. Wuest, D.A. & C.A. Bucher (2006) Foundation of Physical Education, Exercise Science, and Sports. McGraw Hill Companies Inc.: New York, USA.
8. Fahey, T.D., M.P. Insel and W.T. Rath (2006) Fit & Well: Core Concepts and Labs in Physical Fitness, McGraw Hill, New York.
9. Kansal, D.K. (2012) A Practical Approach to Test Measurement and Evaluation Sports and Spiritual Science Publication, New Delhi.
10. Clarke, D.H. (1975). Exercise Physiology. New Jersey: Prentice Hall Inc., Englewood Cliffs.
11. David, L Costill. (2004). Physiology of Sports and Exercise. Human Kinetics.
12. Fox, E.L., and Mathews, D.K. (1981). The Physiological Basis of Physical Education and Athletics. Philadelphia: Sanders College Publishing

SEMESTER- 5

Indian Games and Racket Sports

Course Code: SEC 3

KABADDI

A. Fundamental skills

1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line.
2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques.
3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defence.
4. Game practice with application of Rules and Regulations.

B. Rules and their interpretations and duties of the officials.

OR

KHO-KHO

A. Fundamental skills

1. Skills in Chasing: Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal & Distal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul.
2. Skills in running: Chain Play, Ring play and Chain & Ring mixed play.
3. Game practice with application of Rules and Regulations.

B. Rules and their interpretations and duties of the officials.

AND

BADMINTON

A. Fundamental skills

1. Basic Knowledge: Various parts of the Racket and Grip.
2. Service: Short service, Long service, Long-high service.
3. Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash.
4. Game practice with application of Rules and Regulations.

B. Rules and their interpretations and duties of the officials.

OR

TABLE TENNIS

A. Fundamental skills

1. Basic Knowledge: Various parts of the Racket and Grip (Shake Hand & Pen Hold Grip).
2. Stance: Alternate & Parallel.
3. Push and Service: Backhand & Forehand.
4. Chop: Backhand & Forehand.
5. Receive: Push and Chop with both Backhand & Forehand.
6. Game practice with application of Rules and Regulations.

B. Rules and their interpretations and duties of the officials.

SEMESTER- 6

Psychology in Physical Education and Sports

Course Code- DSE 1B

Total number of classes - 60

Unit- I: Introduction

LH - 12

- 1.1. Meaning and definition Psychology.
- 1.2. Importance and scope of Psychology.
- 1.3. Meaning and definition of Sports Psychology.
- 1.4. Need for knowledge of Sports Psychology in the field of Physical Education.

Unit- II: Learning

LH - 18

- 2.1. Meaning and definition of learning.
- 2.2. Theories and Laws of learning.
- 2.3. Learning curve: Meaning and Types.
- 2.4. Transfer of learning- Meaning, definition and types. Factors affecting transfer of learning.

Unit- III: Psychological Factors

LH – 18

- 3.1 Motivation- Meaning, definition, types and importance of Motivation in Physical Education and Sports.
- 3.2 Emotion- Meaning, definition, types and importance of Emotion in Physical Education and Sports.
- 3.3 Personality- Meaning, definition and types. Personality traits.
- 3.4 Role of physical activities in the development of personality.

Unit- IV: Stress and Anxiety

LH - 12

- 4.1 Stress- Meaning, definition and types of Stress.
- 4.2 Causes of Stress.
- 4.3 Anxiety- Meaning, definition and types of Anxiety.
- 4.4 Management of Stress and Anxiety through physical activity and sports.

LAB PRACTICAL

1. Assessment of Personality, Stress and Anxiety (any one)
2. Measurement of Reaction Time, Depth Perception and Mirror Drawing (any one).

REFERENCES

1. Authors Guide (2013) National Library of Educational and Psychological Test (NLEPT) Catalogue of Tests, New Delhi: National Council of Educational Research and Training Publication.
2. Jain. (2002), Sports Sociology, Heal Sahety Kendre Publishers.
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10. Thelma Horn. (2002). Advances in Sports Psychology. Human Kinetic.
11. Whiting, K, Karman., Hendry L.B & Jones M.G. (1999) Personality and Performance in Physical Education and Sports. London: Hendry Kimpton Publishers.

SEMESTER- 6

Dissertation/ Project **Course Code- DSE 1B**

1.1 Subjects: Physical Fitness Components, Body composition and Somatotype, Educational Tour, Leadership Camp, Non-communicable diseases, Organization of Games & Sports.

1.2 Project Report Format:

- Introduction
- Procedure
- Results
- Conclusions
- Recommendations
- References

SEMESTER- 6

Health Education and Tests & Measurements in Physical Education

(For the students other than Physical Education)

Course Code: GE-2

Total number of classes - 60

Unit- I: Introduction

LH - 18

- 1.1. Concept, definition and dimension of Health.
- 1.2. Definition, aim, objectives and principles of Health Education.
- 1.3. Health Agencies- World Health Organization (WHO), United Nations Educational Scientific and Cultural Organization (UNESCO), United Nations International Children's Emergency Fund (UNICEF).
- 1.4. Nutrition- Nutritional requirements for daily living. Preparation of Balance Diet chart. Health disorders due to deficiency of Protein, Vitamins and Minerals.

Unit- II: Health and First-aid Managements

LH - 18

- 2.1. First aid- Meaning, definition, importance and golden rules of First-aid.
- 2.2. Concept of sports injuries- Sprain, Strain, Wound, Fracture and Dislocation.
- 2.3. Postural deformities- Causes and corrective exercise of Kyphosis, Lordosis, Scoliosis, Bow-legs, Knock Knees and Flat Foot.
- 2.4. Hypo-kinetic Diseases and Physical Activities- Obesity, Diabetes and Asthma.

Unit- III: Measurement of Body Compositions and Somatotype Assessment LH - 12

- 3.1 Body Mass Index (BMI)- Concept and method of measurement.
- 3.2 Body Fat- Concept and method of measurement.
- 3.3 Lean Body Mass (LBM)- Concept and method of measurement.
- 3.4 Somatotype- Concept and method of Assessment

Unit- IV: Fitness Test

LH - 12

- 4.1 Kraus-Weber Muscular Strength Test
- 4.2 AAHPER Health related Fitness Test
- 4.3 Queens College Step Test
- 4.4 J.C.R. Test

REFERENCES

1. Bucher, Charles A. "Administration of Health and Physical Education Programme".
2. Hanlon, John J. "Principles of Public Health Administration" 2003.
3. Turner, C.E. "The School Health and Health Education".
4. Nutrition Encyclopedia, edited by Delores C.S. James, The Gale Group, Inc.
5. Boyd-Eaton S. et al (1989) The Stone Age Health Programme: Diet and Exercise as Nature Intended. Angus and Robertson.
6. Terras S. (1994) Stress, How Your Diet can Help: The Practical Guide to Positive Health Using Diet, Vitamins, Minerals, Herbs and Amino Acids, Thorsons.
7. Collins, R.D., & Hodges P.B. (2001) A Comprehensive Guide to Sports Skills Tests and Measurement (2nd edition) Lanham: Scarecrow Press.
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12. Wilmore JH and Costill DL. (2005) Physiology of Sport and Exercise: 3rd Edition. Champaign IL: Human Kinetics.
13. Yobu, A (2010), Test, Measurement and Evaluation in Physical Education in Physical Education and Sports. New Delhi; Friends Publications

SEMESTER- 6

BALL GAMES (Any two)

Course code: SEC4

FOOTBALL

A. Fundamental Skills

1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick.
2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot.
3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot.
4. Heading: In standing, running and jumping condition.
5. Throw-in: Standing throw-in and Running throw-in.
6. Feinting: With the lower limb and upper part of the body.
7. Tackling: Simple Tackling, Slide Tackling.
8. Goal Keeping: Collection of Ball, Ball clearance- kicking, throwing and deflecting.
9. Game practice with application of Rules and Regulations.

B. Rules and their interpretation and duties of officials.

HANDBALL

A. Fundamental Skills

1. Catching, Throwing and Ball control,
2. Goal Throws: Jump shot, Center shot, Dive shot, Reverse shot.
3. Dribbling: High and low.
4. Attack and counter attack, simple counter attack, counter attack from two wings and center.
5. Blocking, GoalKeeping and Defensive skills.
6. Game practice with application of Rules and Regulations.

B. Rules and their interpretation and duties of officials.

BASKETBALL

A. Fundamental Skills

1. Passing: Two hand Chest Pass, Two hands Bounce Pass, One hand Baseball Pass, Side arm Pass, Overhead Pass, Hook Pass.
2. Receiving: Two hand receiving, One hand receiving, Receiving in stationary position, Receiving while Jumping and Receiving while Running.
3. Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble.
4. Shooting: Lay-up shot and its variations, One hand set shot, Two hands jump shot, Hook shot, Free Throw.
5. Rebounding: Defensive rebound and Offensive rebound.
6. Individual Defence: Guarding the player with the ball and without the ball, Pivoting.
7. Game practice with application of Rules and Regulations.

B. Rules and their interpretation and duties of officials.

VOLLEYBALL

A. Fundamental skills

1. Service: Under arm service, Side arm service, Tennis service, Floating service.
2. Pass: Under arm pass, Over head pass.
3. Spiking and Blocking.
4. Game practice with application of Rules and Regulations.

B. Rules and their interpretation and duties of officials.

NETBALL

A. Fundamental skills

1. Catching: one handed, two handed, with feet grounded and in flight.
2. Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce).
3. Footwork: Landing on one foot, landing on two feet, Pivot, Running pass.
4. Shooting: One hand, forward step shot, and backward step shot.
5. Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed.
6. Defending: Marking the player, marking the ball, blocking, inside the circle, outside the circle. Defending the circle edge against the passing.
7. Intercepting: Pass and shot.
8. Game practice with application of Rules and Regulations.

B. Rules and their interpretation and duties of officials.

THROWBALL

Fundamental skills:

Overhand service, Side arm service, two hand catching, one hand overhead return, side arm return.

Rules and their interpretations and duties of officials.

UNIVERSITY OF KALYANI



**CBCS CURRICULUM FOR THREE YEARS UNDER-GRADUATE COURSE
IN
POLITICAL SCIENCE (GENERAL)**

**WITH EFFECT FROM THE ACADEMIC SESSION
2018-19**

INTRODUCTION:

The University Grants Commission (UGC) has taken various measures by means of formulating regulations and guidelines and updating them, in order to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions in India. The various steps that the UGC has initiated are all targeted towards bringing equity, efficiency and excellence in the Higher Education System of country. These steps include introduction of innovation and improvements in curriculum structure and content, the teaching-learning process, the examination and evaluation systems, along with governance and other matters. The introduction of Choice Based Credit System is one such attempt towards improvement and bringing in uniformity of system with diversity of courses across all higher education institutes in the country. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising of core, elective, skill enhancement or ability enhancement courses. The courses shall be evaluated following the grading system, is considered to be better than conventional marks system. This will make it possible for the students to move across institutions within India to begin with and across countries for studying courses of their choice. The uniform grading system shall also prove to be helpful in assessment of the performance of the candidates in the context of employment.

Outline of the Choice Based Credit System being introduced:

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. Ability Enhancement Courses/ Skill Enhancement Courses:

3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

A. TOTAL Number of courses in UG-CBCS (B.A.GENERAL):

Types of course	Core course (CC)	Elective course		Ability Enhncemnt Course		T O T A L
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancmnt compulsory course(AECC)	Skill Enhancmnt course (SEC)	
No. of course	12	6(BSc)/4(BA/B.Com)	2((BA/B.Com)	2	2	24
Credit/course	6	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.A.(GENERAL) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
1.	Core Course: 14 Papers	Theory + Practicl	Theory + Tutoril
1.A.	Core Course: Theory (12 papers)	12x4 = 48	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x2 = 24	12x1 = 12
2.	Elective Courses: (6 papers)		
A.	DSE (6 papers for B.Sc./ 4 papers for B.A. & B.Com.)	6x4 = 24	4x5 = 20
B.	DSE(Pract./ Tutor.)* (6 papers for B.Sc./4 for B.A. &B.Com.)	6x2 = 12	4x1 = 4
C.	GE (Interdisciplinary) (2 papers for B.A. & B.Com.)	--	2x5 = 10
D.	GE (Pract./Tutor.)* (4 papers) (2 papers for B.A. & B.Com.)	--	2x1 = 2
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication / MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (4 papers of 2 credits each)-----	4x2 = 8	4x2 = 8
Total Credit:		120	120

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.A. GENERAL

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC-1,2 (6)	2(1A,2A)	2 1B,2B)	2 (1C,2C)	2 (1D,2D)			8	48
Language CC - 1,2 (6)	1 (L1-1)	1 (L2-1)	1 (L1-2)	1 (L2-2)			4	24
DSE (6)	-	-	-	-	2(1A,2A)	2 (1B,2B)	4	24
GE (6)					1(GE-1)	1(GE-2)	2	12
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Courses/ Sem.	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

COURSE CODE & COURSE TITLE:

A. Core courses (CC)

1. POL-G-CC-T-1: **Introduction to Political Theory**
2. POL-G-CC-T-2: **Comparative Government and Politics**
3. POL-G-CC-T-3: **Indian Government and Politics**
4. POL-G-CC-T-4: **Introduction to International Relations**

B. Discipline specific elective courses (DSE)

1. POL-G-DSE-T-1/2(A): **Comparative Politics**
2. POL-G-DSE-T-1/2(B): **Public Administration: Concepts and Theories**
3. POL-G-DSE-T-1/2(C): **Democracy and Governance in India**
4. POL-G-DSE-T-1/2(D): **Understanding Globalization**

5. POL-G-DSE-T-3/4(A): **Indian Political Thought**
6. POL-G-DSE-T-3/4(B): **Political Sociology**
7. POL-G-DSE-T-3/4(C): **Public Policy in India**
8. POL-G-DSE-T-3/4(D): **Colonialism and Nationalism in India**

B. Generic elective courses (GE):

1. POL-G-GE-T-1(A): **Reading Gandhi**
2. POL-G-GE-T-1(B): **Politics in South Asia**
3. POL-G-GE-T-2(A): **Local Government in West Bengal**
4. POL-G-GE-T-2(B): **World Politics: Organizations and Issues**

C. Ability enhancement compulsory courses (AECC)

1. AECC-1: **Environmental Education**
2. AECC-2: **English Communication**

D. Skill enhancement courses (SEC)

1. POL-G-SEC-T-1(A): **Legislative Practices and Procedures**

2. POL-G-SEC-T-1(B): **Public Opinion and Survey Research**
3. POL-G-SEC-T-2(A): **Democratic Awareness with Legal Literacy.**
4. POL-G-SEC-T-2(B): **Conflict and Peace Building.**
5. POL-G-SEC-T-3(A): **Human Rights: Theory and Practice**
6. POL-G-SEC-T-3(B): **Gender Politics in India**
7. POL-G-SEC-T-4(A): **Social Movements in Contemporary India**
8. POL-G-SEC-T-4(B): **Environmental Politics**

Table-3: Semester & Course wise credit distribution in B.A. (General): (6 Credit: 75 Marks, 2 Credit:50 Marks)

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-G-CC-T-1	Introduction to Political Theory	Core (75L+15T)	6(5L+1T)
		Core	6
	L1-1	Core	6
AECC-1	Environmental Education	Ability enhancement compulsory (30L)	2 (2L)
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-G-CC-T-2	Comparative Government and Politics	Core (75L+15T)	6(5L+1T)
		Core	6
	L2-1	Core	6
AECC-2	English communication	Ability enhancement compulsory (30L)	2 (2L)
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-G-CC-T-3	Indian Government and Politics	Core (75L+15T)	6(5L+1T)
		Core	6
	L1-2	Core	6
POL-G-SEC-T-1	A. Legislative Practices and Procedures	Skill enhancement (30L)	2 (2L)
	B. Public Opinion and Survey Research		
Total	4 courses	Total	26
SEMESTER-IV			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-G-CC-T-4	Introduction to International Relations	Core (75L+15T)	6(5L+1T)
		Core	6
	L2-2	Core	6

POL-G-SEC-T-2 (any one)	A. Democratic Awareness with Legal Literacy	Skill enhancement (30L)	2 (2L)
	B. Conflict and Peace Building		
Total	4 courses	Total	26
SEMESTER-V			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-G-DSE-T-1 POL-G-DSE-T-2 (any two)	A: Comparative Politics	Discipline specific (75L+15L)	2x6 (2x5L+2x1L)
	B: Public Administration: Concepts and Theories		
	C: Democracy and Governance in India.		
	D: Understanding Globalization		
POL-G-GE-T-1 (any one)	A: Reading Gandhi	Generic Elective (75L+15T)	6(5L+1T)
	B. Politics in South Asia		
POL-G-SEC-T-3 (any one)	A. Human Rights: Theory and Practice	Skill enhancement (30L)	2 (2L)
	B. Gender Politics in India		
Total	4 courses	Total	24
SEMESTER-VI			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
POL-G-DSE-T-3 POL-G-DSE-T-4 (any two)	A: Indian Political Thought	DSE	6x2=12
	B: Political Sociology		
	C: Public Policy in India		
	D: Colonialism and Nationalism in India		
POL-G-GE-T-2 (any one)	A: Local Government in West Bengal	Generic Elective (75L+15T)	6(5L+1T)
	B. World Politics: Organizations and Issues		
POL-G-SEC-T-4 (any one)	A. Social Movements in Contemporary India	Skill enhancement (30L)	2 (2L)
	B. Environmental Politics		
Total	4 courses	Total	24
Total (All Semesters)	26 courses	Total	120

CBCS CURRICULUM OF B.A. IN POLITICAL SCIENCE (GENERAL)

**B.A. Political Science (General)
SEMESTER-I
POL-G-CC-T-1: Introduction to Political Theory:
Core Course; Credit-6. Full Marks-75**

Course Objectives:

After completion of the course the learners will be able to:

- Explain what is politics and what is the relevance of Political Theory
- Understand the different approaches to the study of politics
- Understand the different theories of State
- Understand the concepts like Liberty ,Equality, Law and Rights
- Explain the Concept of Democracy.

B.A. Political Science (General)
SEMESTER-I
AECC-1: Environmental Studies
Ability enhancement compulsory Course; Credit-2. Full Marks-50

COMMON SYLLABUS

B.A. Political Science (General)
SEMESTER-II

POL-G-CC-T-2: Comparative Government and Politics

Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Identify the difference between Comparative Politics and Comparative Government.
- Understand the scope, purpose and methods of comparison in Comparative politics.
- Identify the different types of Constitutional Systems.
- Gain knowledge about the basic features of the constitution in UK, USA and PRC

Unit 1: The Importance and Scope of Comparative Government -Distinction between Comparative Politics and Comparative Government – Development of Comparative Politics.

Unit 2: Theories of Political Systems: Easton, Almond and Powell.

Unit 3: Typology of Constitutional Systems: Unitary and Federal, Parliamentary and Presidential, Liberal and Socialist and Electoral Systems: First past the post, proportional representation, mixed systems.

Unit 4 : Political Parties and Pressure Groups: UK and USA.

Unit 5: Executive, Legislature and Judiciary: UK, USA and PRC.

Suggested Readings:

B.A. Political Science (General)
SEMESTER-III

POL-G-CC-T-3: Indian Government and Politics

Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion the course the learners will be able to:

- Develop a basic understanding about the Indian Constitution
- Understand the major issues affecting politics in India
- Develop a basic idea about the different types of political movements in Independent India.

Unit 1: Framing of the Indian Constitution: Role of the Constituent Assembly; the Preamble.

Unit 2: Fundamental Rights and Duties; Directive Principles of State Policy.

Unit 3: Union Executive: President and Vice-President – Election, power and position. Prime Minister – Power and position; Council of Ministers; Relationship of President and Prime Minister,

Unit 4: Union Legislature: Rajya Sabha and Lok Sabha: Composition and functions; Speaker. The Judiciary: Supreme Court and High Courts – Compositions and functions.

Unit 5: Religion and Politics: debates on secularism and communalism.

Unit 6: Power Structure in India: Role of Caste, class and patriarchy.

Suggested Readings:

1. Basu, D.D., Manohar, V.R., Banerjee B.P., Khan S. A., *Introduction to the Constitution of India*, Nagpur, Lexis Nexis Butterworths Wadhwa, 2008.

2. 2. Kashyap, S.C., *Our Constitution: An Introduction to India's Constitution and Constitutional Law*, New Delhi, National Book Trust, 1994.
3. Chakrabarty, Bidyut & Pandey, Rajendra Kumar, *Indian Government and Politics*, New Delhi, Sage, 2008.
4. Kochanek, Stanley A. & Hardgrave Robert L.(Jr), *India: Government and Politics in a Developing Nation*, USA, Thomson Wadsworth, 2008.
5. Johari J.C., *Indian Government and Politics: Basic Framework and State Structure*, New Delhi, Vikash Publication, 1974.
6. Brass, P., *The Politics of India Since Independence*, Delhi: Cambridge University Press and Foundation Books, 1990.
7. R. Kothari, *Caste in Indian Politics*, Delhi: Orient Longman, 1970.
- Vora, R. and Palshikar, S. (eds.) *Indian Democracy: Meanings and Practices*, New Delhi, Sage, 2004.

B.A. Political Science (General)

SEMESTER-III

Language1-2

Core Course; Credit-6. Full Marks-75

COMMON SYLLABUS

B.A. Political Science (General)

SEMESTER-III

POL-G-SEC-T-1(A): Legislative Practices and Procedures

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- To Identify the legislative process in India at various levels,
- To understand the basic requirements of peoples' representatives in policy making process.
- To understand the basic skills required for understanding the political process.

Unit 1: Powers and functions of people's representative at different tiers of governance: Members of Parliament, State Legislative Assemblies - functionaries of rural and urban local governance.

Unit 2: Legislative Process - How a Bill becomes a Law, Role of the Standing Committee in reviewing a Bill, Legislative Consultations, amendments to a Bill, the framing of Rules and Regulations.

Unit 3: Legislative Committees: Types and role – Types of committees, Role of committees in reviewing government finances, policy, programmes, and legislation.

Unit 4 : Budget Document : Overview of Budget Process, Role of Parliament in reviewing the Union Budget, Railway Budget, Examination of Demands for Grants of Ministries, Working of Ministries.

Unit 5: Media monitoring and communication: Types of media and their significance for legislators. Basics of communication in print and electronic media.

Suggested Readings:

1. Jayal, N and Mehta , P (eds), *The Oxford Companion to Politics in India*, OxfordUniversity Press: New Delhi
2. B. Jalan, (2007) *India 's Politics*, New Delhi: Penguin.
3. H. Kalra, (2011) *Public Engagement with the Legislative Process* PRS, Centre for PolicyResearch, New Delhi.
4. SubhashKashyap, (2006) *Parliamentary Procedure, Law Privilege, Practice & Precedents* - Delhi: Universal Law Publishing.
5. Madhavan, M.R. & N.Wahi *Financing of Election Campaigns* PRS, Centre for Policy Research, New Delh, 2008:
http://www.prsindia.org/uploads/media/conference/Campaign_finance_brief.pdf
6. Vanka, S. *Primer on MPLADS* Centre for Policy Research, New Delhi, 2008.
can be accessed on:
<http://www.prsindia.org/parliamenttrack/primers/mplads-487/>

B.A. Political Science (General)

SEMESTER-III

POL-G-SEC-T-1(B): Public Opinion and Survey Research

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Identify the debates, principles and practices of public opinion polling in the context of democracies with special reference to India.
- Understand how to conceptualize and measure public opinion using quantitative methods, with particular attention being paid to developing basic skills pertaining to the collection, analysis and utilisation of quantitative data.

Unit 1: Definition and Characteristics of Public Opinion: Definition and characteristics of public opinion, conceptions and characteristics, debates about its role in a democratic political system, uses for opinion poll.

Unit 2: Measuring Public Opinion: What is sampling? Why do we need to sample? Sample design, Methods and Types of Sampling, Sampling error and non-response.

Unit 3: Interviewing: Interview techniques pitfalls, different types of and forms of interview

Unit4: Questionnaire: Question wording; fairness and clarity

Unit 5: Quantitative Data Analysis: Introduction to quantitative data analysis, Basic concepts: correlation research, causation and prediction, descriptive and inferential Statistics.

Unit 6: Prediction in polling research: possibilities and pitfalls

Suggested Readings:

1. R. Erikson and K. Tedin, *American Public Opinion*, 8th edition, New York, Pearson Longman Publishers, 2011.
2. G. Gallup, *A Guide to Public Opinion Polls*. Princeton: Princeton University Press, 1948.
3. Kothari, C. R., *Research Methodology*, New Delhi, PHI, 2004.
4. Ahuja, Ram, *Research Methods*, New Delhi, Rawat Publications, 2001.
5. Kalton, G., *Introduction to Survey Sampling* Beverly Hills, Sage Publication, 1983.
6. Asher, H., 'Chapters 3 and 5', in *Polling and the Public: What Every Citizen Should Know*, Washington DC: Congressional Quarterly Press, 2001.
7. Kumar, S. and Rai, P. 'Chapter 1', in *Measuring Voting Behaviour in India*, New Delhi, Sage, 2013.

B.A. Political Science (General) SEMESTER-IV

POL-G-CC-T-4: Introduction to International Relations

Core Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Understand the important theoretical approaches to international relations.
- Understand the major concepts in International Relations.
- Comprehend the evolution of Indian foreign policy since independence and its possible future trajectory.

Unit 1 : Foundation of International Relations as an academic discipline.

Unit 2: Major approaches to the study of International Relations: (a) Liberalism; (b) Realism; (c) Marxist.

Unit 3: Major concepts in International Relations: (a) National Power; (b) Balance of Power; (c) Collective Security, (d) Bipolarity, (e) Uni-polarity, (f) Multi-polarity, (g) National Interest, (h) Globalization.

Unit 4: Foreign Policy Making: Basic Determinants with special reference to India –India's relations with U. S. A, China, Pakistan and Bangladesh.

Unit 5: Techniques of implementation of Foreign Policy: Diplomacy, Propaganda, Foreign Aid.

Suggested Readings:

1. Burchill Scott et al, *Theories of International Relations* 3rd edition, Basingstoke: Palgrave Macmillan, 2005.
2. Aron, Raymond, *Peace and War: A Theory of International Relations*, New York, Anchor Books, 1973.
3. Baylis, J. and Smith, S. (eds.), *The Globalization of World Politics*, Oxford, Oxford University Press, 2001.
4. Ganguly, Sumit, *India's Foreign Policy: Retrospect and Prospect*, New Delhi, Oxford University Press, 2012.
5. William, P., Goldstein, D. M. and Shafritz, J. M. (eds.) (1999) *Classic Readings of International Relations*. Belmont: Wadsworth Publishing Co, pp. 30-58; 92-126.
6. Appadorai and Rajan, M. S. (eds.) *India's Foreign Policy and Relations*. New Delhi, South Asian Publishers, 1985.
7. Vanaik, A. *India in a Changing World: Problems, Limits and Successes of Its Foreign Policy*. New Delhi: Orient Longman, 1995.

B.A. Political Science (General)
SEMESTER-IV
: Language2-2
Core Course; Credit-6. Full Marks-75

COMMON SYLLABUS

B.A. Political Science (General)
SEMESTER-IV

POL-G-SEC-T-2(A): Democratic Awareness through Legal Literacy.

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Understand the structure and manner of functioning of the legal system in India.
- Develop an understanding of the formal and Alternate Dispute Redressal (ADR) mechanisms that exist in India, public interest litigation.

Unit1: Constitution – fundamental rights, fundamental duties, other constitutional rights.

Unit 2: Laws relating to dowry, sexual harassment and violence against women – laws relating to consumer rights.

Unit3: Anti-terrorist laws: Implication for security and human rights. Laws relating to cyber crimes.

Unit 4: System of courts/ tribunals and their jurisdiction in India – criminal and civil courts, writ jurisdiction, specialized courts such as juvenile courts, Mahila courts and tribunals.

Unit 5: Alternate dispute such as Lokadalats, non-formal mechanisms.

Unit 6 : Human Rights - emerging trends; Role of legal aid agencies, Human Rights Commissions, NGOs and Civil liberties groups.

Suggested Readings:

1. Basu, D. D & Others, *Introduction to the Constitution of India*, Nagpur: LexisNexis Butterworths, 2008.
2. Kashyap, S, *Our Constitution: An Introduction to India's Constitution and Constitutional Laws*, New Delhi, National Book Trust, 1994.
3. Gender Study Group, (1996) *Sexual Harassment in Delhi University, A Report*, Delhi: University of Delhi.
4. D. Srivastva, (2007) 'Sexual Harassment and Violence against Women in India: Constitutional and Legal Perspectives', in C. Kumar and K. Chockalingam (eds) *Human Rights, Justice, and Constitutional Empowerment*, Delhi: Oxford University Press.
5. B.L. Wadhera, *Public Interest Litigation - A Handbook*, Universal, Delhi, 2003.
6. Aggarwal, N., *Women and Law in India*, New Century, Delhi, 2002.

B.A. Political Science (General)

SEMESTER-IV

POL-G-SEC-T-2(B): Conflict and Peace Building

Skill Enhancement Course: Credit-2. Full Marks-50

Course Objectives:

After completion the course the learners will be able to:

- Help build an understanding of a variety of conflict situations.
- Understand the various dimensions of Conflict.
- Identify the Gandhian Techniques of Peace-Building.
- Develop ideas on Conflict Responses.

Unit 1: Understanding Conflict and Conflict Resolution: Basic concepts

Unit 2: Dimensions of Conflict: Ideological, Economic (Resource Sharing) and Socio-Cultural (Ethnicity, Religion and Gender).

Unit 3: Nature of Local, Sub-national and International Conflicts

Unit 4: Techniques of Conflict Resolution: Track- I, II & and Multi Track Diplomacy

Unit 5: Ideas of Peace-building: Gandhi

Unit 6: Conflict Responses: Skills And Techniques - Negotiations: Trust Building, Mediation: Skill Building; Active Listening.

Suggested Readings:

1. O. Ramsbotham, T. Woodhouse and H. Miall, (2011) ‘Understanding Contemporary Conflict’, in *Contemporary Conflict Resolution*, (Third Edition), Cambridge: Polity Press, pp. 94-122.
2. S. Ryan, (1990) ‘Conflict Management and Conflict Resolution’, in *Terrorism and Political Violence*, 2:1, pp. 54-71.
3. R. Rubenstein, (2003) ‘Sources’, in S. Cheldelin, D. Druckman and L. Fast (eds.) *Conflict: From Analysis to Intervention*, London: Continuum, pp.55-67.
4. P. Le Billon, (2009) ‘Economic and Resource Causes of Conflicts’, in J. Bercovitch, V. Kremenyuk and I. Zartman (eds.), *The Sage Hand Book of Conflict Resolution*, London: Sage Publications, pp. 210-224.
5. S. AyseKadayifci- Orellana, (2009) ‘Ethno- Religious Conflicts: Exploring the Role of Religion in Conflict Resolution’, in J. Bercovitch, V. Kremenyuk and I. Zartman (eds.)*The Sage Hand Book of Conflict Resolution*, London: Sage Publications, pp. 264- 284.
6. J Bercovitch, V. Kremenyuk, and I. Zartman (eds.) (2009), *The Sage Hand Book of Conflict Resolution*, London: Sage Publications.
7. M. Steger, (2001) ‘Peacebuilding and Non- Violence: Gandhi’s Perspective on Power’, in D. Christie, R. Wagner and D. Winter, (eds.), *Peace, Conflict, and Violence: Peace Psychology for the 21st Century Englewood Cliffs*, New Jersey: Prentice Hall.
8. I. Doucet, (1996) *Thinking About Conflict*, Resource Pack For Conflict Transformation: International Alert.
9. P. Le Billon, (2009) ‘Economic and Resource Causes of Conflicts’, in J. Bercovitch, V. Kremenyuk and I. Zartman (eds.) *The Sage Hand Book of Conflict Resolution*, London: Sage Publications, pp. 210-224.
10. J. Davies and E. Kaufman (eds.), (2003) *Second Track/Citizens' Diplomacy: Concepts and Techniques for Conflict Transformation*, Rowman & Littlefield: Maryland.

B.A. Political Science (General)

SEMESTER-V

POL-G-DSE-T-1/2(A): Comparative Politics

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course objectives:

After end of this course learner will able to-

- Understand the nature and scope of comparative politics
- Identify the different methods of Comparison
- Understand the various theories of Political Development and Modernization
- Know the Dependency Theory

Unit 1: Understanding Comparative Politics - Nature and scope, Going beyond Eurocentrism.

Unit 2: Comparative Politics: Methods of comparison.

Unit 3: Theories of Political Systems: Easton, Almond and Powell.

Unit 4: Theories of Political Modernization and Political Development: L. Pye and Huntington.

Unit5: Dependency Theory: Andre Gunder Frank.

Suggested Readings:

1. Kopstein, J., and Lichbach, M., (eds), *Comparative Politics: Interests, Identities, and Institutions in a Changing Global Order*. Cambridge: Cambridge University Press, 2005.
2. Barrington, L., et. Al, *Comparative Politics - Structures & Choices*, Boston, Wadsworth, 2010.
3. Almond, G and others, eds. *Comparaitve Politics Today: A World View* (New Delhi: Pierson).
4. Chatterjee, Rakhahari, *Introduction to Comparative Political analysis*, Kolkata, Sarat Book House, 2014.
5. Ray, S.N. , *Modern Comparative Politics*, Delhi, PHI Learning,
6. Hague, R., Harrop, M., and Breslin, S., *Comparative Government and Politics - An Introduction*, London, Macmillan Education, 2016.
7. Johari, J.C.,*Major Modern Political Systems*, New Delhi, Vishal Publications,1986.
8. Johari, J.C., *Comparative Politics*, New Delhi, Sterling, 1982.

B.A. Political Science (General)

SEMESTER-V

POL-G-DSE-T-1/2(B): Public Administration: Concepts and Theories

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to-

- Understand the Nature, Scope and Evolution of Public Administration.
- Difference between Private and Public Administration.
- Understand the Major Concepts of Organization
- Describe what is known as Development administration
- Understand the Decision-making model of Herbert Simon.

Unit 1: Nature, Scope and Evolution of Public Administration – Private and Public Administration.

Unit 2: Major Concepts of Organization: (a) Hierarchy, (b) Unity of Command, (c) Span of Control, (d) Authority, (e) Centralization, Decentralization, and Delegation, (f) Line and Staff.

Unit 3: Bureaucracy: Marx and Max Weber.

Unit 4: Development Administration: Fred W. Riggs.

Unit 5: Decision Making Model: Herbert Simon.

Suggested Readings:

1. Bhattacharya Mohit, *New Horizons of Public Administration*, New Delhi, Jawahar Publishers, 2011.
2. Chakraborty, Bidyut & Bhattacharya, Mohit, *Public Administration: A Reader*, New Delhi, Oxford University Press, 2006.
3. Nigro, F.A. and Nigro, L.G. , *Modern Public Administration*, New York: Harper and Row, 1984.
4. Naidu, S.P., *Public Administration: Concepts and Theories*, New Delhi, New Age International (P) Ltd. Publishers, 2005.
5. Mishra, S. & Dhameja, A. eds., *Public Administration: Approaches & Applications*, New Delhi, Pearson, 2016.
6. Robbins, S., Judge, T.A., Millett, B. & Boyle, M., *Organizational Behaviour*, Australia, Pearson, 2014.

POL-G-DSE-T-1/2(C): Democracy and Governance in India
Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Identify the institutional aspects of Indian democracy.
- Identify the Structure and process of Governance in India
- Understand the Ideas, Interests and Institutions in Public Policy in India
- Understand the functioning of major Regulatory Institutions in India

Unit 1 : Structure and Process of Governance: Indian Model of Democracy, Parliament, Party Politics and Electoral behaviour, Federalism, The Supreme Court and Judicial Activism, Units of Local Governance (Grassroots Democracy) Political Communication -Nature, Forms and Importance.

Unit 2 : Ideas, Interests and Institutions in Public Policy: Contextual Orientation of Policy Design, Institutions of Policy Making , Regulatory Institutions – SEBI, TRAI, Competition Commission Of India, Corporate Affairs, Lobbying Institutions: Chambers of Commerce and Industries, Trade Unions, Farmers Associations.

Unit 3: Contemporary Political Economy of Development in India: Policy Debates over Models of Development in India, Recent trends of Liberalisation of Indian Economy in different sectors.

Unit 4: Dynamics of Civil Society: New Social Movements and Various interests, Role of NGO's, Understanding the political significance of Media and Popular Culture.

Unit 5 : Good Governance - Meaning and concept, Difference between Government and Governance, Good Governance initiatives in India, E-governance in India.

Suggested Readings:

1. Kohli, Atul (ed.), *The Success of India's Democracy*, Delhi, Cambridge University Press, 2001.
2. Corbridge, Stuart and John Harris, *Reinventing India: Liberalisation, Hindu Nationalism and Popular Democracy* , Delhi, OUP, 2000.
3. Dreze, J. and Sen, A., *India: Economic Development and Social Opportunity*, Oxford, Clarendon Press, 1999.

4. Saeed, S., *Screening the Public Sphere: Media and Democracy in India*, Taylor & Francis Group, 2016.
5. Fuller, C.J. (ed.), *Caste Today*, Delhi, Oxford University Press, 1997
6. Singh, Himat, *Green Revolution Reconsidered: The Rural World of Punjab*, Delhi, OUP, 2001.
7. Bhagwati, Jagdish, *India in Transition: Freeing The Economy*, Oxford, Clarendon Press, 1993.
8. Stiglitz, Joseph E., *Globalisation and its Discontents*, WW Norton, 2003.
9. Patel , I.G. , *Glimpses of Indian Economic Policy: An Insider View*, Delhi, OUP, 2002.
10. Sinha, R.P., *E-Governance in India: Initiatives and Issues*, Delhi, Concept Publishing , 2006.
11. Bhatnagar, Subhash ,*E-Government: From Vision to Implementation - A Practical Guide With Case Studies*, Delhi, Sage Publication, 2004.
12. Mishra Panda, S., *Engendering Governance Institutions: State, Market And Civil Society*, Delhi, Sage Publications, 2008.
13. Chandhoke, Neera, *State And Civil Society Explorations In Political Theory* ,New Delhi, Sage Publishers,1995.
14. Smith, B. C., *Good Governance and Development*, New York, Palgrave Macmillan, 2007.

B.A. Political Science (General)

SEMESTER-V

POL-G-DSE-T-1/2(D): Understanding Globalization

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completing of the course the students will be able to-

- Understand the meaning and debates on Globalization
- Understand the Impact of Globalization on Indian economy

- Identify the role of New International Order
- Identify the relationship Globalization and Terrorism
- Understand the cultural changes brought about by Globalization.

Unit 1: Globalization: Meaning and debates - Economic, Political, Technological and Cultural Dimensions.

Unit 2: Impact of Globalization on Indian Economy.

Unit 3: Globalization and Terrorism

Unit 4: Globalization and new international order -IMF, WTO, G-77.

Unit 5: Globalization and Localization: Dimensions of cultural change

Suggested Readings:

1. Baylis, J. And S. Smith eds. – The Globalization of World Politics: An Introduction
2. Nayyar, Deepak (ed.) Governing Globalisation: Issues and Institutions, OxfordUniversity Press
3. Keohane, Robert and Nye, Joseph S., *Globalisation: What is new, what is not.*
4. O'Meara, Patrick and others, *Globalization and the Challenges of a New Century: A Reader*, Indiana University Press.
5. Lechner, F. J. and Boli, J. (eds.) (2004) *The Globalization Reader*. 2nd Edition. Oxford: Blackwell.
6. Held, D., Mc Grew, A. et al. (eds.) (1999) *Global Transformations Reader. Politics, Economicsand Culture*, Stanford: Stanford University Press.
7. Taylor, P. and Grom, A.J.R. (eds.) (2000) *The United Nations at the Millennium*. London: Continuum.
8. Ravenhill, J. (2008) 'The Study of Global Political Economy', in Ravenhill, John (ed.) *Global Political Economy*. Second Edition. New York: Oxford University Press

B.A. Political Science (General) SEMESTER-V

POL-G-GE-T-1(A): Reading Gandhi

Generic Elective Course: Credit-6. Full Marks-75

Course Objectives:

After completion of this course the learner will able to –

- To understand the art of reading texts, to enable them to grasp its conceptual and argumentative structure and to help them acquire the skills to locate the texts in a broader intellectual and socio-historical context.
- Acquaint with the social and political thought of Gandhi.

Unit 1: Ways to read a text: a. textual; b. contextual

Unit 2: Hind Swaraj: a. Gandhi in his own words: A close reading of Hind Swaraj.
b. Commentaries on Hind Swaraj and Gandhian thought.

Unit 3: Gandhi and modern India- a. Nationalism. b. Communal unity, c. Women's Question
d. Untouchability, e. Education.

Suggested Readings:

1. Terence Ball, *Reappraising Political Theory*, Ch. 1, OUP, 1995
2. "Meaning and Interpretation in the History of Ideas" in *Visions of Politics*, Quentin Skinner (ed.), Vol. 1, CUP, Cambridge, 2002.
3. "Introduction", M.K.Gandhi, *Hind Swaraj and other writings* ed. A.J.Parel (1997).
4. B.Parekh, *Gandhi* (1997), chs. 4 ("Satyagraha") and 5("The critique of modernity").
5. D.Hardiman, *Gandhi in his time and ours* (2003), ch.4("An alternative modernity")

B.A. Political Science (General)

SEMESTER-V

POL-G-GE-T-1(B) : Politics in South Asia

Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Understand the Geo-politics of South Asia as a region.
- Understand the nature of state system in various countries of South Asia.
- Understand the process of regional integration in South Asia.
- Identify the major environmental issues in South Asia.

Unit 1: South Asia as a region -Geo- Politics in issues border conflict.

Unit 2: State system in South Asia: Nepal, Pakistan, Bangladesh and Srilanka.

Unit 3: Military Intervention in South Asian politics: Pakistan and Bangladesh.

Unit 4: Regional integration in South Asia: SAARC

Unit 5: Environmental Issues in South Asia: Policies, Movements and Trends.

Suggested Readings:

1. B.H. Farmer, *An Introduction to South Asia*, London, Rutledge, 1993.
2. Baxter et al (ed.), *Government and Politics in South Asia*, Boulder, Westview, 1987.
3. Robert W. Stern, *Democracy and Dictatorship in South Asia*, India Research Press, New Delhi, 2001.
4. Urmila Phadnis and Rajat Ganguly, *Ethnicity and Nation Building in South Asia*, New Delhi: Sage, 2001.
5. Hamza Alavi and John Harriss (ed.), *The Sociology of Developing States: South Asia*, Houndmill: Macmillan, 1987.

B.A. Political Science (General)

SEMESTER-V

POL-G-SEC-T-3(A): Human Rights: Theory and Practice

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Understand the historical evolution of the concept of Human Rights
- Identify how terrorism leads to violation of Human Rights
- Understand the role and limitations of National Human Rights Commission.
- Trace the evolution of Human Rights movement in India.

Unit 1: Meaning and a brief history of human rights (UDHR)

Unit 2: Human rights – Terrorism and Counter-terrorism

Unit 3: Indian Constitution and protection of human rights

Unit 4: National Human Rights Commission – Composition, role, functions and limitations.

Unit 5: Human Rights Movements in India – Evolution, nature, challenges and prospects

Suggested Readings:

1. Priyam,M., Menon K. and Banerjee,M., *Human Rights, Gender and the Environment* New Delhi, Pearson, 2009.
2. Donnelly, Jack, *Universal Human Rights in Theory and Practice*, Ithaca& London, Cornell University Press, 2013.
3. Clapham, Andrew, *Human Rights: A very short introduction*, Oxford, Oxford University Press, 2015.
4. Amartya Sen, *The Idea Justice*, New Delhi: Penguin Books, 2009.
5. Conor Grealy and Adam Tomkins (Eds). *Understanding Human Rights* , London: Manshell, 1996.
6. David Beetham, *Politics and Human Rights* , Oxford: Blackwell, 1995
7. Gurpreet Mahajan Ed., *Democracy, Difference and Social Justice*, New Delhi: Oxford University Press, 1998.
8. James Nickel, *Making Sense of Human Rights: Philosophical Reflections on the Universal Declaration of Human Rights* , Berkeley, University of California Press, 1987.

**B.A. Political Science (General)
SEMESTER-V**

POL-G-SEC-T-3(B): Gender Politics in India

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Conceptualize Gender Politics in India.
- Understand the major security concerns faced by the Indian women in India.
- Identify the role of women in major decision-making structures in India.
- Describe the changing status of Women in Indian society

Unit 1: Conceptualizing Gender in Politics: Political Participation, policy making and development.

Unit 2: Security concern for Women and Third Gender/ Transgender. Changing Status of Women in India Society – Factors and Consequences.

Unit 3: Effective participation of Women in Decision making structures with special reference to PRIs, Issue of Reservation Impact.

Unit 4: Gender Identity and Women's Movement in India. Major Women's Organizations in India.

Unit 5: Indian State and Law : Gender Perspectives.

Suggested Readings:

1. Burton, A. *Burdens of History: British Feminists, Indian Women and Imperial Culture*, University of North Carolina Press, 1994.
2. Holton, S. *Suffrage Days: Stories from the Women's Suffrage Movement*, London: Routledge, 1996.
3. Legates, M. *In Their Time: A History of Feminism in Western Society*, London: Routledge, 2001.
4. Rendall, J. *The Origins of Modern Feminism: Women in Britain, France and the United States, 1780-1960*, Basingstoke: Macmillan, 1985.
5. Menon, Nivedita. *Gender and Politics in India*, New Delhi, OUP, 1999.

6.Sangari, Kumkum and Suresh Vaid (eds.). *Recasting Women: Essays in Colonial India*, New Delhi: OUP, 2003.

7.Bhasin, Kamala and Nighat Said Khan. *Some Questions on Feminism and Its Relevance in South Asia.*, Institute of Women's Studies (St. Scholastica's College), New Delhi, Kali Publishers, 2002.

8.Chaudhuri, Maitrayee (Ed.) *Feminism in India*, Kali for Women, New Delhi, 2004.

9.Sangari and Vaid (eds), *Recasting Women: Essays in Colonial History*, New Jersey, Rutgers University Press, 1989.

10.Lotika Sarkar and B. Sivaramayya. Edt. , *Women and law: contemporary problems*, New Delhi, Vikas, 1994.

B.A. Political Science (General)
SEMESTER-VI
POL-G-DSE-T-3/4(A): Indian Political Thought

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learner will be able to:

- Understand the concepts of Dharma, Danda as discussed in Arthashastra.
- Identify the main features of Medieval Political Thought
- Understand the concept of Rule of law and freedom of thought as pointed out by Raja Rammohan Roy
- Comprehend the concept of Social Justice as visualized by B.R. Ambedkar

Unit 1: Kautilya's Political Thought: *Dharma* and *Danda*, *Saptanga*, and *Dandaniti*

Unit 2: Medieval Political Thought in India: A broad outline.

Unit 3: Raja Rammohan Roy: Rule of law, and freedom of thought.

Unit 4: Swamy Vivekananda: Ideal society and Nationalism

Unit 5: B.R. Ambedkar: Social justice.

Suggested Readings:

1. Altekar A. S., *The state and government in ancient India*, Delhi, Motiram Banarasidas, 1973.

2. Bhandarkar D. R., *Some aspects of ancient Indian polity*. Banaras, Banaras Hindu University, 1963.
3. Drekmeier C. *Kingship and Community in early India*, Burckley, University of California, 1962.
4. Verma, V.P., *Modern Indian Political Thought*, Agra, Lakshmi Narain Agarwal Educational Publishers, 1974.
5. Pantham, T. and Deutsch, K. eds., *Political Thought in Modern India*, New Delhi, Sage publications, 1986.
6. Appadorai, A., *Documents on political thought in Modern India*, 02 Vols. Bombay, Oxford University Press, 1970.
7. Chakrabarty, B. & Pandey, R.K., *Modern Indian Political Thought : Text and Context*, New Delhi, Sage Publication, 2009.
8. Kakan, K.N. (ed) *Dr. B.R. Ambedkar*, New Delhi, Sage Publication, 1992.

B.A. Political Science (General)

SEMESTER-VI

POL-G-DSE-T-3/4(B): Political Sociology

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Understand the nature and scope of Political Sociology
- Understand the concept of Social Stratification and the role of caste, class and elite in politics.
- Comprehend the concepts of Power, authority and Influence and their inter-relationships.
- Understand the meaning, nature and type of Political Culture
- Identify the process of political socialization

Unit 1: Nature and scope of Political Sociology – Sociology of politics and political sociology

Unit 2: Social Stratification and Politics: Caste, class and elite

Unit 3: Power, Influence, and Authority.

Unit 4: Political Culture: Meaning , nature and types

Unit 5: Political Socialization: Meaning and agencies

Suggested Readings:

1. Tom Bottomore , Political Sociology , Pluto Press, 1993.
2. Satyabrata Chakraborty (ed.), Political Sociology , Trinity Press.
3. Amal Kumar Mukhopadhyay, Political Sociology: an introductory analysis, K.P. Bagchi, 1977.
4. Guy Rocher, A General introduction to sociology: A theoretical perspective, Academic Publishers, 2004.
5. Gajanafar Alam, Political Sociology, Anmol Publications, 2011.

**B.A. Political Science (General)
SEMESTER-VI
POL-G-DSE-T-3/4 (C): Public Policy in India**

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Develop a theoretical and practical understanding of the concepts and methods that can be employed in the analysis of public policy.
- Understand the methods of political economy to understand public policy as well as understand politics as it is shaped by economic changes.

Unit 1: Public Policy: Meaning, elements and actors of public policy making and implementation in India.

Unit 2: Public Policy in India since independence: An overview

Unit 3 : Political Economy and Public Policy: Interest Groups and Social Movements.

Unit 4: Constraints of Public Policy: Economic, Political and Socio-Cultural

Unit 5: Public Policy in India: a) Public Health; b) Education and c) Environment.

Suggested Readings:

1. Dye, Thomas, Understanding Public Policy, Pearson Education, Singapore.
2. Rathod, P.B, Framework of Public Policy : The Discipline and its Dimensions, Commonwealth Publishers, New Delhi
3. R. K. Saprú, Public Policy, Sterling Publishers, New Delhi
4. Galtung, Johan, There Are Alternatives: Four Roads to Peace and Security, Nottingham, Spokesman, 1984.
5. Prabir Kumar De (edt.), Public Policy and Systems, Pearson, 2011.
6. Rajesh Chakrabarti and Kaushik Sanyal , Public Policy in India, Oxford University Press, 2016.

B.A. Political Science (General)

SEMESTER-VI

POL-G-DSE-T-3/4(D): Colonialism and Nationalism in India

Discipline Specific Elective Course; Credit-6. Full Marks-75

Course Objectives:

After end of this course learner will able to-

- Understand historically the advent of colonialism in India and the emergence of the discourse on nationalism as a response to it.
- Engage with theoretical explanations of colonialism and nationalism in India at the same time study the social, political and institutional practices that unfolded in that period, gradually paving way towards independence and democracy in India.

Unit 1: Colonialism and Nationalism: a. Main perspectives on colonialism: Liberalism, Marxism, Post-colonialism b. Approaches to the study of nationalism in India: Nationalist, Imperialist, Marxist, and Subaltern interpretations

Unit 2: Colonial Rule in India and its impact: On agriculture, land relations, industry and administration

Unit 3: Reform and Resistance: a. The 1857 rebellion b. Major social and religious movements
c. Education and the rise of the new middle class

Unit 4: Nationalist Politics and Expansion of its Social Base: a. Phases of the Nationalist Movement: Liberal constitutionalist, Swadeshi and the Radicals, Formation of the Muslim League b. Gandhi and mass mobilisation: Non-cooperation, Civil Disobedience, and Quit India Movements c. Socialist alternatives: Congress socialists, Communists d. Communalism in Indian Politics e. The two-nation theory, negotiations over partition

Unit 5: Social Movements - The Women's Question: participation in the national movement and its impact - The Caste Question: anti-Brahmanical Politics - Peasant, Tribals, and Workers movements

Suggested Readings:

1. Chandra, B., *Essays on Colonialism*, Hyderabad, Orient Blackswan, 1999.
2. Chandra, B., Mukherjee, M., Mukherjee, A., Panikkar, K.N. & Mahajan S., *India's Struggle for Independence (1857-1947)*, New Delhi, Penguin, 2016.
3. Young, R., *Postcolonialism : A Very Short Introduction*. Oxford: Oxford University Press, 2003.
5. Bandopadhyay, S., *From Plassey to Partition and After: A History of Modern India*, New Delhi: Orient Longman, 2015. (revised edition)
6. Sarkar, S., *Modern India (1885-1847)*, New Delhi: Macmillan, 1983.
8. Desai, A.R., *Social Background of Indian Nationalism*, Bombay, Popular, 1987.

B.A. Political Science (General)
SEMESTER-VI
POL-G-GE-T-2(A): Local Government in West Bengal
Generic Elective Course; Credit-6. Full Marks-75

Course objectives:

After completing of the course, the student will be able to

- Understand the evolution of Local Government in West Bengal.
- Understand the role of PRIs in decentralized governance in West Bengal
- Comprehend the role of Local Governments in empowerment of Women, Sc and STs in West Bengal.

Unit 1: Evolution of Rural and Urban local government in West Bengal since independence.

Unit 2: Structure and functions of Panchayati Raj Institutions in the light of the 73rd Constitution (Amendment) Act, 1992.

Unit 3: Structure and functions of urban local governments under the 74th Constitution (Amendment) Act, 1993 and the West Bengal Municipality Act, 1993.

Unit 4: Local Government and empowerment of women, SCs, and STs in West Bengal.

Unit 5: State-Local Government Relations: Financial control of the State.

Suggested Readings:

1. Chakraborty, Biswanath, *People's Participation in West Bengal Panchayat System*, Kolkata: Mitram Publishers, 2008.
2. Datta, Prabhat, *Panchayat, Rural Development and Local Autonomy: West Bengal Experience*, Kolkata, Dasgupta and Co, 2001.
3. Bhattachariya, Moitree, *Panchayati Raj in West Bengal,,: Democratic Decentralization and Democratic Centralism*, New Delhi, Monak Publication, 2002.
4. Datta, Prabhat, *Democratic Governance and Decentralised Planning: Rhetoric and Reality*, Kolkata: Dasgupta and Co, 2012.
5. Datta, Prabhat, *Decentralisation, Participation and Governance*, New Delhi, Kalpaz Publications, 2006.

SEMESTER-VI

POL-G-GE-T-2(B) : World Politics: Organizations and Issues

Generic Elective Course; Credit-6. Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Identify the role of the United Nations in International politics.
- Identify the role of International Financial Organizations.
- Understand the role of Regional Organizations like SAARC and ASEAN.
- Understand the major issues affecting global politics in post-cold war era.

Unit 1: The Cold War: A Broad Outline.

Unit 2: The United Nations: General Assembly, and Security Council – Reform of the UN.

Unit 3: International Financial Institutions: World Bank, and IMF.

Unit 4: Regional Organizations: SAARC, and ASEAN.

Unit 5: Emerging issues in Post-Cold War era: Development and Environment. Human Rights: UNDHR, Terrorism.

Suggested Readings:

1. Baylis John & Smith Steve, *The Globalization of World Politics: An introduction to International Relations*, New Delhi, Oxford University Press, 2005.
2. Salmon, Trevor C. & Imber Mark F. eds., *Issues in International Relations*, New York, Routledge, 2000.
3. Larche, Rene A. edt., *Global Terrorism Issues and Developments*, New York, Nova Science Publishers, 2008.
4. Forsythe, David P. ,*Human Rights in International Relations*, Cambridge , Cambridge University Press, 2012.
5. Grugel, Jean & Hout Wil , Eds. *Regionalism across the North/South Divide: State Strategies and Globalization*, New York, Routledge, 1999.
6. Footer, Mary E., *An Institutional and Normative Analysis of the World Trade Organization*, Leiden, Martinus Nijhoff Publishers, 2006.
7. Ayres, A. and Raja Mohan, C. (eds), *Power Realignments in Asia: China, India, and the United States*, New Delhi, Sage, 2009.

8. Saez, Lawrence, *The South Asian Association for Regional Cooperation (SAARC): An emerging collaboration architecture*, New Delhi, Routledge, 2011.

B.A. Political Science (General)
SEMESTER-VI
POL-G-SEC-T-4(A): Social Movements in Contemporary India

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Understand the meaning and types of social movements in India
- Get an idea of the various types of social movements in India.

Unit 1: Social Movements in India : Meaning , features and Types.

Unit 2: Social Movement and New Social Movement

Unit 3: Peasant Movement – Telengana and Singur

Unit 4: Tribal Movements – POSCO and Niyam Girhi

Unit 5: Environmental Movement – Chipko, Narmada Bachao and Silent Valley

Suggested Readings:

1. Ray, Raka and Katzenstain, Mary Fainsod, *Social Movements in India: Poverty, Power, and Politics*, Oxford, Rowman and Littlefield Publishers, 2005.
2. Simha, A. P., *Development Process and Social Movements in Contemporary India*, Pinnacle Learning, 2015.
3. Joshi, Sarat. C., *Contemporary Social Mobility and Social Movements: Views and Reviews*, Delhi, Akansha Publication, 2011.
4. Shah Ghanshyam, *Social Movements and the State*, New Delhi, Sage, 2002.
5. Pawar, S.N., Patil, R.B. & Salunkhe, S.A., *Environmental Movements in India: Strategies and Practices*, Jaipur, Rawat Publishers, 2005.

6. Shah Ghanshyam, *Social Movements in India: A Review of Literature*, New Delhi, Sage, 2004.

**B.A. Political Science (General)
SEMESTER-VI**

POL-G-SEC-T-4(B): Environmental Politics

Skill Enhancement Course; Credit-2. Full Marks-50

Course Objectives:

After completion of the course the learners will be able to:

- Identify the various concepts related to Environment
- Discern the relation between politics and environment
- Understand the Environmental policy in India
- Identify the major threats to environment in India.

Unit 1: Environment : Meaning, its relation with Politics. Green Governance and Sustainable Development.

Unit 2: United Nations Environment Programme: Rio, Johannesburg and After.

Unit 3: Issue of Industrial Pollution, Global Warming and Threats to Biodiversity in India.

Unit 4: Environment Policy in India

Unit 5: Environmental Movement in India: Chipko and Narmada Bachao Andolan.

Suggested Readings :

1. Guha , Ramachandra , *Environmentalism : A Global History* , Allenlane, 2014.

2. O' Lear, Shannon, *Environmental Politics: Scale and Power*, U.K., Cambridge University Press, 2010.
3. Rosenbaum, Walter A. , *Environmental Politics and Policy* , Washington, Sage, 2016.
4. Heywood, A ., *Global Politics*, New York, Palgrave, 2014.
5. Weber, T., *Hugging the trees: the story of the Chipko movement*, Delhi, Penguin Books, 1989.
6. Pawar, S.N., Patil, R.B. & Salunkhe, S.A., *Environmental Movements in India: Strategies and Practices*, Jaipur, Rawat Publishers, 2005.
7. Rangarajan, M., *Environmental Issues in India : A Reader*, New Delhi, Pearson Longman, 2007.

Choice Based Credit System (CBCS)

UNIVERSITY OF KALYANI

DEPARTMENT OF SANSKRIT
(Honours Syllabus)

UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2018-19)



SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching-learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point

Average (CGPA) based on student's performance in examinations; the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - 2.1 **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - 2.2 **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
 - 2.3 **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
 - 3.1 AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
 - 3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving /analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses under B.A (Honors), B.Com (Honors) & B.Sc. (Honors)

Course	*Credits Theory + Tutorial
I. Core Course (14 Courses)	
6 Credits for each Core Course Paper [84 Credits]	
Core Course (Theory)	14x5=70
Core Course (Tutorial)	14x1=14
II. Elective Course (08 Papers)	
[DSE 04 Paper* + GE 04 Paper]	
*Optional Dissertation on Project Work in Place of One Discipline Specific Elective Paper (6 credits) in 6 th Semester 6 Credits for each Elective Course Paper [48 Credits]	
Discipline Specific Elective (DSE) [04 Courses]	4x6=24
DSE (Theory)	4x5=20
DSE (Tutorial)	4x1=04
Generic Elective/Interdisciplinary (GE) [04 Courses]	4x6=24
GE (Theory)	4x5=20
GE (Tutorial)	4x1=04
Ability Enhancement Courses (04 Papers)	
[AECC 02 Papers + AEEC 02 Papers]	
02 Credits for each Ability Enhancement Courses [08 Credits]	
*Ability Enhancement Compulsory Course (AECC) *Environmental Science (1 Course) + English/MIL Communication (1 Course)	2x2=04
Ability Enhancement [Skill Bases] Elective Course (AEEC)	2x2=04
Core Course [14] + Elective Course [08] + Ability Enhancement Courses [04]	Core Course [14 X (5+1)] = 84 Credits + Elective Course [08 X (5+1)] = 48 Credits + Ability Enhancement Courses [04 X 2] = 08 Credits
Total = 26 Courses	Total = 140 Credits

*This Course will be Common & Compulsory as well for all UG students of Kalyani University.

A. TOTAL Number of courses in UG-CBCS (B.A./B.Sc./B.Com. Hons.):

Types of course	Core course (CC)	Elective course		Ability enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

TABLE-1: DETAILS OF COURSES & CREDIT OF B.A./ B.SC./ B.COM. (HONOURS) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory + Tutorial
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (14 papers)	14x4 = 56	14x5 = 70
1.B.	Core Course (Practical/Tutorial)*(14 papers)	14x2 = 28	14x1 = 14
2.	Elective Courses: (8 papers)		
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x4 = 16	4x5 = 20
2.B.	DSE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
2C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x4 = 16	4x5 = 20
2.D.	GE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester			
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
Total Credit:		140	140
## Wherever there is a practical, there will be no tutorial and vice- versa.			

TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.A./B.SC./B.COM. HONS

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-VI	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1	--	--	--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

❖ **COURSE CODE & COURSE TITLE:**

❖ *Each paper of any course denoted by-(2-4 letters Subject Code--Honours/General (H/G)--Course Type(CC/GE/DSE)-(Theory/Tutorial/Practical)-Number of course. Ex.-Chemistry-CHEM-H-CC-T-1)*

A. Core courses (CC)

01.	SANS-H-CC-T-01	Classical Sanskrit Literature (Poetry)
02.	SANS-H-CC-T-02	Critical Survey of Sanskrit Literature
03.	SANS-H-CC-T-03	Classical Sanskrit Literature (Prose)
04.	SANS-H-CC-T-04	Sanskrit Composition and Communication
05.	SANS-H-CC-T-05	Classical Sanskrit Literature (Drama)
06.	SANS-H-CC-T-06	Poetics and Literary Criticism
07.	SANS-H-CC-T-07	Indian Social Institutions and Polity
08.	SANS-H-CC-T-08	Indian Epigraphy, Palaeography and Chronology
09.	SANS-H-CC-T-09	Modern Sanskrit Literature
10.	SANS-H-CC-T-10	Sanskrit and World Literature
11.	SANS-H-CC-T-11	Vedic Literature
12.	SANS-H-CC-T-12	Sanskrit Grammar
13.	SANS-H-CC-T-13	Indian Ontology and Epistemology
14.	SANS-H-CC-T-14	Self-Management in the Gītā

B. Discipline specific elective courses (DSE)

01.	SANS-H-DSE-T-01	Indian System of Logic and Debate
02.	SANS-H-DSE-T-02	Art of Balanced Living
03.	SANS-H-DSE-T-03	Theatre and Dramaturgy in Sanskrit
04.	SANS-H-DSE-T-04	Sanskrit Linguistics

C. Generic elective courses (GE): (Interdisciplinary)

01.	SANS-H-GE-T-01	Basic Sanskrit
02.	SANS-H-GE-T-02	Indian Culture and Social Issues
03.	SANS-H-GE-T-03	Ancient Indian Polity
04.	SANS-H-GE-T-04	Fundamentals of Indian Philosophy

D. Ability enhancement compulsory courses (AECC)

01.	SANS-H-AECC-T-01	As Prescribed by the University
02.	SANS-H-AECC-T-02	As Prescribed by the University

E. Skill enhancement courses (SEC)

01.	SANS-H-SEC-T-01	Evolution of Indian scripts
02.	SANS-H-SEC-T-02	Acting, Script Writing & Sanskrit Meter

**PROPOSED SCHEME FOR CHOICE BASED CREDIT
SYSTEM IN B.A (Honors), B.Com (Honors) & B.Sc. (Honors)**

	CORE COURSE (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course(SEC)(2) (Skill Based)	Elective: Discipline Specific DSE (4)	Elective: Generic (GE) (4)
I	C 1	(English Communication/MIL)/ Environmental Science			GE-1
	C 2				
II	C 3	Environmental Science/(English/MIL Communication)			GE-2
	C 4				
III	C 5		SEC -1		GE-3
	C 6				
	C 7				
IV	C 8		SEC -2		GE-4
	C 9				
	C 10				
V	C 11			DSE-1	
	C 12			DSE -2	
VI	C 13			DSE -3	
	C 14			DSE -4	

The Universities/Institutes may offer any number of choices of papers from different disciplines under Generic Elective and Discipline Specific Elective as per the availability of the courses/faculty.

Core Papers (14)		
B.A. (Hons) Sanskrit		
Semester: I		
SANS-H-CC-T-01 Classical Sanskrit Literature (Poetry)	SANS-H-CC-T-02 Critical Survey of Sanskrit Literature	
Semester: II		
SANS-H-CC-T-03 Classical Sanskrit Literature (Prose)	SANS-H-CC-T-04 Sanskrit Composition and Communication	
Semester: III		
SANS-H-CC-T-05 Classical Sanskrit Literature (Drama)	SANS-H-CC-T-06 Poetics and Literary Criticism	SANS-H-CC-T-07 Indian Social Institutions and Polity
Semester: IV		
SANS-H-CC-T-08 Indian Epigraphy, Paleography and Chronology	SANS-H-CC-T-09 Modern Sanskrit Literature	SANS-H-CC-T-10 Sanskrit and World Literature
Semester: V		
SANS-H-CC-T-11 Vedic Literature	SANS-H-CC-T-12 Sanskrit Grammar	
Semester: VI		
SANS-H-CC-T-13 Indian Ontology and Epistemology	SANS-H-CC-T-14 Self-Management in the Gītā	
Discipline Specific Elective (DSE)		
B.A. (Hons.) Sanskrit, Semester V/VI		
SANS-H-DSE-T-01 Indian System of Logic and Debate	SANS-H-DSE-T-02 Art of Balanced Living	
SANS-H-DSE-T-03 Theatre and Dramaturgy in Sanskrit	SANS-H-DSE-T-04 Sanskrit Linguistics	
Generic Elective (GE)		
B.A. (Hons.) Sanskrit		
Semester-I : SANS-H-GE-T-01 Basic Sanskrit	Semester-II : SANS-H-GE-T-02 Indian Culture and Social Issues	
Semester-III : SANS-H-GE-T-03 Ancient Indian Polity	Semester-IV : SANS-H-GE-T-04 Fundamentals of Indian Philosophy	
Skill Enhancement Course(SEC)		
Semester-III : SANS-H-SEC-T-01 Evolution of Indian scripts	Semester-IV : SANS-H-SEC-T-02 Acting, Script Writing & Sanskrit Meter	

**TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN INB.A./B.COM/B.SC.(Hons.)
(6 Credit: 75 Marks)**

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
SANS-H-CC-T-01	Classical Sanskrit Literature (Poetry)	T	6
SANS-H-CC-T-02	Critical Survey of Sanskrit Literature	T	6
SANS-H-GE-T-01 (Interdisciplinary)	Basic Sanskrit	T	6
SANS-H-AECC-T-01	(English Communication/ MIL)/ Environmental Science	T	2
Total	4 courses	Total	20

SEMESTER-II			
Course Code	Course Title	Course wise Class	Credit
SANS-H-CC-T-03	Classical Sanskrit Literature (Prose)	T	6
SANS-H-CC-T-04	Sanskrit Composition and Communication	T	6
SANS-H-GE-T-02 (Interdisciplinary)	Indian Culture and Social Issues	T	6
SANS-H-AECC-T-02	Environmental Science/(English/MIL Communication)	T	2
Total	4 courses	Total	20

SEMESTER-III			
Course Code	Course Title	Course wise Class	Credit
SANS-H-CC-T-05	Classical Sanskrit Literature (Drama)	T	6
SANS-H-CC-T-06	Poetics and Literary Criticism	T	6
SANS-H-CC-T-07	Indian Social Institutions and Polity	T	6
SANS-H-GE-T-03 (Interdisciplinary)	Ancient Indian Polity	T	6
SANS-H-SEC-T-01	Evolution of Indian scripts	T	2
Total	5 courses	Total	26

SEMESTER-IV			
Course Code	Course Title	Course wise Class	Credit
SANS-H-CC-T-08	Indian Epigraphy, Paleography and Chronology	T	6
SANS-H-CC-T-09	Modern Sanskrit Literature	T	6
SANS-H-CC-T-10	Sanskrit and World Literature	T	6
SANS-H-GE-T-04 (Interdisciplinary)	Fundamentals of Indian Philosophy	T	6
SANS-H-SEC-T-02	Acting, Script Writing & Sanskrit Meter	T	2
Total	5 courses	Total	26

SEMESTER-V			
Course Code	Course Title	Course wise Class	Credit
SANS-H-CC-T-11	Vedic Literature	T	6
SANS-H-CC-T-12	Sanskrit Grammar	T	6
SANS-H-DSE-T-01	Indian System of Logic and Debate	T	6
SANS-H-DSE-T-02	Art of Balanced Living	T	6
Total	4 courses	Total	24

SEMESTER-VI			
Course Code	Course Title	Course wise Class	Credit
SANS-H-CC-T-13	Indian Ontology and Epistemology	T	6
SANS-H-CC-T-14	Self-Management in the Gītā	T	6
SANS-H-DSE-T-03	Theatre and Dramaturgy in Sanskrit	T	6
SANS-H-DSE-T-04	Sanskrit Linguistics	T	6
Total	4 courses	Total	24
<i>Total (All semesters)</i>	<i>26 courses</i>	<i>Total</i>	<i>140</i>

Detail Course

Core Course: B.A. (Hons.) Sanskrit

SANS-H-CC-T-01 Classical Sanskrit Literature (Poetry)		
Prescribed Course:		Total 56 Credits
Section 'A'	<i>Raghuvamśam</i> : Canto-I (Verse: 1-25)	12 Credits
Section 'B'	<i>Kumārasambhavam</i> : Canto-V (Verse: 1-30)	12 Credits
Section 'C'	<i>Kirātārjunīyam</i> : Canto I (1-25 Verses)	12 Credits
Section 'D'	<i>Nītiśatakam</i> (1-20 Verses, 1st two Paddhatis)- M. R. Kale Edition	08 Credits
Section 'E'	Origin and Development of <i>Mahākāvya</i> and <i>Gītikāvya</i>	12 Credits
Unit-Wise Division:		
Section 'A' <i>Raghuvamśam</i>: Canto-I (Verse: 1-25)		
Unit: I	<i>Raghuvamśam</i> : Introduction (Author and Text), Appropriateness of title, Canto I, 1-10 Grammatical analysis, Meaning/translation, Explanation, content analysis, Characteristics of Raghu Clan.	06 Credits
Unit: II	<i>Raghuvamśam</i> : Canto I (Verses 11-25) grammatical analysis, Meaning/translation, Explanation, Role of Dilīpa in the welfare of subjects.	06 Credits
Section 'B' <i>Kumārasambhavam</i>: Canto-V (Verses: 1-30)		
Unit: I	<i>Kumārasambhavam</i> : Introduction (Author and Text), Appropriateness of title, Background of given contents. Text Reading Canto I Verses 1-15, (Grammatical analysis, Translation, and Explanation), Poetic excellence and Plot.	06 Credits
Unit: II	<i>Kumārasambhavam</i> : Text Reading Canto I Verses 16-30 (Grammatical analysis, Translation, Explanation), Penance of Pārvaṭī, Poetic excellence, Plot.	06 Credits
Section 'C' <i>Kirātārjunīyam</i> - Canto I (1-25 Verses)		
Unit: I	<i>Kirātārjunīyam</i> : Introduction (Author and Text), Appropriateness of title, Background of given contents, Canto I Verses 1-16, Grammatical analysis, Translation, Explanation, Poetic excellence, thematic analysis.	06 Credits
Unit: II	<i>Kirātārjunīyam</i> : Verses 17-25, Grammatical analysis, Translation, Explanation, Poetic excellence, thematic analysis.	06 Credits

Section 'D'		
Nītiśatakam (1-20 Verses, 1st two Paddhatis)-M. R. Kale Edition		
Unit: I	<i>Nītiśatakam</i> : Verses (1-10) Grammatical analysis Translation, explanation.	04 Credits
Unit: II	<i>Nītiśatakam</i> : Verses (11-20) Grammatical analysis Translation, explanation, thematic analysis bhartṛhari's comments on society.	04 Credits
Section 'E'		
Origin and Development of Mahākāvya and Gītikāvya		
Unit: I	Origin and development of different types of <i>Māhākāvya</i> with special reference to <i>Aśvaghōṣa</i> , <i>Kālidāsa</i> , <i>Bhāravi</i> , <i>Māgha</i> , <i>Bhatti</i> , <i>Śṛīharṣa</i> .	06 Credits
Unit: II	Origin & Development of Sanskrit <i>Gītikāvya</i> s with special reference to <i>Kālidāsa</i> , <i>Bilhaṇa</i> , <i>Jayadeva</i> , <i>Amarūk</i> , <i>Bhartṛhari</i> and their works.	06 Credits

SANS-H-CC-T-02		
Critical Survey of Sanskrit Literature		
Prescribed Course:		Total 56 Credits
Section 'A'	Vedic Literature	20 Credits
Section 'B'	Rāmāyaṇa	08 Credits
Section 'C'	Mahābhārata	08 Credits
Section 'D'	Purāṇas	06 Credits
Section 'E'	General Introduction to <i>Vyākaraṇa</i> , <i>Darśana</i> and <i>Sāhityaśāstra</i>	14 Credits
Unit-Wise Division:		
Section 'A'		
Vedic Literature		
Unit: I	<i>Samhitā (Ṛk, Yajuh, Sāma, Atharva)</i> time, subject– matter, religion & Philosophy, social life	12 Credits
Unit: II	<i>Brāhmaṇa, Āraṇyaka, Upaniṣad, Vedāṅga</i> (Brief Introduction)	08 Credits
Section 'B'		
Rāmāyaṇa		
Unit: I	<i>Rāmāyaṇa-time, subject–matter, Rāmāyaṇa</i> as an <i>Ādikāvya</i> .	4 Credits
Unit: II	<i>Rāmāyaṇa</i> as a Source Text and its Cultural Importance.	4 Credits
Section 'C'		
Mahābhārata		
Unit: I	<i>Mahābhārata</i> and its Time, Development, and subject matter	4 Credits
Unit:II	<i>Mahābhārata</i> : Encyclopaedic nature, as a Source, Text, Cultural Importance.	4 Credits
Section 'D'		
Purāṇas		
Unit: I	Purāṇas : Subject matter, Characteristics	02 Credits
Unit: II	Purāṇas : Social, Cultural and Historical Importance	04 Credits
Section 'E'		
General Introduction to Vyākaraṇa, Darśana and Sāhityaśāstra		
Unit-I	General Introduction to <i>Vyākaraṇa</i> - Brief History of <i>Vyākaraṇaśāstra</i>	04 Credits
Unit-II	General Introduction to <i>Darśana</i> -Major schools of Indian Philosophy <i>Cārvāka, Bauddha, Jaina, Sāṅkhya-yoga, Nyāya-Vaiśeṣika, Pūrva-mīmāṃsā</i> and <i>Uttara mīmāṃsā</i> .	05 Credits
Unit-III	General Introduction to Poetics- Six major Schools of Indian Poetics-Rasa, Alamkāra, Rīti, Dhvani, Vakrokti and Aucitya.	05 Credits

SANS-H-CC-T-03		
Classical Sanskrit Literature (Prose)		
Section 'A'	<i>Śukanāsopadeśa</i>	24 Credits
Section 'B'	<i>Viśrutacaritam</i> Upto 15th Para	16 Credits
Section 'C'	Origin and development of prose, Important prose romances and fables	16 Credits
Unit-Wise Division:		
Section 'A'		
Śukanāsopadeśa (Ed. Prahlad Kumar)		
Unit: I	Introduction- Author/Text, Text up to page 116 of Prahlad Kumar Up to the end of the Text.	12 Credits
Unit: II	Society, <i>Āyurveda</i> and political thoughts depicted in <i>Śukanāsopadeśa</i> , logical meaning and application of sayings like बाणोच्छिष्टं जगत्सर्वम्, वाणी बाणो बभूव, पञ्चाननो बाणः etc.	12 Credits
Section 'B'		
Viśrutacaritam Upto 15th Para		
Unit: I	Para 1 to 10 - Introduction- Author, Text, Text reading (Grammar, Translation, and Explanation), Poetic excellence, plot, Timing of Action.	10 Credits
Unit: II	Para 11 to 15 - Text reading (Grammar, Translation, and Explanation), Poetic excellence, plot, Timing of Action. Society, language and style of Daṇḍin. Exposition of Saying दण्डितः पदलालित्यम्, कविर्दण्डी कविर्दण्डी कविर्दण्डी न संशयः।	06 Credits
Section 'C'		
Origin and development of prose, Important prose romances and fables		
Unit: I	Origin and development of prose, important prose romances and fables	08 Credits
Unit: II	(i) Subandhu, Daṇḍin, Bāṇa, Ambikādatta Vyāsa. (ii) Pañcatantra, Hitopadeśa, Vetālapañcaviṃśatikā, Siṃhāsanadvātriṃśikā, Puruṣaparīkṣā, Śukasaptati.	08 Credits

SANS-H-CC-T-04		
Sanskrit Composition and Communication		
Prescribed Course:		Total 56 Credits
Section 'A'	Vibhaktyartha, Voice and Kṛt	16 Credits
Section 'B'	Translation and Communication	20 Credits
Section 'C'	Essay	20 Credits
Unit-Wise Division:		
Vibhaktyartha, Voice & Kṛt		
Section 'A'		
Unit: I	(i) <i>Vibhaktyartha Prakaraṇa</i> of <i>Laghusiddhāntakaumudī</i>	06 Credits
Unit: II	(ii) Voice (<i>katṛ, karma</i> and <i>bhāva</i>) Selections from <i>Kṛt Prakaraṇa</i> - from <i>Laghusiddhāntakaumudī</i> Major Sūtras for the formation of <i>kṛdanta</i> words (<i>tavyat, tavya, anīyar, yat, , vul, tric, a, kta, katavatu, śatṛi, śānac, tumun, ktvā-lyap, lyuṣ, ghan, ktin</i>)	10 Credits
Section 'B'		
Translation and Communication		
Unit: I	(i) Translation from Hindi/English to Sanskrit on the basis of cases, Compounds and kṛt suffixes.	10 Credits
Unit: II	(ii) Translation from Sanskrit and Hindi Communicative Sanskrit: Spoken Sanskrit.	10 Credits
NB: For Unit –I First Book of Sanskrit should be introduced		
Section 'C'		
Essay		
Unit: I	Essay (traditional subjects) e.g. <i>veda, upaniṣad, Sanskrit Language, Sanskriti, Rāmāya, Mahābhārata, purāṇa, gītā</i> , principal Sanskrit poets.	10 Credits
Unit: II	Essay based on issues and topic related to modern subjects like entertainment, sports, national and international affairs and social problems.	10 Credits
NB: Essay – 8 Samasa – 12		

SANS-H-CC-T-05		
Classical Sanskrit Literature (Drama)		
Prescribed Course:		Total 56 Credits
Section 'A'	Svapnavāsavadattam– Bhāsa Act I & VI	10 Credits
Section 'B'	Abhijñānaśākuntalam– Kālidāsa I to IV	16 Credits
Section 'C'	Abhijñānaśākuntalam– Kālidāsa V to VII	20 Credits
Section 'D'	Critical survey of Sanskrit Drama	10 Credits
Unit-Wise Division:		
Section 'A'		
Svapnavāsavadattam– Bhāsa Act I & VI		
Unit: I	Svapnavāsavadattam: Act I & VI Story, Meaning/Translation and Explanation.	05 Credits
Unit: II	Svapnavāsavadattam: Unique features of Bhāsa's style, Characterization, Importance of 1st and 6th Act, Society, Norms of Marriage, Story of 'regains'. <i>Bhāso hāso</i>	05 Credits
Section 'B'		
Abhijñānaśākuntalam– Kālidāsa I to IV		
Unit: I	Abhijñānaśākuntalam : Act I- (a) Introduction, Author, Explanation of terms like <i>nāndī</i> , <i>prastāvanā</i> , <i>sūtradhāra</i> , <i>naṭī</i> , <i>viškambhaka</i> , <i>vidūṣaka</i> , <i>kañcukī</i> , (b) Text Reading (Grammar, Translation, Explanation), Poetic excellence, Plot, Timing of Action. Personification of nature, Language of Kālidāsa, <i>dhvani</i> in Upamā Kālidāsa, Purpose and design behind <i>Abhijñānaśākuntalam</i> and other problems related to texts, popular saying about Kālidāsa & Śākuntalam.	08 Credits
Unit II	Abhijñānaśākuntalam Act II to IV- Text Reading (Grammar, Translation, Explanation), Poetic excellence, Plot, Timing of action.	08 Credits
Section 'C'		
Abhijñānaśākuntalam– Kālidāsa V to VII		
Unit: I	Abhijñānaśākuntalam Act V to VII Text Reading (Grammar, Translation, Explanation).	10 Credits
Unit-II	Abhijñānaśākuntalam Act V to VII Poetic excellence, Plot, Timing of Action. Personification of nature, Language of Kālidāsa, <i>dhvani</i> in Upamā Kālidāsa, Purpose and design behind <i>Abhijñānaśākuntalam</i> and other problems related to texts, popular saying about Kālidāsa & Śākuntalam.	10 Credits
Section 'D'		
Critical survey of Sanskrit Drama		
Unit-I	Sanskrit Drama : Origin and Development, Nature of Nāṭaka,	05 Credits
Unit-II	Some important dramatists and dramas: Bhāsa, Kālidāsa, Śūdraka, Viśākhadatta, Śrīharṣa, Bhavabhūti, Bhaṭṭanārāyaṇa and their works.	05 Credits

SANS-H-CC-T-06		
Poetics and Literary Criticism		
Prescribed Course:		Total 56 Credits
Section 'A'	Introduction to Sanskrit poetics	10 Credits
Section 'B'	Forms of Kāvya-Literature	10 Credit
Section 'C'	<i>Śabda-śakti</i> (Power of Word) and <i>rasa-sūtra</i>	16 Credits
Section 'D'	<i>Alaṅkāra</i> (figures of speech) and <i>chandasā</i> (metre)	20 Credits
Unit-Wise Division:		
Section 'A'		
Introduction to Sanskrit Poetics		
Unit: I	Introduction to poetics: Origin and development of Sanskrit poetics, its various names- kriyākalpa, alaṅkāraśāstra, sāhityaśāstra, saundryaśāstra.	05 Credits
Unit: II	Definition (lakṣaṇa), objectives (prayojana) and causes (hetu) of poetry. (according to <i>kāvya prakāśa</i>)	05 Credits
Section 'B'		
Forms of Kāvya-Literature		
Unit: I	Forms of poetry : <i>drśya, śravya, miśra, (campū)</i>	04 Credits
Unit: II	<i>Mahākāvya, khaṇḍakāvya, gadya-kāvya: kathā, ākhyāyikā</i> (according to <i>Sāhityadarpaṇa</i>)	06 Credits
Section 'C'		
Śabda-śakti and rasa-sūtra		
Unit: I	Power/Function of word and meaning (according to <i>kāvya prakāśa</i>). <i>abhidhā</i> (expression/ denotative meaning), <i>lakṣaṇā</i> (indication/ indicative meaning) and <i>vyañjanā</i> (suggestion/ suggestive meaning).	6 Credits
Unit: II	<i>Rasa: rasa-sūtra</i> of Bharata and its prominent expositions: <i>utpattivāda, anumitivāda, bhuktivāda</i> and <i>abhivyaktivāda, alaukikatā</i> (transcendental nature) of <i>rasa</i> (as discussed in <i>Kāvya prakāśa</i>).	10 Credits
Section 'D'		
Figures of speech and Meter		
Unit: I	Figures of speech- <i>anuprāsa, yamaka, śleṣa, upamā, rūpaka, sandeha, bhrāntimān, apahnuti, utprekṣā, atīśayokti, tulyayogitā, dīpaka, drṣṭānta, nīdarśanā, vyatireka, samāsokti, svabhāvokti, aprastutaprasāmsā, arthāntaranyāsa, kāvyaliṅga, vibhāvanā.</i>	16 Credits
Unit: II	Metres- <i>anuṣṭup, āryā, indravajrā, upendravajrā, drutavilambita, upajāti, vasantatilakā, mālinī, mandākrāntā, śikharinī, śārdūlavikrīḍita, sragdharā.</i>	04 Credits

SANS-H-CC-T-07		
Indian Social Institutions and Polity		
Prescribed Course:		Total 56 Credits
Section 'A'	Indian Social Institutions : Nature and Concepts	12 Credits
Section 'B'	Structure of Society and Value of Life	14 Credits
Section 'C'	Indian Polity : Origin and Development	18 Credits
Section 'D'	Cardinal Theories and Thinkers of Indian Polity	12 Credits
Unit-Wise Division:		
Section 'A'		
Indian Social Institutions : Nature and Concepts		
Unit: I	Indian Social Institutions : Definition and Scope: Sociological Definition of Social Institutions. Trends of Social Changes, Sources of Indian Social Institutions (Vedic Literature, <i>Sūtra</i> Literature, <i>Purānas</i> , <i>Rāmāyaṇa</i> , <i>Mahābhārata</i> , <i>Dharmaśāstras</i> , Buddhist and Jain Literature, Literary Works, Inscriptions, Memoirs of Foreign Writers)	06 Credits
Unit: II	Social Institutions and <i>Dharmaśāstra</i> Literature: <i>Dharmaśāstra</i> as a special branch of studies of Social Institutions, sources of Dharma (<i>Manusmṛti</i> , 2,12; <i>Yājñavalkyasmṛti</i> ,1.7). Different kinds of <i>Dharma</i> in the sense of Social Ethics <i>Manusmṛti</i> , 10,63; <i>Viṣṇupurāṇa</i> 2.16-17); Six kinds of <i>Dharma</i> in the sense of Duties (<i>Mitākṣarāṭīkā</i> on <i>Yājñavalkyasmṛti</i> ,1.1). Tenfold <i>Dharma</i> as Ethical Qualities (<i>Manusmṛti</i> ,6.92); Fourteen- <i>Dharmasthānas</i> (<i>Yājñavalkyasmṛti</i> ,1.3)	06 Credits
Section 'B'		
Structure of Society and Values of Life		
Unit: I	Varṇa-System and Caste System : Four-fold division of <i>Varṇa</i> System, (<i>Rgveda</i> , 10.90.12), <i>Mahābhārata</i> , <i>Śāntiparva</i> ,72.3-8); Division of <i>Varṇa</i> according to <i>Guṇa</i> and <i>Karma</i> (<i>Bhagavadgīta</i> , 4.13, 18.41-44). Origin of Caste-System from Inter-caste Marriages (<i>Mahābhārata</i> , <i>Anuśāsanaparva</i> , 48.3-11); Emergence of non-Aryan tribes in <i>Varṇa</i> -System (<i>Mahābhārata</i> , <i>Śāntiparva</i> , 65.13-22). Social rules for up-gradation and down-gradation of Caste System (<i>Āpastambadharmasūtra</i> , 2.5.11.10-11, <i>Baudhāyanadharmasūtra</i> , 1.8.16.13-14, <i>Manusmṛti</i> , 10,64, <i>Yājñavalkyasmṛti</i> , 1.96)	05 Credits

<p>Unit: II</p>	<p>Position of Women in the Society : Brief survey of position of women in different stages of Society. Position of women in <i>Mahābhārata</i> (<i>Anuśāsanaparva</i>, 46.5-11, <i>Sabhāparva</i>, 69.4-13. Praise of women in The <i>Bṛhatsaṃhitā</i> of Varāhamihira (<i>Strīprasamsā</i>, chapter-74.1-10)</p>	<p>04 Credits</p>
<p>Unit: III</p>	<p>Social Values of Life : Social Relevance of Indian life style with special reference to Sixteen <i>Samśkāras</i>. Four aims of life '<i>Puruṣārtha-Catuṣṭaya</i>'- 1. <i>Dharma</i>, 2. <i>Artha</i>, 3. <i>Kāma</i>, 4. <i>Mokṣa</i>. Four <i>Āśramas</i>- 1. <i>Brahmacarya</i>, 2. <i>Gṛhastha</i>, 3. <i>Vānaprastha</i>, 4. <i>Samnyāsa</i></p>	<p>05 Credits</p>
<p>Section 'C' Indian Polity : Origin and Development</p>		
<p>Unit: I</p>	<p>Initial stage of Indian Polity (from Vedic period to Buddhist period). Election of King by the people: '<i>Viśas</i>' in Vedic priod (<i>Rgveda</i>, 10.173; 10.174; <i>Atharvaveda</i>, 3.4.2; 6.87.1-2). Parliamentary Institutions: '<i>Sabhā</i>', '<i>Samiti</i>' and '<i>Vidatha</i>' in Vedic period (<i>Atharvaveda</i>, 7.12.1; 12.1.6 ; <i>Rgveda</i> , 10.85.26); King-maker '<i>Rājakartāraḥ</i>' Council in <i>Atharvaveda</i>(3.5.6-7), Council of '<i>Ratnis</i>' in <i>śatapathabrāhmaṇa</i>(5.2.5.1); Coronation Ceremony of <i>Samrāj</i> in <i>śatapathabrāhmaṇa</i> (51.1.8-13; 9.4.1.1-5) Republic States in the Buddhist Period (Digghanikāya, Mahāparinibbaṇa Sutta, Aṅguttaranikāya, 1.213; 4.252, 256)</p>	<p>09 Credits</p>
<p>Unit: II</p>	<p>Later Stages of Indian Polity (From Kauṭilya to Mahatma Gandhi). Concept of Welfare State in <i>Arthaśāstra</i> of Kauṭilya (<i>Arthaśāstra</i>, 1.13 : '<i>matsyanyāyābhibhuth</i>' to '<i>yo</i>' <i>asmāngopāyatīti</i>'); Essential Qualities of King (<i>Arthaśāstra</i>, 6.1.16-18: '<i>sampādayatyasampannaḥ</i>' to '<i>jayatyeva na hīyate</i>'); State Politics '<i>Rajadharma</i>'(<i>Mahābhārata</i> , <i>Śāntiparva</i>, 120.1-15; <i>Manusmṛti</i>, 7.1-15; <i>Śukranīti</i>, 1.1-15); Constituent Elements of Jain Polity in <i>Nītivākyāmṛta</i> of Somadeva Suri, (<i>Daṇḍanīti-samuddeśa</i>, 9.1.18 and <i>Janapada- samuddeśa</i>, 19.1.10). Relevance of Gandhian Thought in Modern Period with special reference to '<i>Satyāgraha</i>' Philosophy ('<i>Satyāgrahagītā</i>' of Pa .itā Kṣamārāva and '<i>Gandhi Gītā</i>', 5.1-25 of Prof. Indra)</p>	<p>09 Credits</p>

Section 'D' Cardinal Theories and Thinkers of Indian Polity		
Unit: 1	<p>Cardinal Theories of Indian Polity:</p> <p>'Saptāṅga' Theory of State: 1.Svāmi, 2. Amātya, 3. Janapada 4. Pura, 5. Kośa, 6. Daṇḍa and 7. Mitra(Arthaśāstra, 6.1. Mahābhārata, Śāntiparva, 56.5, Śukranīti, 1.61-62).</p> <p>'Maṇḍala'Theory of Inter-State Relations: 1.Ari, 2. Mitra, 3. Ari-mitra,4.Mitra- mitra, 5.Ari-mitra-mitra;</p> <p>'Śāḍgunya'Policy of War and Peace : 1. Sandhi, 2. Vighraha, 3. Yāna, 4. Āsana, 5. Saṁśraya 6.Dvaidhibhāva.</p> <p>'CaturvidhaUpāya'for Balancing the power of State : 1.Sāma 2.Dāma,3.Daṇḍa.4.Bheda;</p> <p>Three Types of State Power 'Śakti': 1.Prabhu-śakti,2.Mantra-śakti, 3. Utsāha-śakti.</p>	06 Credits
Unit: 2	<p>Important Thinkers on Indian Polity: Manu, Kauṣṭilya, Kāmandaka, Śukrācārya, SomadevaSuri, Mahatma Gandhi.</p>	06 Credits

SANS-H-CC-T-08		
Indian Epigraphy, Paleography and Chronology		
Prescribed Course:		Total 56 Credits
Section 'A'	Epigraphy	14 Credits
Section 'B'	Paleography	14 Credits
Section 'C'	Study of selected inscriptions	18 Credits
Section 'D'	Chronology	10 Credits
Unit-Wise Division:		
Section 'A'		
Epigraphy		
Unit: I	Introduction to Epigraphy and Types of Inscriptions	04 Credits
Unit: II	Importance of Indian Inscriptions in the reconstruction of Ancient Indian History and Culture	04 Credits
Unit: III	History of Epigraphical Studies in India	02 Credits
Unit: IV	History of Decipherment of Ancient Indian Scripts (Contribution of Scholars in the field of epigraphy): Fleet, Cunningham, Prinsep, Buhler, Ojha, D.C.Sircar.	04 Credits
Section 'B'		
Paleography		
Unit: I	Antiquity of the Art of Writing	04 Credits
Unit: II	Writing Materials, Inscribers and Library	04 Credits
Unit: III	Introduction to Ancient Indian Scripts.	06 Credits
Section 'C'		
Study of Selected inscriptions		
Unit: I	Aśoka's Giranāra Rock Edict-1	02 Credits
	Aśoka's Sāranātha Pillar Edict	02 Credits
Unit: II	Girnāra Inscription of Rudradāman	04 Credits
Unit: III	Allahabad Stone Inscription of Samudragupta	04 Credits
	Mehrauli Iron Pillar Inscription of Candra	04 Credits
Unit: IV	Aihole Inscription	02 Credits
Section 'D'		
Chronology		
Unit: I	General Introduction to Ancient Indian Chronology	03 Credits
Unit: II	System of Dating the Inscriptions (Chronograms)	03 Credits
Unit: III	Main Eras used in Inscriptions - Vikrama Era, Śaka Era and Gupta Era	04 Credits

SANS-H-CC-T-09		
Modern Sanskrit Literature		
Prescribed Course:		Total 56 Credits
Section 'A'	Mahākāvya and Charitakāvya	14 Total Credits
Section 'B'	GadyaKāvya and Sanskrit rendering of Tagore's play - Muktheadhārā	18 Total Credits
Section 'C'	GītiKāvya and Other genres	12 Total Credits
Section 'D'	General Survey of Modern Sanskrit Literature	12 Total Credits
NB: Section B – Muktheadhara – Dhyanes: Chakraborty (Traus.)		
Unit-Wise Division:		
Section 'A'		
Mahākāvya and Charitakāvya		
Unit: I	SvāntaryaSambhavam (Revaprasada Dwivedi) Canto 2, verses 1-45 Bhīmāyanam (Prabha Shankar Joshi) Canto X. verses 20-29; Canto - XI. Verses 13-20 & 40-46.	14 Credits
Section 'B'		
Gadya and Rūpaka		
Unit: I	Vārtāgrham (Sanskrit version of Tagore's play)	18 Credits
Section 'C'		
Gitikāvya and Other genres		
Unit: I	Bhaṭṭa Mathurā Nath Shastri (Kundaliyān), BacchuLal Avasthi Jñāana (Kaete, Kva Yataste), Srinivasa Rath (Katamā Kavita) etc	4 Credits
Unit: II	Hariram Acharya (Sankalpa Gītiā); Pushpa Dikshit (Bruhi kosminYuge..) RadhaVallabhTripathi DhivaraGītiḥ (Naukāmihasaramsaram...);	4 Credits
Unit III	Harshdev Madhava Haiku- Snanagrihe, vedanā, mrityuḥ1, mṛtyuḥ 2; kaniḥ; shatāvadhāni R. Ganesh (Kavi-viṣādaḥ, Varṣāvibhūtiḥ –selected verses)	4 Credits
Section 'D'		
General Survey		
Unit 1	Pandita Kshama Rao, P.K. Narayana Pillai, S. B. Varnekar, ParmanandShastri, Reva Prasad Dwivedi	04 Credits
Unit 2	Janaki VallabhShastri, Ram Karan Sharma, Jagannath Pathak, S. Sundarrajan, Shankar Dev Avatare	04 Credits
Unit 3	Haridas SiddhantaVagish, Siddheswar Chattopadhyay, Rama Chodhury, Srijeev Nyāyatīrtha, YatindraVimal Chowdhury, Virendra Kumar Bhattacharya	04 Credits

SANS-H-CC-T-10		
Sanskrit and World Literature		
Prescribed Course:		Total 56 Credits
Section 'A'	Buddhist Sanskrit Literature	10 Credits
Section 'B'	Upaniṣads and Gītā in World Literature	08 Credit
Section 'C'	Sanskrit Fables in World Literature	08 Credits
Section 'D'	Rāmāyaṇa and Mahābhārata in South East Asian Countries	10 Credits
Section 'E'	Kālidāsa's Literature in World Literature	10 Credits
Section 'F'	Sanskrit Studies across the World	10 Credits
Unit-Wise Division:		
Section 'A'		
Buddha-Carita – Chapter-I		
Unit: I	Translation.	03 Credits
Unit: II	Short note.	03 Credits
Unit: III	Explanation Description.	04 Credits
Section 'B'		
Upaniṣads and Gītā in the West		
Unit: I	Dara Shikoh's Persian Translation of Upanisads and their Influence on Sufism. Latin translation and its influence on Western thought	04 Credits
Unit: II	Translation of the Gītā in European languages and religio–philosophical thought of the west.	04 Credits
Section 'C'		
Sanskrit Fables in World Literature		
Unit: I	Translation of Pañcatantra in Eastern and Western Languages.	04 Credits
Unit: II	Translation of <i>Vetālapañcaviṃśatikā</i> , <i>Siṃhāsanadvātriṃśikā</i> and <i>Śukasaptati</i> in Eastern Languages and Art.	04 Credits
Section 'D'		
Rāmāyaṇa and Mahābhārata in South Eastern Asia		
Unit: I	Rāma Kathā in south eastern countries	05 Credits
Unit: II	<i>Mahābhārata</i> stories as depicted in folk cultures of SE Asia	05 Credits
Section 'E'		
Kālidāsa in the West		
Unit: I	English and German translation of Kālidāsa's writings and their influence on western literature and theatre.	10 Credits
Section 'F'		
Sanskrit Studies across the World		
Unit: I	i. Sanskrit Study Centers in Asia ii. Sanskrit Study Centers in Europe iii. Sanskrit Study Centers in America	10 Credits

SANS-H-CC-T-11 Vedic Literature		
Prescribed Course:		Total 56 Credits
Section 'A'	<i>Samhitā and Brāhmaṇa</i>	30 Credits
Section 'B'	Vedic Grammar	10 Credits
Section 'C'	Bṛhadāraṇyakopaniṣad	16 Credits
Unit-Wise Division:		
Section 'A' <i>Samhitā and Brāhmaṇa</i>		
Unit: I	<i>Rgveda-</i> Agni- 1.1, Uṣas- 3.61, Akṣa Sūkta 10.34, Hiranyagarbha- 10.121	20 Credits
Unit: II	<i>Yajurveda-</i> Śivasamkalpa Sūkta- 34.1-6	05 Credits
Unit: III	<i>Atharvaveda-</i> Sāmmanasyam- 3.30, Bhūmi- 12.1-12	05 Credits
Section 'B' Vedic Grammar		
Unit: I	Declensions (<i>śabdarūpa</i>), Subjunctive Mood (<i>leṭ</i>), Gerunds (<i>ktvārthaka, Tumarthaka</i>), Vedic Accent and Padapāṭha.	10 Credits
Section 'C' (Bṛhadāraṇyakopaniṣad)		
Unit: I	Bṛhadāraṇyakopaniṣad (4.4)	8 Credits
Unit: II	Bṛhadāraṇyakopaniṣad (4.5)	8 Credits

SANS-H-CC-T-12 Sanskrit Grammar		
Prescribed Course		Total 56 Credits
Section 'A'	Kāraṅkaraṇam	28 Credits
Section 'B'	Samāsa-prakaraṇam	28 Credits

All these sections shall be taught from Vaiyākaraṇa-siddhānta-kaumudī.

SANS-H-CC-T-13		
Ontology and Epistemology		
Prescribed Course		Total 56 Credits
Section 'A'	Essentials of Indian Philosophy	16 Credits
Section 'B'	Ontology (Based on Tarkasaṃgraha)	20 Credits
Section 'C'	Epistemology (Based on Tarkasaṃgraha)	20 Credits
Unit-Wise Division:		
Section 'A'		
Essentials of Indian Philosophy		
Unit: I	Meaning and purpose of darśana, general classification of philosophical schools in classical Indian philosophy	05 Credits
Unit: II	Realism (<i>yathārthavāda</i> or <i>vastuvāda</i>) and Idealism (<i>pratyayavāda</i>), Monism (<i>ekattvavāda</i>), Dualism (<i>dvaitavavāda</i>) & Pluralism (<i>bahuttvavāda</i>) ; dharma (property)-dharmi (substratum)	05 Credits
Unit: III	Causation (<i>kāryakāraṇavāda</i>) : naturalism (<i>svabhāvavāda</i>), doctrine of pre-existence of effect (<i>satkāryavāda</i>), doctrine of real transformation (<i>pariṇāmvāda</i>), doctrine of illusory transformation (<i>vivartavāda</i>), doctrine of non-prexistence of effect in cause (<i>asatkāryavāda</i> and <i>ārambhavāda</i>)	06 Credits
Section 'B'		
Ontology		
Unit: I	Concept of padārtha, three dharmas of padārthas, definition of Dravya,	05 Credits
Unit: II	Sāmānya, Viśeṣa, Samavāya, Abhāva.	05 Credits
Unit: III	Definitions of first seven dravyas and their examination; Ātma and its qualities, manas.	05 Credits
Unit: IV	Qualities (other than the qualities of the ātman) Five types of Karma.	05 Credits
Section 'C'		
Epistemology		
Unit: I	Buddhi(jñāna) – nature of <i>jñāna</i> in Nyāya <i>vaiśeṣika</i> ; <i>smṛiti-anubhava</i> ; <i>yathārtha</i> and <i>ayathārtha</i> ,	6 Credits
Unit: II	Karaṇa and kāraṇa, definitions and types of pramā, kartā-kāraṇa-vyāpāra-phala, model	6 Credits
Unit: III	Pratyakṣa	4 Credits
Unit: IV	Anumāna including hetvābhāsa	4 Credits
Unit: V	Upamāna and śabda pramāṇa	4 Credits
Unit: VI	Types of ayathārtha anubhava	4 Credits

SANS-H-CC-T-14		
Self Management in the Gītā		
[A] Prescribed Course:		Total 56 Credits
Section 'A'	Gītā: Cognitive and emotive apparatus	16 Credits
Section 'B'	Gītā: Controlling the mind	24 Credits
Section 'C'	Gītā: Self management through devotion	16 Credits
Unit-Wise Division:		
Section 'A'		
Gītā: Cognitive and emotive apparatus		
Unit: I	Hierarchy of <i>indriya</i> , <i>manas</i> , <i>buddhi</i> and <i>ātman</i> III.42; XV. 7 Role of the <i>ātman</i> –XV.7; XV.9	8 Credits
Unit: II	Mind as a product of <i>prakṛti</i> VII.4 Properties of three <i>guṇas</i> and their impact on the mind – XIII. 5-6; XIV.5-8, 11-13; XIV.17	8 Credits
Section 'B'		
Gītā: Controlling the mind		
Unit: I	Confusion and conflict Nature of conflict I.1; IV.16; I.45; II.6 Causal factors – Ignorance – II.41; <i>Indriya</i> – II.60, Mind – II.67; <i>Rajoguṇa</i> – III.36-39; XVI.21; Weakness of mind- II.3; IV.5	8 Credits
Unit: II	Means of controlling the mind Meditation–difficulties –VI.34-35; procedure VI.11-14 Balanced life- III.8; VI.16-17 Diet control- XVII. 8-10 Physical and mental discipline – XVII. 14-19, VI. 36. Means of conflict resolution Importance of knowledge – II. 52 ; IV.38-39; IV.42 Clarity of <i>buddhi</i> – XVIII.30-32 Process of decision making – XVIII.63	8 Credits
Unit: III	Control over senses – II.59, 64 Surrender of <i>karṣṇbhāva</i> –XVIII .13-16; V.8-9 Desirelessness- II.48; II.55 Putting others before self – III.25	8 Credits
Section 'C'		
Gītā: Self management through devotion		
Unit: I	Surrender of ego – II.7 ; IX.27; VIII.7; XI.55 ; II.47 Abandoning frivolous debates – VII.21, IV.11; IX.26 Acquisition of moral qualities - XII.11; XII.13-19	16 Credits

Discipline Specific Elective

SANS-H-DSE-T-01 Indian System of Logic and Debate		
Prescribed Course:		Total 56 Credits
Section 'A'	Fundamentals of Science of Debate	10 Credits
Section 'B'	Syllogistic Logic	20 Credits.
Section 'C'	Theory of Debate	26 Credits.
Unit-Wise Division:		
Section 'A' Fundamentals of Science of Debate		
Unit: I	Science of inquiry (<i>ānvīkṣikī</i>) & its importance, Growth of <i>ānvīkṣikī</i> into art of debate, The council of debate (<i>parīṣad</i>) & its kinds, Discussant (<i>vādī</i>), Opponent (<i>prativādī</i>), Judge (<i>madhyastha/prāśnika</i>).	05 Credits
Unit: II	The Method of debate (<i>sambhāṣavidhi/vādavidhi</i>) & its utility, Types of debate - congenial debate (<i>anuloma sambhāṣā</i>) & hostile debate (<i>vighya sambhāṣā</i>), The expedience of debate (<i>vādopāya</i>), The limits of debate (<i>vādamaryādā</i>). Note : The definitions and concepts are to be taken only from the <i>Nyāyasūtra</i> , <i>Nyāyakośa</i> by Bhimacharya Jhalkikar and <i>A History of Indian Logic</i> by S. C. Vidyabhushan, Chapter III of Section I. The illustrations and examples must be taken from day to day life and philosophical examples must be abandoned	05 Credits
Section 'B' Syllogistic Logic		
Unit: I	Inference (<i>anumāna</i>) & its key terms, viz. major term or probandum (<i>sādhyā</i>), middle term or probans (<i>hetu</i>), minor term (<i>pakṣa</i>), illustration (<i>sapakṣa</i>), contrary-illustration (<i>vipakṣa</i>), basic understanding of invariable concomitance (<i>vyāpti</i>) & its types, establishing <i>vyāpti</i> by inductive method, Five components of argument (<i>pañcāvayava</i>) – proposition (<i>pratiṣṭhā</i>), reason (<i>hetu</i>), example (<i>udāharana</i>), application (<i>upanaya</i>) & conclusion (<i>nigamana</i>), the <i>hetu</i> term – its nature and requirement, demonstration of pervasion – <i>upādhi and tark</i> , nature and variety of <i>tark</i> . Note : The definitions and concepts are to be taken only from the <i>Tarkasaṃgraha</i> and <i>The Nyāya Theory of Knowledge</i> by S. C. Chatterjee, Chapters XI-XIV.	20 Credits

Section 'C' Theory of Debate		
Unit: I	Basic understanding of the following terms: Example (<i>dr̥ṣṭānta</i>), Tenet (<i>siddhānta</i>), Ascertainment (<i>nirṇaya</i>), Dialouge (<i>kathā</i>) and its kinds, Discussion (<i>vāda</i>), Wrangling (<i>jalpa</i>), Cavil (<i>vitandā</i>).	13 Credits
Unit: II	Quibble (<i>chala</i>) & its kinds; Analogue (<i>jāti</i>) and its important kinds (only first four, i.e. <i>sādharmyasama</i> , <i>vaidharmyasama</i> , <i>utkarṣasama</i> & <i>apakarṣasama</i>); Point of defeat (<i>nigrahasthāna</i>) & its kinds – Hurting the proposition (<i>pratijñāhāni</i>), Shifting of proposition (<i>pratijñāntara</i>), Opposing the proposition (<i>pratijñāvirodha</i>), Renouncing the proposition (<i>pratijñāsannyāsa</i>), Admission of an opinion (<i>matānujñā</i>). Note : The definitions and concepts are to be taken only from the <i>Nyāyasūtra</i> , <i>Nyāyakośa</i> by Bhimacharya Jhalkikar and <i>A History of Indian</i> <i>Logic</i> by S. C. Vidyabhushan, Chapter II of Section II. The illustrations and examples must be taken from day to day life and philosophical examples must be abandoned.	13 Credits

SANS-H-DSE-T-02 Art of Balanced Living		
[A] Prescribed Course:		Total 56 Credits
Section 'A'	Self-presentation	16 Credits
Section 'B'	Concentration	20 Credits
Section 'C'	Refinement of Behaviour	20 Credits
Unit-Wise Division:		
Section 'A' Self-presentation		
Unit: I	Method of Self-presentation : Hearing (<i>śravaṇa</i>), Reflection (<i>manana</i>) & meditation (<i>nididhyāsana</i>) – (Bṛhadāraṇyakopaniṣad, 2.4.5)	16 Credits
Section 'B' Concentration		
Unit: I	Concept of Yoga : (<i>Yogasūtra</i> , 1.2) Restriction of fluctuations by practice (<i>abhyāsa</i>) and passionlessness (<i>vairāgya</i>) :(<i>Yogasūtra</i> , 1.12-16) Eight aids to Yoga (<i>aṣṭāṅgayoga</i>) : (<i>Yogasūtra</i> , 2.29, 30,32, 46, 49, 50; 3.1-4). Yoga of action (<i>kriyāyoga</i>) : (<i>Yogasūtra</i> , 2.1) Four distinct means of mental purity (<i>cittaprasādana</i>) leading to oneness : (<i>Yogasūtra</i> , 1.33)	20 Credits
Section 'C' Refinement of Behavior		
Unit: I	Methods of Improving Behavior : <i>jñāna-yoga</i> , <i>dhyāna-yoga</i> , <i>karma-yoga</i> and <i>bhakti-yoga</i> (especially <i>karma-yoga</i>) Karma : A natural impulse, essentials for life journey, co-ordination of the world, an ideal duty and a metaphysical dictate (<i>Gītā</i> , 3.5, 8, 10-16, 20 & 21)	20 Credits

SANS-H-DSE-T-03		
Theatre and Dramaturgy in Sanskrit		
Prescribed Course:		Total 56 Credits
Section 'A'	Theatre: Types and Constructions	16 Credits
Section 'B'	Drama : <i>vastu</i> (subject-matter), <i>netā</i> (Hero) and <i>rasa</i>	30 Credits
Section 'C'	Tradition and History of Indian Theatre	10 Credits
Unit-Wise Division:		
Section 'A'		
Theatre: Types and Construction		
Unit: I	Types of theatre: <i>vikṛṣṭa</i> (oblong), <i>caturasra</i> (square), <i>tryasra</i> (triangular), <i>jyeṣṭha</i> (big), <i>madhyama</i> (medium), <i>avara</i> (small). <i>bhūmi-śodhana</i> (Examining the land) and <i>māpa</i> (measurement of the site), <i>mattavāraṇī</i> (raising of pillars), <i>raṅgapīṭha</i> and <i>rangaśīrṣa</i> (stage), <i>dārukarma</i> (wood-work), <i>nepathya -gr̥ha</i> (greenhouse), <i>prekṣkopaveśa</i> (audience-hall), Doors for entrance & exit.	16 Credits
Section 'B'		
Drama - <i>vastu</i> (subject-matter), <i>netā</i> (hero) and <i>rasa</i>		
Unit: I	Definition of drama and its various names - <i>dr̥śya</i> , <i>rūpa</i> , <i>rūpaka</i> , <i>abhineya</i> ; abhinaya and its types: <i>āṅgika</i> (gestures), <i>vācika</i> (oral), <i>sāttvika</i> (representation of the sattva), <i>āhārya</i> (dresses and make-up). Vastu: (subject-matter) : <i>ādhikārika</i> (principal), <i>prāsaṅgika</i> (subsidiary), <i>Five kinds of arthaprakṛti</i> , <i>kāryāvasthā</i> (stages of the action of actor) and <i>sandhi</i> (segments), <i>arthopakṣepaka</i> (interludes), kinds of dialogue: 1. <i>sarvaśrāvya</i> or <i>prakāśa</i> (aloud) 2. <i>aśrāvya</i> or <i>svagata</i> (aside) 3. <i>niyataśrāvya</i> : <i>janāntika</i> (personal address), <i>apavārita</i> (confidence) 4. <i>ākāśabhāṣita</i> (conversation with imaginary person).	10 Credits
Unit: II	Netā: Four kinds of heroes, Three kinds of heroines, <i>sūtradhāra</i> (stage manager), <i>pāripārśvika</i> (assistant of sūtradhāra), <i>vidūṣaka</i> (jester), <i>kañcukī</i> (chamberlain), <i>pratināyaka</i> (villain).	10 Credits
Unit: III	Rasa: definition and constituents, ingredients of <i>rasa-niṣpatti</i> : - <i>bhāva</i> (emotions), <i>vibhāva</i> (determinant), <i>anubhāva</i> (consequent), <i>sāttvikabhāva</i> (involuntary state), <i>sthāyibhāva</i> (permanent states), <i>vyabhicāribhāva</i> (complementary psychological states), <i>svāda</i> (pleasure), Four kinds of mental levels : <i>vikāsa</i> (cheerfulness), <i>vistāra</i> (exaltation), <i>kṣobha</i> (agitation), <i>vikṣepa</i> (perturbation).	10 Credits

Section 'C' Tradition and History of Indian Theatre		
Unit: I	Origin and development of stage in different ages: pre-historic, Vedic age, epic-puranic age, court theatre, temple theatre, open theatre, modern theatre: folk theatre, commercial theatre, national and state level theatre.	10 Credits 8610

SANS-H-DSE-T-04 Sanskrit Linguistics		
Prescribed Course		Total 56 Credits
Section 'A'	ভাষাশাস্ত্র	56 Credits
Unit-Wise Division:		
Section 'A' ভাষাশাস্ত্র		
Unit: I	ভাষার স্বরূপ, পরিভাষা, ভাষার বৈশিষ্ট, ভাষা বিজ্ঞানের স্বরূপ, ভাষাবিজ্ঞানের মুখ্য অঙ্গ এবং উপাদেয়তা।	14 Credits
Unit: II	সংস্কৃত ভাষার আলোকে ধ্বনিবিজ্ঞান, পদবিজ্ঞান, বাক্যবিজ্ঞান এবং তার উপাদেয়তা।	14 Credits
Unit: III	সংস্কৃত এবং ভারতীয় ভাষা পরিবার	14 Credits
Unit: IV	সংস্কৃত এবং তুলনাত্মক ভাষাবিজ্ঞানের ইতিহাসে সামান্য পরিচয়।	14 Credits

Generic Elective
(Interdisciplinary)

SANS-H-GE-T-01
Basic Sanskrit

Prescribed Course:		Total 56 Credits
Section 'A'	Grammar and composition Part - I	26 Credits
Section 'B'	Grammar and composition Part – II	20 Credits
Section 'C'	Literature	10 Credits
Unit-Wise Division:		
Section 'A'		
Grammar and Composition Part I		
Unit: I	Nominative forms of pronouns- <i>asmad, yuṣmad, etat</i> and <i>tat</i> in masculine, feminine and neuter. Nominative forms of 'a' ending masculine and neuter gender nouns with <i>paṭh, khād, likh</i> and similar simple verbs in present, past and future. Objective forms of the above nouns and pronouns in singular with more simple verbs	08 Credits
Unit: II	Instrumental, dative, ablative forms of the above nouns and pronouns in singular, dual and plural instrumental, dative, ablative forms of all the words in this syllabus.	06 Credits
Unit: III	'ā' and 'ī' ending feminine words in nominative and accusative cases with <i>loṭ lakāra</i> (imperative).	04 Credits
Unit: IV	'ā' and 'ī' ending feminine nouns in singular in Genitive/ possessive and locative cases, genitive and locative cases in singular in pronouns <i>tat, etat, yat, kim</i>	02 Credits
Unit: V	Masculine and Feminine nouns ending in 'i' and masculine nouns ending in 'u' in various cases in singular	03 Credits
Unit: VI	Masculine nouns ending in consonants – <i>bhavat, guṇin, ātman</i> and Feminine nouns ending in consonants – <i>vāk</i> , Neuter nouns ending in consonants – <i>jagat, manas</i>	03 Credits
Section 'B'		
Grammar and Composition Part II		
Unit: I	Special Verb forms – <i>in parasmaipada</i> –past, present, future and imperative - <i>kr, śrū</i>	05 Credits
Unit: II	Special Verb forms – <i>in parasmaipada</i> –past, present, future and imperative <i>jñā</i> . Special Verb forms – <i>in parasmaipada</i> –past, present, future and imperative <i>dā</i> .	02 Credits
Unit: III	ātmanepada – <i>sev, labh</i>	02 Credits
Unit: IV	Phonetic changes – <i>visarga sandhi</i> vowel sandhis.	06 Credits

Unit: V	Participles - <i>śatṛ, śānac, ktavatu, kta.</i> Pratyayas – <i>ktivā, lyap, tumun.</i> Active – passive structures in <i>lakāras</i> – (third person forms only) and <i>pratyayas kta, ktavatu</i>	05 Credits
Section ‘C’ Literature		
Unit: I	Gita Chapter XII	10 Credits

SANS-H-GE-T-02		
Indian Culture and Social Issues		
Prescribed Course:		Total 56 Credits
Section 'A'	Culture in a multi-cultural Society	16 Credits
Section 'B'	Cultural Roots of India	30 Credits
Unit-Wise Division:		
Section 'A'		
Understanding Culture		
Unit: I	1. What is culture? Culture and Civilization? 2. What is 'Indian' culture? 3. Culture in a multi-cultural society?	06 Credits
Unit: II	1. Indus-Valley Civilization 2. Vedic Civilization 3. Sanskrit in Indo-Islamic tradition – (Proceedings of the Sagar University Seminar on "Islām kā Sanskrit Paramparā ko Yogadāna")	09 Credits
Unit: III	1. Versions of the Rāma legend in Sanskrit literature – Vālmīki's Rāmāyaṇa, Bhāṣā's Pratimā nāṭakam, Bhavabhūti's Uttaraārama- caritam, Rāghuvaṃśam of Kālidāsa, Somadeva's Kathāsaritsāgara, Rāmāyaṇa- mañjarī of Rājaśekhara etc. 2. Sanskrit themes in traditional dance forms in Kerala 3. Yakṣāgān 4. Gītagovinda and Odissi 5. Major agricultural and Seasonal festivals of India and the Indian Calendar – Holi, Bihu, Poṃgal, Makar-Saṃkrāntī, Lohari, Oṇam, Baisākhī, Śrāvaṇī Pūrṇimā etc.	12 Credits
Section 'B'		
Social Issues		
Unit: I	1. Law and Change – Dharma as an even evolving Phenomenon 2. Manusmṛti, Chapter 2, verses 6 and 12 with commentary of Medhātithi; 3. Lingat, Robert: Classical Law of India, Chapter 1, pp 3-7; tradition – pp 9-14 4. Mathur, A.D.: Medieval Hindu Law, Chapter I, pp 1-8	04 Credits
Unit: II	1. Caste – Voice of Challenge 2. Traditional Varṇa hierarchy 3. Vajrasūci by Aśaḡhiśa	04 Credits

<p>Unit: III</p>	<p>Identity of Women in Ancient Indian Society (6 hrs.) Draupadī's question – Mahābhārata, Sabhā-Parvan – Dyūta Pārvan Chapter 66 – Duryodhana asks Draupadī to be brought to the court 1; Vidura's protest 2, 4; Chapter 67 – Duryodhana asks Pratikāmī to fetch Draupadī 2; Draupadī's refusal and question 5-10, 16; Yudhiṣṭhira's response 39-41; Bhīṣma's response 47-49; Draupadī's Rejoinder 50-52; Vikarṇa's statement, Chapter 68, verse 12-17; Karṇa to Vikarṇa – 27-31, 35.</p>	<p>12 Credits</p>
<p>Unit: III</p>	<p>Struggle to Secure Women's right property (8hrs.) Yājñavalkya Smṛti, Vyāharāhādhyāya: Verse 135 with Vijñāneśvara's Commentary (Section on Patnī)</p>	<p>10 Credits</p>

SANS-H-GE-T-03 Ancient Indian Polity		
Prescribed Course:		Total 56 Credits
Section 'A'	Name, Scope and Origin of Ancient Indian Polity	10 Credits
Section 'B'	Types and Nature of the State	12 Credits
Section 'C'	Kingship, Council of Ministers and Assemblies	16 Credits
Section 'D'	Law and Justice, Taxation and Inter-State Relations	18 Credits
Unit-Wise Division:		
Section 'A' Name, Scope and Origin of Ancient Indian Polity		
Unit: I	Name, Scope and Sources of the Science of Polity Name of Ancient Indian Polity: <i>Danḍanīti</i> , <i>Dharmaśāstra</i> , <i>Nītiśāstra</i> ; Scope of Indian Polity: Relation with <i>Dharma</i> , <i>Artha</i> and <i>Nīti</i> ; Sources : Vedic Literature, <i>Purāṇas</i> , <i>Rāmāyaṇa</i> , <i>Mahābhārata</i> , <i>Dharmaśāstra</i> , <i>Kautilya's Arthaśāstra</i> and <i>Nīti –śāstra</i>	05 Credits
Unit: II	Origin of the State 'Danḍanīti' : Origin of State 'Danḍanīti': <i>Mātsyanyāya</i> -Theory -(<i>Arthaśāstra</i> 1.1.3, <i>Mahābhārata</i> , <i>Śānti parva</i> , 67.17-28, <i>Manusmṛti</i> , 7.20) Divinity of the King 'Rājā' – (<i>Arthaśāstra</i> , 1.9, <i>Mahābhārata</i> , <i>Śānti parva</i> , 67.43-48, <i>Manusmṛti</i> , 7.4-7)	05 Credits
Section 'B' Types and Nature of the State		
Unit: I	Types of the State : <ul style="list-style-type: none"> • <i>Rājya</i>, <i>Svarājya</i>, <i>Bhojya</i>, <i>Vairājya</i>, <i>Mahārājya</i>, <i>Sāmrajya</i> concept in <i>Aitreya Brāhmaṇa</i> (8.3.13-14 and 8.4.15-16) • Republics in Buddhist Literature (<i>Dighanikāya</i>, <i>Mahāparinibbāṇa Sūta</i>, <i>Anguttaranikāya</i>, 1.213; 4.252, 256) 	06 Credits
Unit: II	Nature of the State : With special reference to <i>Saptāṅga</i> —Theory : 1. <i>Svāmī</i> , 2. <i>Amātya</i> , 3. <i>Janapada</i> , 4. <i>Pura</i> , 5. <i>Kośa</i> , 6. <i>Daṇḍa</i> and 7. <i>Mitra</i> (<i>Arthaśāstra</i> , 6.1; <i>Manusmṛti</i> , 9.294)	06 Credits

Section 'C'		
Kingship and Council of Ministers and Assemblies		
Unit: I	Kingship and Council of Ministers: <ul style="list-style-type: none"> • Kingship :Royal Succession, Coronation Ceremony, King as a Public Servent (áukranīti,4.2.130,137), King as a Trustee(<i>Arthaśāstra</i>,10.3), • King as Upholder of the Moral Order(<i>Mahābhārata</i>, <i>Śānti parva</i>,120.1-35; <i>Manusmṛti</i>, 7.1-35); Council of Ministers :<i>Ratni Council</i> in Vedic age <i>Śatapathabrāhmaṇa</i>, 5.2.5.1); Council of Ministers in Kauṭilya's <i>Arthaśāstra</i> (1.4,1.5,1.11) and <i>Śukranīti</i>,(2.70-72) 	08 Credits
Unit: II	Central Assemblies and Local Administration: <ul style="list-style-type: none"> • Central Assembly in Vedic Literature : 'Sabhā', 'Samiti' in <i>Atharvaveda</i> (7.12.1;12.1.6) and 'Vidatha' in <i>R̥gveda</i> (10.85.26): • Town Assembly:' Paura- Janpada' in <i>Rāmāyaṇa</i> and <i>Mahābhārata</i>; • Village Council: <i>Sabhā</i>, <i>Pañcakula</i>, <i>Pañcāyata</i> 	08 Credits
Section 'D'		
Law, Justice, Taxation and Inter-State Relations		
Unit: I	Nature and Sources of Law'Dharma': Four types of Source of Law <i>Dharma</i> ':1.'Dharma', 2. <i>Vyavahāra</i> ', 3.' <i>Caritra</i> ' and 4. ' <i>Rājaśāsana</i> '; Four types of Enforcement of Law: 1. Rules of Castes ' <i>Jatidharma</i> ', 2. Local Customs' ' <i>Janapadadharmā</i> ', 3. Bye-laws of Guilds ' <i>Śreṇīdharmā</i> ' and 4. Family Traditions ' <i>Kuladharmā</i> '	04 Credits
Unit: II	Judicial administration and Courts : <ul style="list-style-type: none"> • King as Head and Fountain Sources of all Justice, Qualities of Chief Justice-'<i>Pradvivak</i>' and members of Jury-'<i>Sabhāsadaḥ</i>, (<i>Shukranīti</i>, 4.5.69-196) Two types of Royal Courts '<i>Dharmasthīya</i>' and '<i>Kaṇṭakaśodhana</i>' in <i>Arthaśāstra</i> (3.1-20) Social and local Courts situated in Villages '<i>Kula</i>', '<i>Puga</i>', '<i>Dharmaśāsana</i>'. 	04 Credits
Unit: III	Taxation Policy of State : Reasonable and Equitable Taxation Policy ' <i>Śāstranīta</i> ' permitted by <i>Dharmaśāstra</i> (<i>Mahābhārata</i> , <i>Śānti parva</i> ,71.10-25, <i>Manusmṛti</i> , 7.127, 144) ;Criticism of unlawful taxation policy in <i>Mahābhārata</i> , <i>Śānti parva</i> (87.19-18-22,88.4-7) Two Types of Tax Sources in <i>Arthaśāstra</i> -1. ' <i>Aya-sarira</i> ' and 2. ' <i>Aya-mukha</i> ' (Altekar, A.S , <i>State and Government in Ancient India</i> , pp.262 267; Sahay, Shiva Swarup, <i>Prachin Bharat ka Samajika evam Arthika Itihas</i> ,pp.456-458)	05 Credits

Unit: IV	Inter-State Relations of State: Brief survey of 'Manḍala' Theory of Inter-State Relations; Principles and means of Diplomacy : 1.Sāma 2.Dāma,3 Daṇḍa.4.Bheda; Diplomacy of War and Peace –'Ṣāḍgūṇya theory:1.Sandhi, 2.Vigraha, 3.Yāna, 4.Āsana, 5.Sanśraya and,6.Dvaidhībhāva (Altekar, A.S , <i>State and Government in Ancient India</i> , pp.291- 308; Satyaketu Vidyalankar, <i>Prachin Bharatiya Shasana Vyavastha aur Rajashastra</i> , pp.363-376)	05 Credits
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SANS-H-GE-T-04		
Fundamentals of Indian Philosophy		
Prescribed Course:		Total 56 Credits
Section 'A'	General Introduction	10 Credits
Section 'B'	Schools of Indian Philosophy	30 Credits
Section 'C'	Problems in Indian Philosophy	16 Credits
Unit-Wise Division:		
Section 'A'		
Fundamentals of Philosophy		
Unit: I	Darśana - concept and aims, Classification of Indian Philosophical schools,	05 Credits
Unit: II	Salient features of Indian Philosophy	05 Credits
Section 'B'		
Schools of Indian Philosophy		
Unit: I	Heterodox Schools Cārvāka – General introduction with emphasis on Chanllenge to Veda, Rejection of Transcendental Entities, Ethics (Based on <i>Sarvadarshansamgraha</i>) Jainism – General introduction with emphasis on Anekāntavāda, Syādvāda, Saptabhaṅginaya, triratna	06 Credits
Unit: II	Orthodox Schools of Philosophy Sāṃkhya – General Introduction with emphasis on prakṛti, guṇatraya & puruṣa Entities (Based on Sāṃkhyakārikā) Yoga - Eight fold path of Yoga (Based on Yogasūtra Sādhanapāda and <i>Yogabhāṣya thereon</i>)	06 Credits
Unit: III	Nyāya –General introduction with emphasis on Vaiśeṣika : Seven Padārthas (Based on <i>Tarksamgrah</i>)	06 Credits
Unit: IV	Advaita Vedānta – General introduction with emphasis a Brahman, Māyā, Jīva and Jagat (Based on <i>Vedāntasāra</i>)	04 Credits
Unit: V	Mīmāṃsā - Svataḥ Prāmāṇyavāda	04 Credits
Unit: VI	Bhakti Schools of Vedānta – General introduction with emphasis on God, Īśvara & nature of bhakti	04 Credits
Section 'C'		
Problems in Indian Philosophy		
Unit: I	Epistemology : six pramāṇas	05 Credits
Unit: II	Metaphysics : realism, idealism, Causation - Satkāryavāda. Asatkāryavāda, Pariṇāmavāda, Vivartavāda, svabhāvavāda, consciousness and matter, theories of self	06 Credits
Unit: III	Ethics : Karma & Punarjanma theory, Liberation	05 Credits

Skill Enhancement Course

SANS-H-SEC-T-01		
Evolution of Indian Scripts		
Prescribed Course:		Total 28 Credits
Section 'A'		14 Credits
Section 'B'		14 Credits
Unit-Wise Division		
Section 'A'		
Unit: I	1. Antiquity of writing in India 2. Early Brāhmī and Kharoshthi Scripts 3. Development of Devanāgarī Scripts 4. Development of Eastern Indian Scripts with Special Reference to Bengali and Odia	14 Credits
Section 'B'		
Unit: I	1. Types/Kinds of the Brāhmī script by 400 A.D. 2. Transition to early modern Indian scripts 3. Causes of variation in the Brāhmī script	14 Credits

SANS-H-SEC-T-02		
Acting, Script Writing & Sanskrit Meter		
Prescribed Course:		Total 28 Credits
Section 'A'	Acting (<i>Abhinaya</i>)	10 Credits
Section 'B'	Script Writing (<i>Paṭakathālekhana</i>)	08 Credits
Section 'C'	Brief Introduction to <i>Chhandahśāstra</i>	02 Credits
Section 'D'	Analysis of Selected Classical Meters and their musical rendering	08 Credits
Unit-Wise Division:		
Section 'A'		
Acting (<i>Abhinaya</i>)		
Unit: I	A) Persons competent for presentation (acting): <i>kuśala</i> (skilful), <i>vidagdha</i> (learned), <i>pragalbha</i> (bold in speech), <i>jitaśramī</i> (inured to hard) B) <i>Lokadharmī</i> and <i>Nāṭyadharmī Abhinaya</i> C) <i>Nāṭya-prayoktā-gaṇa</i> (members of theatrical group): <i>sūtradhāra</i> (director), <i>nāṭyakāra</i> (playwriter), <i>naṭā</i> (actor), <i>kuśīlava</i> (musician), <i>bharata</i> , <i>nartaka</i> (dancer), <i>vidūṣaka</i> (jester) etc.	05 Credits
Unit II	A) Special cases of assigning of role: i) Kinds of roles: <i>anurūpa</i> (natural), <i>virūpa</i> (unnatural), <i>rūpānusariṇī</i> (imitative) B) Definition of <i>abhinaya</i> and its types: i) <i>Āṅgika</i> (gestures): <i>aṅga</i> , <i>upāṅga</i> and <i>pratyāṅga</i> ii) <i>Vācika</i> (oral): <i>svara</i> , <i>sthāna</i> , <i>varṇa</i> , <i>kāku</i> , <i>bhāṣā</i> iii) <i>Sāttvika</i> (representation of the Involuntary gestures) iv) <i>Āhārya</i> : <i>pusta</i> , <i>alaṅkāra</i> , <i>aṅgaracanā</i> , <i>sañjīva</i> (dresses and make-up)	05 Credits
Section 'B'		
Script Writing		
Unit I	A) Types of dramatic production: <i>sukumāra</i> (delicate), <i>āviddha</i> (energetic). B) Nature of plot (<i>vastu</i>): <i>ādhikārika</i> (principal), <i>prāsaṅgika</i> (subsidiary), <i>dṛśya</i> (presentable), <i>sūcya</i> (restricted scenes). C) Division of Plot: <i>prakhyāta</i> (legendary), <i>utpādya</i> (invented), <i>miśra</i> (mixed)	04 Credits
Unit II	A) Elements of plot – five kinds of <i>Arthaprakṛtis</i> (causations), <i>Kāryāvasthā</i> (stages of the action of actor), <i>Sandhis</i> (junctures) and their sub-divisions (segments), Five kinds of <i>Arthopakṣepaka</i> (interludes) B) Dialogue writing: Kinds of <i>saṃvāda</i> (dialogue)	02 Credits

	i) <i>sarvaśrāvya</i> or <i>prakāśa</i> (aloud) ii) <i>aśrāvya</i> or <i>svagata</i> (aside) iii) <i>niyataśrāvya</i> : <i>janāntika</i> (personal address), <i>apavārita</i> (confidential)	
Unit III	A) Duration of the play B) Three Unities: Time, Actions and Place C) Starting of the play: <i>pūrvaraṅga - raṅgāvatāra, nāndī, prastāvanā, prarocanā.</i> D) Analysis of acting, plot and dialogue in the context of <i>Abhijñānaśākuntalam</i>	02 Credits
Section ‘C’ Brief introduction to <i>Chandaśāstra</i>		
Unit: I	Brief Introduction to Chhandaśāstra	02 Credits
Section ‘D’ Analysis of Selected Classical Meter		
Unit: I	Definition, Example and Analysis of following Meters: <i>bhujāṅgaprayāta, sragviṇī, toṭaka, hariḡitīkā, vidyunmālā, anuṣṭupa, āryā, mālinī, śikhariṇī, vasantatilakā, mandākrāntā, sragdharā</i> and, <i>śārdūlavikrīta</i>	08 Credits

Choice Based Credit System (CBCS)

UNIVERSITY OF KALYANI (General Syllabus)

DEPARTMENT OF SANSKRIT

UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2018-19)



SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching-learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point

Average (CGPA) based on student's performance in examinations; the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - 2.1 **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - 2.2 **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
 - 2.3 **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course: The Ability Enhancement (AE) Courses may be of two kinds: AE

Compulsory Course (AECC) and AE Elective Course (AEEC). “AECC” courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1 AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.

3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving /analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

A. TOTAL Number of courses in UG-CBCS (B.A./B.Sc./B.Com. GENERAL):

Types of course	Core course (CC)	Elective course		Ability Enhancement Course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course(AECC)	Skill Enhancement course (SEC)	
No. of course	12	4(BA/B.Com)	2((BA/B.Com)	2	4	24
Credit/course	6	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.A./ B.SC./ B.COM.(GENERAL) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practicl	Theory + Tutoril
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (12 papers)	12x4 = 48	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x2 = 24	12x1 = 12
2.	Elective Courses: (6 papers)		
A.	DSE (6 papers for B.Sc./ 4 papers for B.A. & B.Com.)	6x4 = 24	4x5 = 20
B.	DSE (Pract./ Tutor.)* (6 papers for B.Sc./4 for B.A. & B.Com.)	6x2 = 12	4x1 = 4
C.	GE (Interdisciplinary) (2 papers for B.A. & B.Com.)	--	2x5 = 10
D.	GE (Pract./Tutor.)* (4 papers) (2 papers for B.A. & B.Com.)	--	2x1 = 2
#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester			
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication / MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (4 papers of 2 credits each)-----	4x2 = 8	4x2 = 8
Total Credit:		120	120
## Wherever there is a practical, there will be no tutorial and vice-versa.			

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.A./B.COM. GENERAL

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-VI	Total No. of Courses	Total credit
CC-1,2 (6)	2(1A,2A)	2(1B,2B)	2 (1C,2C)	2 (1D,2D)			8	48
Language CC - 1,2 (6)	1 (L1-1)	1 (L2-1)	1 (L1-2)	1 (L2-2)			4	24
DSE (6)	-	-	-	-	2(1A,2A)	2 (1B,2B)	4	24
GE (6)					1(GE-1)	1(GE-2)	2	12
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Courses/ Sem.	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

❖ **COURSE CODE & COURSE TITLE:**

❖ *Each paper of any course denoted by-(2-4 letters Subject Code--Honours/General (H/G)--Course Type(CC/GE/DSE)-(Theory/Tutorial/Practical)-Number of course. Ex.-Chemistry-CHEM-H-CC-T-1)*

A. Core courses (CC)

01.	SANS-G-CC-T-01	Classical Sanskrit Literature (Poetry)
02.	SANS-G-CC-T-02	Classical Sanskrit Literature (Prose)
03.	SANS-G-CC-T-03	Classical Sanskrit Literature (Drama)
04.	SANS-G-CC-T-04	Sanskrit Grammar

B. Discipline specific elective courses (DSE)

01.	SANS-G-DSE-T-01	Philosophy, Religion and Culture in Sanskrit Tradition
02.	SANS-G-DSE-T-02	Indian Perspectives in Personality Development
03.	SANS-G-DSE-T-03	Literary Criticism
04.	SANS-G-DSE-T-04	Nationalism in Sanskrit Literature

C. Generic elective courses (GE):

01.	SANS-G-GE-T-01	Political Thought in Sanskrit
02.	SANS-G-GE-T-02	Nationalistic Thought in Sanskrit Literature

D. Ability enhancement compulsory courses (AECC)

01.	SANS-G-AECC-T-01	As per University
02.	SANS-G-AECC-T-02	As per University

E. Skill enhancement courses (SEC)

01.	SANS-G-SEC-T-01	Evolution of Indian Scripts
02.	SANS-G-SEC-T-02	Basic Elements of Āyurveda
03.	SANS-G-SEC-T-03	Yogasūtra of Patañjali
04.	SANS-G-SEC-T-04	Indian Theatre

**TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN B.A./B.COM/B.SC.(GENERAL)
(6 Credit: 75 Marks)**

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
SANS-G-CC-T-01	Classical Sanskrit Literature (Poetry)	T	06
2A	As prescribed by the University	T	06
1 (L ₁ -1)	As Prescribed by the University	T	06
AECC - 01	As Prescribed by the University	T	02
Total	4 courses	Total	20

SEMESTER-II			
Course Code	Course Title	Course wise Class	Credit
SANS-G-CC-T-02	Classical Sanskrit Literature (Prose)	T	06
2B	As prescribed by the University	T	06
1 (L ₂ -1)	As Prescribed by the University	T	06
AECC -02	As Prescribed by the University	T	02
Total	4 courses	Total	20

SEMESTER-III			
Course Code	Course Title	Course wise Class	Credit
SANS-G-CC-T-03	Classical Sanskrit Literature (Drama)	T	06
2C	As prescribed by the University	T	06
1 (L ₁ -2)	As Prescribed by the University	T	06
SANS-G-SEC- T-01	Evolution of Indian Scripts	T	02
Total	4 courses	Total	20

SEMESTER-IV			
Course Code	Course Title	Course wise Class	Credit
SANS-G-CC-T-04	Sanskrit Grammar	T	06
2D	As prescribed by the University	T	06
1 (L ₂ -2)	As Prescribed by the University	T	06
SANS-G-SEC- T-02	Basic Elements of Āyurveda	T	02
Total	4 courses	Total	20

SEMESTER-V			
Course Code	Course Title	Course wise Class	Credit
SANS-G-DSE-T-01	Philosophy, Religion and Culture in Sanskrit Tradition	T	06
SANS-G-DSE-T-02	Indian Perspectives in Personality Development	T	06
SANS-G-GE-T-01	Political Thought in Sanskrit	T	06
SANS-G-SEC-T-03	Yogasūtra of Patañjali	T	02
Total	4 courses	Total	20

SEMESTER-VI			
Course Code	Course Title	Course wise Class	Credit
SANS-G-DSE-T-03	Literary Criticism	T	06
SANS-G-DSE-T-04	Nationalism in Sanskrit Literature	T	06
SANS-G-GE-T-02	Nationalistic Thought in Sanskrit Literature	T	06
SANS-G-SEC-T-04	Indian Theatre	T	02
Total	4 courses	Total	20
Total (All semesters)	24 courses	Total	120

**Detail Course & Contents of each subject specific syllabus will be given as per standard format as provided below.*

	CORE COURSE (12)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (4)	Discipline Specific Elective (DSE) (4)	Generic Elective GE (2)
I	English/MIL-1	(English/MIL Communication) / Environmental Science			
	DSC- 1 A				
	DSC- 2 A				
II	MIL/English-1	Environmental Science/ (English/MIL Communication)			
	DSC- 1 B				
	DSC- 2 B				
III	English/MIL-2		SEC -1		
	DSC- 1 C				
	DSC- 2 C				
IV	MIL/English-2		SEC -2		
	DSC- 1 D				
	DSC- 2 D				
V			SEC -3	DSE-1 A	GE-1
				DSE-2 A	
VI			SEC -4	DSE-1 B	GE-2
				DSE-2 B	

Core Papers (04 of 12)	
B.A. (General) Sanskrit [06 Credits Each]	
Semester: I	Semester: II
SANS-G-CC-T-01 Classical Sanskrit Literature (Poetry)	SANS-G-CC-T-02 Classical Sanskrit Literature (Prose)
Semester: III	Semester: IV
SANS-G-CC-T-03 Classical Sanskrit Literature (Drama)	SANS-G-CC-T-04 Sanskrit Grammar
Discipline Specific Elective (DSE)	
B.A. (General.) Sanskrit [06 Credits Each]	
Semester: V	
SANS-G-DSE-T-01 Philosophy, Religion and Culture in Sanskrit Tradition	SANS-G-DSE-T-02 Indian Perspectives in Personality Development
Semester: VI	
SANS-G-DSE-T-03 Literary Criticism	SANS-G-DSE-T-04 Nationalism in Sanskrit Literature
Generic Elective (GE)	
B.A. (General) Sanskrit [06 Credits Each]	
Semester: V	Semester: VI
SANS-G-GE-T-01 Political Thought in Sanskrit	SANS-G-GE-T-02 Nationalistic Thought in Sanskrit Literature
Skill Enhancement Course(SEC)	
B.A. (General) Sanskrit [02 Credits Each]	
Semester III	Semester IV
SANS-G-SEC-T-01 Evolution of Indian Scripts	SANS-G-SEC-T-02 Basic Elements of Āyurveda
Semester V	Semester VI
SANS-G-SEC-T-03 Yogasūtra of Patañjali	SANS-G-SEC-T-04 Indian Theatre

Detail Course
B.A. (General Sanskrit)
Core Course

SANS-G-CC-T-01		
Classical Sanskrit Literature (Poetry)		
Prescribed Course:		Total 48 Credits
Section 'A'	<i>Raghuvamśam</i> : Canto-I (Verse: 1-25)	12 Credits
Section 'B'	<i>Kirātārjunīyam</i> : Canto I (1-25 Verses)	12 Credits
Section 'C'	<i>Nītiśatakam</i> (1-20 Verses, 1st two Paddhatis)- M. R. Kale Edition	12 Credits
Section 'D'	History of Sanskrit Poetry	12 Credits
Unit-Wise Division:		
Section 'A'		
<i>Raghuvamśam</i>: Canto-I (Verse: 1-25)		
Unit: I	<i>Raghuvamśam</i> : Introduction (Author and Text), Appropriateness of title, Canto I, 1-10 Grammatical analysis, Meaning/translation, Explanation, content analysis, Characteristics of Raghu Clan.	06 Credits
Unit: II	<i>Raghuvamśam</i> : Canto I (Verses 11-25) grammatical analysis, Meaning/translation, Explanation, Role of Dilīpa in the welfare of subjects.	06 Credits
Section 'B'		
<i>Kirātārjunīyam</i> - Canto I (1-25 Verses)		
Unit: I	<i>Kirātārjunīyam</i> : Introduction (Author and Text), Appropriateness of title, Background of given contents, Canto I Verses 1-16, Grammatical analysis, Translation, Explanation, Poetic excellence, thematic analysis.	06 Credits
Unit: II	<i>Kirātārjunīyam</i> : Verses 17-25, Grammatical analysis, Translation, Explanation, Poetic excellence, thematic analysis.	06 Credits

Section 'C'		
Nītiśatakam (1-20 Verses, 1st two Paddhatis)-M. R. Kale Edition		
Unit: I	<i>Nītiśatakam</i> : Verses (1-10) Grammatical analysis Translation, explanation.	06 Credits
Unit: II	<i>Nītiśatakam</i> : Verses (11-20) Grammatical analysis Translation, explanation, thematic analysis Bhartṛhari's comments on society.	06 Credits
Section 'D'		
History of Sanskrit Poetry		
Unit: I	<i>Aśvaghōṣa, Kālidāsa, Bhāravi, Māgha, Śrīharṣa,</i> <i>Jayadeva, Bhartṛhari</i> and their works.	06 Credits
Unit: II	Origin & Development of Different types of Mahākāvyas and Gītikāvyas with special reference to the following poets and their works <i>Kālidāsa, Bilhaṇa, Jayadeva, Amarūk, Bhartṛhari</i> <i>and their works.</i>	06 Credits

SANS-G-CC-T-02		
Classical Sanskrit Literature (Prose)		
Prescribed Course:		Total 48 Credits
Section 'A'	<i>Śukanāśopadeśa</i>	20 Credits
Section 'B'	<i>Viśrutacaritam</i> upto 15 th Para	16 Credits
Section 'C'	Survey of Sanskrit Literature – Prose	12 Credits
Unit-Wise Division:		
Section 'A'		
<i>Śukanāśopadeśa</i>		
Unit: I	Introduction- Author/Text, Text up to page 116 of Prahlad Kumar upto यथा यथा चेयं चपला दीप्यते समाप्तिपर्यन्त (up to the end of the text)	14 Credits
Unit: II	Society and political thought depicted in <i>Śukanāśopadeśa</i> , logical meaning and application of sayings like बाणोच्छिष्टं जगत्सर्वम्, वाणी बाणो बभूव, पञ्चाननो बाणः etc.	06 Credits
Section 'B'		
<i>Viśrutacaritam</i> Upto 15th Paragraph		
Unit: I	Para 1 to 10 – Introduction – Author, Text, Text reading (Grammar, Translation, and Explanation), Poetic excellence, plot, Timing of Action.	08 Credits
Unit: II	Para 11 to 15 – Text reading (grammar Translation, and Explanation), Poetic excellence, plot, Timing of Action, Society, Language and Style of Daṇḍin. Exposition of saying दण्डिणः पदलालित्यम्, कविर्दण्डी कविर्दण्डी कविर्दण्डी न संशयः।	08 Credits
Section 'C'		
Survey of Sanskrit Literature: Prose		
Unit: I	Origin and development of prose and important prose romances <i>Subandhu, Bāṇa, Daṇḍin, Ambikādatta Vyāsa.</i>	06 Credits
Unit: II	<i>Pañcatantra, Hitopadeśa, Vetālapañcaviṃśatikā, Śiṃhāsanadvātriṃśikā</i> and <i>Purūṣaparīkṣā.</i>	06 Credits

SANS-G-CC-T-03		
Classical Sanskrit Literature (Drama)		
Prescribed Course:		Total 48 Credits
Section 'A'	<i>Svapnavāsavadattam</i> - Bhāsa Act I & VI	14 Credits
Section 'B'	Abhijñānaśākuntalam- Kālidāsa Act I & IV	16 Credits
Section 'C'	Technical Terms from Sanskrit Dramaturgy	06 Credits
Section 'D'	History of Sanskrit Drama and an Introduction to Principal of Sanskrit Dramas	12 Credits
Unit-Wise Division:		
Section 'A'		
<i>Svapnavāsavadattam</i> - Bhāsa Act I & VI		
Unit: I	<i>Svapnavāsavadattam</i> : Act I& VI Story, Meaning/Translation and Explanation.	07 Credits
Unit: II	<i>Svapnavāsavadattam</i> : Unique features of Bhāsa's style, characterization, importance of 1st and 6 th Act, society, Norms of Marriage, Story of 'regains'. <i>Bhaso hāso</i>	07 Credits
Section 'B'		
Abhijñānaśākuntalam – Kālidāsa Act IV		
Unit: I	Act I (a) Introduction, Explanation of term like <i>nāndī</i> , <i>prastavānā</i> , <i>sūtradhāra</i> , <i>nāṭī</i> , <i>viṣkambhaka</i> , <i>vidhūṣaka</i> and <i>kañcukī</i> (b) Text Reading (Grammar, Translation, Explanation), Poetic excellence, Plot, Timing of Action. Personification of nature	08 Credits
Unit: II	<i>kāvyeṣu nāṭakam ramyam</i> , <i>upamā</i> , Language of Kālidāsa, <i>dhvani</i> in Kālidāsa, Purpose and design behind <i>Abhijñānaśākuntalam</i> and other problems related to the text.	08 Credits
Section 'C'		
Technical Terms from Sanskrit Dramaturgy		
Unit: I	नाटक, नायक, नायिका, पूर्वरङ्ग, नान्दी, सूत्रधार, नेपथ्य, प्रस्तावना, कञ्चुकी एवं विदूषक।	03 Credits
Unit: II	अङ्क, स्वगत, प्रकाश, अपवारित, जनान्तिक, आकाशभाषित, विष्कम्भक, प्रवेशक एवं भरतवाक्य	03 Credits

Section 'D'		
History of Sanskrit Drama and an Introduction to Principle Sanskrit Drama		
Unit I	Origin and Development	06 Credits
Unit II	Some important dramatists and dramas: Bhāsa, Kālidāsa, Śūdraka, Viśākhadatta, Harṣa, Bhavabhūti, and their works.	06 Credits

SANS-G-CC-T-04		
Sanskrit Grammar		
Prescribed Course:		Total 48 Credits
Section 'A'	Laghusiddhāntakaumudī : Saṃjñā prakaraṇa	08 Credits
Section 'B'	Laghusiddhāntakaumudī : Sandhi prakaraṇa	20 Credits
Section 'C'	Laghusiddhāntakaumudī : Vibhakti prakaraṇa	20 Credits
Unit-Wise Division:		
Section 'A'		
Laghusiddhāntakaumudī : Saṃjñā prakaraṇa		
Unit: I	<i>Saṃjñā Prakaraṇa</i>	08 Credits
Section 'B'		
Laghusiddhāntakaumudī : Sandhi Prakaraṇa		
Unit: I	<i>ac sandhi: yaṅ, guṇa, dīrgha, ayādi, vṛddhi and pūrvarūpa.</i>	08 Credits
Unit: II	<i>hal sandhi: ścutva, ṣṭutva, anunāsikatva, chhatva and jaśtva</i>	08 Credits
Unit: II	<i>visarga sandhi: utva, lopa, satva and rutva</i>	08 Credits
Section 'C'		
Laghusiddhāntakaumudī: Vibhaktyartha Prakaraṇa		
Unit: I	Vibhaktyartha Prakaraṇa	20 Credits

Discipline Specific Elective Course (DSE)

SANS-G-DSE-T-01

Philosophy, Religion and Culture in Sanskrit Tradition

Prescribed Course:		Total 48 Credits
Section 'A'	Dharma	20 Credits
Section 'B'	Saṃskāra and Puruṣārtha	14 Credits
Section 'C'	Svadharmā	14 Credits
Unit-Wise Division:		
Section 'A'		
Dharma		
Unit: I	Form of God, Mode of worship, Bhakta as a morally evolved person - Gita Chapter XII	07 Credits
Unit: II	<i>Dharma</i> – ten-fold <i>dharma</i> and its versions, definitions of <i>satya</i> , <i>ahiṃsā</i> , <i>asteya</i> , <i>aparigraha</i> , <i>pañcha mahāyajña</i> ; theory of three debts.	06 Credits
Unit: III	Man's initiative and God's design; God's <i>līlā</i> and <i>Kṛpā</i> , Daiva versus puruṣakāra, adṛṣṭa, three types of <i>karma</i> – saṃchita, kriyamāṇa and prārabdha karma.	07 Credits
Section 'B'		
Saṃskāra and Puruṣārtha		
Unit: I	Process of acculturation – importance of <i>Saṃskāra</i> .	07 Credits
Unit: II	Aim of human life – theory of Puruṣārtha.	07 Credits
Section 'C'		
Svadharmā		
Unit: I	An 'amoral' person – <i>svadharmā</i> and <i>karmayoga</i> , <i>sthita prajña</i> in the <i>Gita</i> (Chapter II).	07 Credits
Unit: II	<i>Prakṛti</i> – three <i>guṇas</i> and their impact on personality.	07 Credits

SANS-G-DSE-T-02		
Indian Perspectives in Personality Development		
Prescribed Course:		Total 48 Credits
Section 'A'	Historical Perspective	04 Credits
Section 'B'	Concept of a person	20 Credits
Section 'C'	Personality Types	04 Credits
Section 'D'	Measures for behavioral Improvement	20 Credits
Unit-Wise Division:		
Section 'A'		
Historical Perspective		
Unit: I	Historical Perspective : <i>Ṛgveda</i> , 1.164.37; <i>Chāndogyopaniṣad</i> , VI. 2.3, VI.8.6, VIII.1.4 <i>Bṛhadāraṇyakopaniṣad</i> , II.5.18-19	04 Credits
Section 'B'		
Concept of a person		
Unit: I	Concept of a person, <i>Gītā</i> , Chapter: 1, Verses:1-30 <i>Jīva</i> as Core and Eight-fold Nature as Cover <i>Kṣetrajña</i> as Core and <i>Kṣetra</i> as Cover Chapter-13, Verses-1-2, Chapter-13, Verses: 5-6, Chapter-13, Verses-19-23. <i>Akṣara</i> as Core and <i>Kṣara</i> as Cover, Chapter-15, Verses: 7-11 and 6-19).	20 Credits
Section 'C'		
Personality Types		
Unit: I	Personality Types: <i>Gītā</i> , Chapter-14, Verses:5-14, Chapter-17, Verses:2-6, Chapter-17, Verses:11.21	04 Credits
Section 'D'		
Measures for behavioral Improvement		
Unit: I	Measures for behavioral Improvement: Control of Senses and Mind (<i>Gītā</i> : Chapter-2, Verses: 59-60, 64 and 68, Chapter:3, Verses:41-43, Chapter: 6, Verses:19-23. Right Faith (<i>Gītā</i> , Chapter: 9, Verses:3, 22, 23-28, 30-34). Recognition of Svadharma - Inner Urge; (<i>Gītā</i> , Chapter: 2, Verses:31,41-44, Chapter: 3, Verses:4, 5, 8, 9, 27-30, 33-34, Chapter:4, Verses:18-22, Chapter:5, Verses:11-12, Chapter:7, Verses:15, 18, 20- 23, 27-29) Channelizing Innate Urges on Social Lines: (<i>Gītā</i> , Chapter:18, Verses:41-62)	20 Credits

SANS-G-DSE-T-03
Literary Criticism

Prescribed Course:		Total 48 Credits
Section 'A'	Kāvya Prakāśa: Kāvya vaiśiṣṭya and Kāvya Prayojana	20 Credits
Section 'B'	Kāvya Prakāśa: Kāvya Kāraṇa	12 Credits
Section 'C'	Kāvya Prakāśa: Kāvya Svarūpa and Kāvyaabheda	16 Credits
Unit-Wise Division:		
Section 'A' Kāvya Prakāśa: Kāvya Vaiśiṣṭya and Kāvya Prayojana		
Unit: I	Kāvya Prakāśa: Kāvya Vaiśiṣṭya and Kāvya Prayojana	20 Credits
Section 'B' Kāvya Prakāśa: Kāvya Kāraṇa		
Unit: I	Kāvya Prakāśa: Kāvya Kāraṇa	12 Credits
Section 'C' Kāvya Prakāśa: Kāvya Svarūpa and Kāvyaabheda		
Unit: I	Kāvya Prakāśa: Kāvya Svarūpa and Kāvyaabheda	16 Credits

SANS-G-DSE-T-04		
Nationalism in Sanskrit Literature		
Prescribed Course:		Total 48 Credits
Section 'A'	Concepts and Basic Features of Indian Nationalism	16 Credits
Section 'B'	Name of Country, National Symbols and Rise of Nationalism	16 Credits
Section 'C'	Nationalistic Thought and Modern Sanskrit Literature	16 Credits
Unit-Wise Division:		
Section 'A'		
Concepts and Basic Features of Indian Nationalism		
Unit: I	Meaning, Definitions and Elements of Indian Nation 'Rāṣṭra': Meaning of Nation, Definitions and Constituent Elements of Nation in Western Perspective. Indian Concept of Nation: 'Raṣṭra', Meaning, Etymology and Definitions, Essential Elements of 'Rāṣṭra' in Sanskrit Literature (Atharva-veda, 11.9.17; 12.1, 1-12 Sukla Yajurveda, 22.22) 'Rāṣṭra' in the Context of 'Saptāṅga' Theory of State (Kauṭilya's Arthaśāstra, 6.1, Mahābhārata, Śāntiparva, 56.5; Śukranīti, 1.61-62)	08 Credits
Unit: II	Meaning, Definitions and Elements of Indian Nationality: Meaning of Nationality, Definitions and Constituent Elements of Nationality, Essential Factors of Nationality: National Integration, Patriotism, Freedom, Religious Tolerance, National Pride, National Consciousness and Citizenship. Special Features of Indian Nationalism: Social Harmony (Sāmājika Samarsata), Equality of the Religions, International Brotherhood, Unity in Diversity and Cultural Consciousness.	08 Credits
Section 'B'		
Name of Country, National Symbols and Rise of Nationalism		
Unit: I	Name of the Country 'Bharatavarsha' and National Symbols: Different views regarding name of 'Bharatavarsha' in Vedic and Pauranic Literature, National Symbols of India: National Anthem-'Jana Gana Mana', National Song-'Vande Mataram', National Flag of India, National Emblem 'Ashok Chakra', National Calendar of India 'Śaka Samvat'.	08 Credits

Unit: II	<p>Rise of Indian Nationalism and Freedom Struggle Movement: Major Factors which led to the rise of nationalist sentiments in modern period with special reference to Western Thought and Education, Rediscovery of India's Past, Socio-religious reform movements and Impact of contemporary national movements worldwide. Brief survey of Socio-religious nationalistic thought of modern India with special reference to Raja Ram Mohan Rai, Swami Dayanand Saraswati, Swami Vivekanand, Bankim Chandra Chatopadhyay, Mahatma Gandhi, Madan Mohan Malaviya, Vir Savarkar and Dr. B.R.Ambedkar.</p>	08 Credits
<p>Section 'C' Nationalistic Thought and Modern Sanskrit Literature</p>		
Unit: I	<p>Contributions of Sanskrit Literature to Freedom Struggle Movement: Survey of nationalistic trends in modern Sanskrit literature before Independence; Survey of nationalistic trends in modern Sanskrit literature after Independence.</p>	09 Credits
Unit: II	<p>Modern Nationalistic Thought and Gandhian Sanskrit Literature: Social, political and religious background of Gandhian Thought with special reference to 'Grama Svaraja' (Local Self Government), 'Satyāgraha' (Truth Fullness), 'Ahiṃsā' (Non Violence), 'Prajātantra' (People's Democracy) and 'Dhārmika Sahisnuta' (Religious Tolerance). Contemporary Sanskrit Literature on Gandhian Thought with special reference to 'Satyagrahagita' of Pandita Ksamarava, 'Bhāratavijayanātakam' of Mathura Priṣad Dikshita, 'Gandhicaritam' of Charudeva Shastri, 'Gandhi Gita' of Prof. Indra.</p>	07 Credits

Generic Elective

SANS-G-GE-T-01		
Political Thought in Sanskrit		
Prescribed Course:		Total 48 Credits
Section 'A'	Basic Features of Ancient Indian Political Thought	20 Credits
Section 'B'	Ancient Indian Political Thought : Origin and Development	14 Credits
Section 'C'	Cardinal Theories and Ancient Indian Political Thinkers	14 Credits
Unit-Wise Division:		
Section 'A'		
Basic Features of Ancient Indian Political Thought		
Unit: I	Name, Scope and Sources of Ancient Indian Political Thought: Name of the Science: 'Dananīti', 'Dharmaśāstra', 'Nītiśāstra'. Scope of Indian Political Thought: relation with Dharma, Artha and Nīti; Sources of Ancient Indian Political Thought :Vedic Literature, Purāṇa, Rāmāyaa, Mahābhārata, Dharmaśāstra, Nītiśāstra Kautilya's Arthaśāstra and Rajaśāsana (Inscriptions).	10 Credits
Unit: II	Nature, Types and Theories of the State: Nature of the State in Arthaśāstra (6.1) and Manusmṛti (9.294) with Special reference to Saptāṅga-Theory: Svāmi, Amātya, Janapada, Pura, Kośa, Daṇḍa and Mitra. Types of the State: Rājya, Svarājya, Bhojya, Vairājya, Mahārājya, Sāmarājya (Aitreya Brāhmaṇa, 8.3.13-14; 8.4.15-16).	10 Credits
Section 'B'		
Ancient Indian Political Thought: Origin and Development		
Unit: I	Indian Political Thought from Vedic Period to Buddhist Period: Election of King by the People' Visas 'in Vedic period: (Ṛgveda,10.173;10.174, Atharvaveda,3.4.2; 6.87.1-2), Parliamentary Institutions: 'Sabhā', 'Samiti' and 'Vidatha' in Vedic period (Atharvaveda, 7.12.1;12.1.6 ; Ṛgveda, 10.85.26), King-maker Council: 'Rajakartarah' and 'Ratnis' in Vedic period (Atharvaveda, 3.5.6-7 and Śatapathabrahmaa, 5.2.5.1); Coronation Ceremony of the King	06 Credits

	‘Samrāṭa’ (Śatapathabrāhmaa, 51.1.8- 13; 9.4.1.1-5) Republics in the Buddhist Period (Diggnikāya, Mahāparinibbāa Sūta, Anguttaranikāya, 1.213;4.252,256)	
Unit II	Indian Political Thought from Kauṭilya to Mahatma Gandhi: Kauṭilya’s concept of Welfare State (Arthaśāstra, 1.13); Essential Qualities of King (Arthaśāstra, 6.1.16-18); Duties of King and State ‘Rajadharma’ (Mahābhārata, Śāntiparva, 120.1-15; Manusmṛti, 7.1-15; Śukranīti, 1.1-15) Constituent Elements of Jain political thought (Somadeva’s Nītivākyāmṛta, 9.1.18 and, 19.1.10); Relevance of Gandhian political thoughts in modern period (Gandhi Gītā of Prof. Indra, 5.1-25)	08 Credits
Section ‘C’		
Cardinal Theories and Ancient Indian Political Thinkers		
Unit: I	Cardinal Theories of Indian Political Science: ‘Saptāṅga’ Theory of State: Svāmī, Amātya, Janapada, Pura, Kośa, Daṇḍa and Mitra (Arthaśāstra- 6.1, Mahābhārata-Śāntiparva-56.5, Śukranīti, 1.61- 62). ‘Maṇḍala’ Theory of Inter-State Relations: ‘Sādḡṇuya’ Policy of War and Peace Diplomacy: Sandhi, Vighraha, Yāna, Āsana, Sanśraya and Dvaidhībhāva. ‘Caturvidha Upāya’ for balancing the power of State: Śāma, Dāma, Daṇḍa, Bheda. Three types of State power ‘Śakti’: Prabhu Śakti, Mantra Śakti, Utsāha Śakti.	08 Credits
Unit: II	Prominent Indian Political Thinkers: Manu, Śukrācārya, Kauṭilya, Kāmandaka, Somadeva Suri and Mahatma Gandhi.	06 Credits

SANS-G-GE-T-02		
Nationalistic Thought in Sanskrit Literature		
Prescribed Course:		Total 48 Credits
Section 'A'	Definitions, Concepts of Nation and Indian Nationalism	16 Credits
Section 'B'	Nationalistic Thought in Vedic and Classical Literature	16 Credits
Section 'C'	Nationalistic Thought in Modern Sanskrit Poetry	16 Credits
Unit-Wise Division:		
Section 'A'		
Definitions, Concepts of Nation and Indian Nationalism		
Unit: I	Definitions of Nation 'Rāṣṭra' in Indian Perspective: Meaning and Definitions of Nation and Nationality in Modern Context, Etymology and Meaning of 'Rāṣṭra' according to Sanskrit lexicographers, Concept of Nation with special reference to Term 'Rāṣṭra' in Sanskrit Literature, Political Concept of 'Rāṣṭra' and 'Saptāṅga' Theory of State: Kautilya's Arthaśāstra, 6.1, Mahābhārata, Śāntiparva, 56.5, Śukranīti, 1.61-62.	08 Credits
Unit: II	Factors of Nationalism, Country Name and National Symbols: Essential Factors of Nationality: National Integration, Patriotism, Freedom, Religious Tolerance, National Pride, National Consciousness, Citizenship. Characteristics of Indian Nationalism: Social Harmony, Equality of the Religions, International Brotherhood, Unity in Diversity, and Cultural Consciousness; Different Views Regarding Name of the Country 'Bhāratavarṣa' in Purāṇa; National Symbols of India: National Anthem-'Jana Gaṇa Mana', National Song 'Vande Mātaram' National Flag of India, National Emblem 'Ashok Chakra'.	08 Credits
Section 'B'		
Nationalistic Thought in Vedic and Classical Literature		
Unit: I	Origin and Development of 'Rāṣṭra' in Vedic Literature: Nationalistic Identity of the Vedic People with 'Bharatas' and 'Bharatajana' in Ṛgveda (3 .53.12 3; 3.53.24;7.33.6); Concept of 'Raṣṭra' in 'Bhūmisūkta' Atharvaveda (12.1.1 12; Elements of 'Rāṣṭra' in ŚuklaYajurveda (22.22); Nationalistic Significance of 'Rāṣṭrabhṛt homa'(Coronation Ceremony) in Śatapathabrāhmaṇa (9.4.1.1-5)	08 Credits

Unit: II	Nationalistic Identity of 'Rāṣṭra' in Classical Literature: Geographical and Sociological Identity of 'Bhāratavarṣa' in Viṣṇupurāṇa (2.3), Geographical Unity of 'Rāṣṭra' in Vālmīki Rāmāyaṇa (Kiṣkindhā kāṇḍa, chapters-46,47,48); Cultural Unity in Kālidasa's Raghuvamśa (fourth canto), Demographical Unification of 'Rāṣṭra' in Mahābhārata (Śāntiparva, 65.13-22).	08 Credits
Section 'C'		
Nationalistic Thought in Modern Sanskrit Poetry		
Unit: I	Nationalistic Trends of Modern Sanskrit Poetry before Independence: Survey of nationalistic trends in modern Sanskrit poetry before Independence with special reference to 'Bhāratavijayanātakam' of Mathura Prasad Dikshita, 'Satyāgrahagītā' of Pandit Kāmṣārāva, 'Gāndhicaritam' of Charudeva Shastri, and 'Śivarājavijayaḥ' of Ambikadatta Vyasa.	08 Credits
Unit: II	Nationalistic Trends of Modern Sanskrit Poetry After Independence Survey of nationalistic trends in modern Sanskrit poetry after Independence with special reference to Dr. Satyavrat Shstri, Dr Harinarayan Dikshit, Dr. Radha Vallabh Tripathi, Dr. Abhiraja Rajendra Mishra and Dr. Hari Datt Sharma.	08 Credits

Skill Enhancement Courses (SEC)

SANS-G-SEC-T-01		
Evolution of Indian Scripts		
Prescribed Course:		Total 28 Credits
Section 'A'		14 Credits
Section 'B'		14 Credits
Unit-Wise Division		
Section 'A'		
Unit: I	1. Antiquity of writing in India 2. Early Brāhmī and Kharoshthi Scripts 3. Development of Devanāgarī Scripts 4. Development of Eastern Indian Scripts with Special Reference to Bengali and Odia	14 Credits
Section 'B'		
Unit: I	1. Types/Kinds of the Brāhmī script by 400 A.D. 2. Transition to early modern Indian scripts 3. Causes of variation in the Brāhmī script	14 Credits

SANS-G-SEC-T-02
Basic Elements of Āyurveda

Prescribed Course:		Total 28 Credits
Section 'A'	Introduction of Āyurveda	14 Credits
Section 'B'	Carakasamhitā – (Sūtra-sthānam)	14 Credits
Unit-Wise Division		
Section 'A' Introduction of Āyurveda		
Unit: I	Introduction of Āyurveda, History of Indian Medicine in the pre-caraka period, The two schools of Āyurveda: Dhanvantari and Punarvasu.	07 Credits
Unit: II	Main Ācāryas of Āyurveda – Caraka, Suśruta, Vāgbhaṭṭa, Mādhava, Sārṅgadhara and Bhāvamiśra	07 Credits
Section 'B' Carakasamhitā – (Sūtra-sthānam)		
Unit: I	Carakasamhitā – (Sūtra-sthānam): Division of Time and condition of nature and body in six seasons. Regimen of Fall Winter (Hemanta), Winter (Śīśira) & Spring (Vasanta) seasons. Regimen of Summer (Grīṣma), Rainy (Varṣā) and Autumn (Śarada) seasons.	14 Credits

SANS-G-SEC-T-03
Yogasūtra of Patañjali

Prescribed Course:		Total 28 Credits
Section 'A'	Yogasūtra of Patañjali: Samādhi Pāda	14 Credits
Section 'B'	Yogasūtra of Patañjali: Sādhana Pāda	14 Credits
Unit-Wise Division		
Section 'A' Yogasūtra of Patañjali – Samādhi Pāda		
Unit: I	Yogasūtra of Patañjali: Samādhi Pāda (Sutras: 1-15)	07 Credits
Unit: II	Yogasūtra of Patanjali: Samādhi Pāda (Sutras: 16-29)	07 Credits
Section 'B' Yogasūtra of Patañjali: Sādhana Pāda		
Unit: I	Yogasūtra of Patanjali: Sādhana Pāda (Sutra: 29-45).	07 Credits
Unit: II	Yogasūtra of Patanjali: Sādhana Pāda (Sutras: 46-55)	07 Credits

SANS-G-SEC-T-04
Indian Theatre

Prescribed Course:		Total 28 Credits
Section 'A'	Tradition and History of Indian Theatre	07 Credits
Section 'B'	Theatre: Types and Constructions	07 Credits
Section 'C'	Acting: Āgika, Vācika, Sāttvika and Āhārya	07 Credits
Section 'D'	Drama: Subject-Plot (<i>vastu</i>), Hero (<i>netā</i>) and Sentiment (<i>rasa</i>).	07 Credits
Unit-Wise Division		
Section 'A' Tradition and History of Indian Theatre		
Unit: I	Origin and development of stage in different ages: pre-historic, Vedic age.	02 Credits
Unit: II	Epic-puranic age, court theatre, temple theatre, open theatre, modern theatre, folk theatre, commercial theatre, national and state level theatre.	05 Credits
Section 'B' Theatre: Types and Constructions		
Unit: I	Theatre: Types and Constructions	07 Credits
Section 'C' Acting: Āgika, Vācika, Sāttvika and Āhārya		
Unit: I	Acting: Āgika, Vācika	03 Credits
Unit: II	Sāttvika and Āhārya	04 Credits
Section 'D' Drama : Subject-Matter (<i>vastu</i>), Actor (<i>netā</i>) and <i>rasa</i>		
Unit: I	<i>Vastu</i> (Subject-Matter)	02 Credits
Unit: II	<i>Netā</i> (Hero)	02 Credits
Unit: III	<i>Rasa</i> (Sentiment)	03 Credits

Draft syllabus

for

B.Sc. (General/Pass) Physics

University of Kalyani

Under

Choice Based Credit System

**CHOICE BASED CREDIT
SYSTEM
B. SC. GENERAL/PASS WITH
PHYSICS**

PREAMBLE

The University Grants Commission (UGC), as a part of its policy, has taken several measures to improve the higher education system in India. The mission is to provide uniform standard of higher education and equality across the higher educational institutions. To achieve this, new regulations and guidelines have been formulated which provide parallel movement of the choice of subjects of any course. Further steps include introduction of up-to-date and innovative course curricula, improved teaching-learning method, more scientific examination and evaluation systems. The introduction of Choice Based Credit System (CBCS) is one such measure which is important to improve higher education system with diversity of courses across all higher educational institutes in the country. The CBCS course curriculum has provisions to provide Core, Elective, Skill Enhancement and Ability Enhancement courses. The semester-wise grading system is to be followed to evaluate the students, which is better than conventional points systems. This will enable the students to carry their grade points from one institute to other to begin with courses of their choice. Moreover uniform grading system will provide uniform assessment of the candidates for job or for any other required purpose.

DESCRIPTION OF COURSE TYPES INTRODUCED IN CBCS CURRICULUM

Core Course (CC): A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

Discipline Specific Elective Course (DSE): Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course and if the Elective courses that are offered by the main discipline/subject of study are referred to as Discipline Specific Elective.

Skill Enhancement Course (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Ability Enhancement Compulsory Course (AECC): Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

A. TOTAL Number of courses in UG-CBCS B.Sc. GENERAL:

Types of course	Core course (CC)	Elective course	Ability Enhancement Course		TOTAL
		Discipline specific elective course (DSE)	Ability Enhancement compulsory course(AECC)	Skill Enhancement course (SEC)	
No. of course	12	6	2	4	24
Credit/course	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.SC. (GENERAL) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory + Tutorial
1.	Core Course: 12 Papers		
1.A.	Core Course: Theory (12 papers)	12x4 = 48	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x2 = 24	12x1 = 12
2.	Elective Courses: (6 papers)		
A.	DSE: Theory (6 papers)	6x4 = 24	4x5 = 20
B.	DSE(Pract./ Tutor.)*(6 papers)	6x2 = 12	4x1 = 4
<i>#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester</i>			
3.	Ability Enhancement Courses		
A.	Ability Enhancement compulsory course (AECC): (Theory)*(2 papers) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course (SEC): (Theory)*(4 papers) (4 papers of 2 credits each)	4x2 = 8	4x2 = 8
Total Credit:		120	120
## Wherever there is a practical, there will be no tutorial and vice-versa.			

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.SC. GENERAL

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-VI	Total No. of Courses	Total credit
CC-1,2,3 (6)	3 (1A,2A, 3A)	3 (1B,2 B,3B)	3 (1C,2C, 3C)	3 (1D,2D, 3D)	-	-	12	72
DSE - 1,2,3 (6)	-	-	-	-	3 (1A,2A,3A)	3 (1B,2B,3B)	6	36
AECC (2)	1	1	-	-	-	-	2	04
SEC (2)	-	-	1	1	1	1	4	08
Total No. of Course/ Sem	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN B.SC.(GENERAL)

(6 Credit: 75 Marks)

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
UG-PHY-G-CC-T-01	Any one from TABLE-4.1	Core (60L+60P)	6 (4T+2P)
UG-PHY-G-CC-P-01			
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
AECC-01	English Communication/ Environmental Science	AECC	2
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
UG-PHY-G-CC-T-01	Any one from TABLE-4.1	Core (60L+60P)	6 (4T+2P)
UG-PHY-G-CC-P-01			
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
AECC-02	English Communication/ Environmental Science	AECC	2
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
UG-PHY-G-CC-T-03	Any one from TABLE-4.1	Core (60L+60P)	6 (4T+2P)
UG-PHY-G-CC-P-03			
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
UG-PHY-G-SEC-T-01	Any one from TABLE-4.2	SEC (30L)	2
Total	4 courses	Total	20
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
UG-PHY-G-CC-T-03	Any one from TABLE-4.1	Core (60L+60P)	6 (4T+2P)
UG-PHY-G-CC-P-03			
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
UG-PHY-G-SEC-T-02	Any one from TABLE-4.2	SEC (30L)	2
Total	4 courses	Total	20
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
UG-PHY-G-DSE-T-01	Any one from TABLE-4.3	DSE (60L+60P)	6 (4T+2P)
UG-PHY-G-DSE-P-01			

from other discipline	from other discipline	DSE	6
from other discipline	from other discipline	DSE	6
UG-PHY-G-SEC-T-03	Any one from TABLE-4.2	SEC (30L)	2
Total	4 courses	Total	20
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
UG-PHY-G-DSE-T-02	Any one from TABLE-4.3	DSE	6
UG-PHY-G-DSE-P-02		(60L+60P)	(4T+2P)
from other discipline	from other discipline	DSE	6
from other discipline	from other discipline	DSE	6
UG-PHY-G-SEC-T-04	Any one from TABLE-4.2	SEC (30L)	2
Total	4 courses	Total	20
Total (All semesters)	24 courses	Total	120

TABLE-4.1: Choices for Pass: Core Papers (Credit: 06 each)

Core Papers(Credit: 06 each) : 4 papers to be selected for Pass/General Students			
1. Mathematical Physics-I	5. Mathematical Physics-II	9. Elements of Modern Physics	13. Electromagnetic Theory
2. Mechanics)	6. Thermal Physics	10. Analog Systems and Applications	14. Statistical Mechanics
3. Electricity and Magnetism	7. Digital Systems and Applications	11. Quantum Mechanics and Applications	
4. Waves and Optics	8. Mathematical Physics III	12. Solid State Physics	

TABLE-4.2: Skill Enhancement Courses (Credit: 02 each)

For Pass COURSE (may be chosen) : 1 paper for Semester-III ; 1 paper for Semester-IV;1 paper for Semester-V and 1 paper for Semester-VI and			
1. Physics Workshop	3. Electrical circuits &	5. Renewable Energy &	7. Radiation
2. Computational	4. Basic	6. Technical Drawing	8. Applied
			9. Weather Forecasting

TABLE-4.3: Discipline specific elective course (DSE) (Pass/General course only): (Credit: 06 each)

For Pass/General COURSE:1 paper for Semester-V and 1 paper for Semester-VI			
1.Mechanics	3.ThermalPhysicsandStatistical Mechanics	5.Digital, Analog Circuits and Instrumentation	7.Solid State Physics
2.Electricity and Magnetism	4. Waves and Optics	6.ElementsofModernPhysics	8. Quantum Mechanics
			9.Nuclear and Particle Physics

CORE COURSE (GENERAL/PASS IN PHYSICS)

PHY-C I: MATHEMATICAL PHYSICS-I

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,
Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

The emphasis of course is on applications in solving problems of interest to physicists.

The students are to be examined entirely on the basis of problems, seen and unseen.

Calculus:

Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation.

Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only). First

Order Differential Equations and Integrating Factor. (6 Lectures)

Second Order Differential equations: Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness

Theorem for Initial Value Problems. Particular Integral. (12 Lectures)

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization

using Lagrange Multipliers. (6 Lectures)

Vector Calculus:

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields. (5 Lectures)

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities, Gradient, divergence, curl and Laplacian in

spherical and cylindrical coordinates. (10 Lectures)

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs). (14 Lectures)

Orthogonal Curvilinear Coordinates:

Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. (5 Lectures)

Dirac Delta function and its properties:

Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function.

(2 Lectures)

Reference Books:

- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
- An introduction to ordinary differential equations, E. A. Coddington, 2009, PHI learning
- Differential Equations, George F. Simmons, 2007, McGraw Hill.
- Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
- Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
- Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
- Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press

PHY- C I

LAB:

MATHEMAT

ICAL

PHYSICS-I

60 Lectures

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- *Highlights the use of computational methods to solve physical problems*
- *The course will consist of lectures (both theory and practical) in the Lab*
- *Evaluation done not on the programming but on the basis of formulating the problem*
- *Aim at teaching students to construct the computational problem to be solved*
- *Students can use any one operating system Linux or Microsoft Windows*

Introduction and Overview

Computer architecture and organization, memory and Input/output devices

Basics of scientific computing

Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods

Errors and error Analysis

Truncation and round off errors, Absolute and relative errors, Floating point computations.

Introduction to plotting graphs with Gnuplot/Origin/Excel

Basic 2D and 3D graph plotting - plotting functions and datafiles, fitting data using gnuplot's fit function, polar and parametric plots, modifying the appearance of graphs, Surface and contour plots, exporting plots

Introduction to programming in python/Fortran/Matlab/C,C++:

Introduction to programming, constants, variables and data types, dynamical typing, operators and expressions, modules, I/O statements, iterables, compound statements, indentation in python, the if-elif-else block, for and while loops, nested compound statements, lists, tuples, dictionaries and strings, basic ideas of object oriented programming.

Programs:

Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search

Random number generation

Area of circle, area of square, volume of sphere, value of pi (π)

Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods

Solution of linear and quadratic equation, solving $\alpha = \tan \alpha$, $I = I_0 \left[\frac{\sin \alpha}{\alpha} \right]^2$, in optics

Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation

Evaluation of trigonometric functions e.g. $\sin \theta$, $\cos \theta$, $\tan \theta$, etc.

Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method

Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop

Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods

First order differential equation

- ▶ Radioactive decay
- ▶ Current in RC, LC circuits with DC source
- ▶ Newton's law of cooling
- ▶ Classical equations of motion

Attempt following problems using RK 4 order method

Also attempt some problems on differential equation like:

1. Solve the coupled first order differential equations $dy/dx = y + x - x^2$, $dy/dx = -x$

for four initial conditions $x(0) = 0$, $y(0) = -1, -2, -3, -4$. Plot x vs y for each of the four initial conditions on the same screen for $0 < t < 15$.

2. The ordinary differential equation describing the motion of a pendulum is $\theta'' = -\sin\theta$.

. The pendulum is released from rest at an angular displacement α i.e. $\theta(0) = \alpha$, $\theta'(0) = 0$. Use the RK4 method to solve the equation for $\alpha = 0.1, 0.5$ and 1.0 and plot d as a function of time in the range $0 < t < 8\pi$. Also, plot the analytic solution valid in the small θ ($\sin(\theta) = \theta$).

Attempt following problems using RK 4 order method

Also attempt some problems on differential equation like:

1. Solve the coupled first order differential equations $dy/dx = y + x - x^2$, $dy/dx = -x$

for four initial conditions $x(0) = 0$, $y(0) = -1, -2, -3, -4$. Plot x vs y for each of the four initial conditions on the same screen for $0 < t < 15$.

2. The ordinary differential equation describing the motion of a pendulum is $\theta'' = -\sin\theta$.

The pendulum is released from rest at an angular displacement α i.e. $\theta(0) = \alpha$, $\theta'(0) = 0$. Use the RK4 method to solve the equation for $\alpha = 0.1, 0.5$ and 1.0 and plot d as a function of time in the range $0 < t < 8\pi$. Also, plot the analytic solution valid in the small θ ($\sin(\theta) = \theta$) for four initial conditions $x(0) = 0$, $y(0) = -1, -2, -3, -4$. Plot x vs y for each of the four initial conditions on the same screen for $0 < t < 15$.

Referred Books:

- Introduction to Numerical Analysis, S.S. Sastry, 5th Edn. , 2012, PHI Learning Pvt. Ltd.
- Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Pub.
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al,

- 3rd Edn.
 , 2007, Cambridge University Press.
- A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
 - Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn. , 2007, Wiley India Edition.
 - Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.
 - An Introduction to computational Physics, T.Pang, 2nd Edn. , 2006, Cambridge Univ. Press

PHY-C2: MECHANICS

(Credits: Theory-04,
 Practicals-02) Theory: 60

Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Fundamentals of Dynamics: Reference frames. Inertial frames; Galilean transformations; Galilean invariance. Review of Newton's Laws of Motion. Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum.

Impulse. Momentum of variable-mass system: motion of rocket. **(6 Lectures)**

Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy. **(4 Lectures)**

Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames. **(3 Lectures)**

Rotational Dynamics: Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and

rotation. (12

Lectures)

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

**(3
Lectures)**

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube. (2

Lectures)

Gravitation and Central Force Motion: Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. (3

Lectures)

Motion of a particle under a central force field. Two-body problem and its reduction to

one-body problem and its solution. The energy equation and energy diagram. Kepler's

Laws. Satellite in circular orbit and applications. Geosynchronous orbits.

Weightlessness. Basic idea of global positioning system (GPS). Physiological effects on astronauts. (6

Lectures)

Oscillations: SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values.

Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. (7

Lectures)

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating

frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force

and its applications. Components of Velocity and Acceleration in Cylindrical and

Spherical Coordinate Systems. (4

Lectures)

Special Theory of Relativity: Michelson-Morley Experiment and its outcome.

Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum. Energy-Momentum Four Vector. **(10 Lectures)**

Reference Books:

- An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Mechanics, Berkeley Physics, vol. 1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
- Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
- Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
- Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Additional Books for Reference

- Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
- University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
- Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning
- Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

PHY C2 LAB: MECHANICS

60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) g
5. To determine the Moment of Inertia of a Flywheel/ a rigid body.
6. To determine g and velocity for a freely falling body using Digital Timing Technique
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. To determine the Young's Modulus of the material of a bar by flexure method
9. To determine the Modulus of Rigidity of a Wire by - Dynamic Method.
10. To determine the elastic Constants of a wire by Searle's method.
11. To determine the value of g using Bar Pendulum.

12. To determine the value of g using Kater's Pendulum.
13. To draw the frequency – resonance length curve of a sonometer wire and to determine an unknown frequency of a tuning fork
14. Measurement of coefficient of viscosity by Stoke's method.

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal

PHY-C3: ELECTRICITY AND MAGNETISM

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Electric Field and Electric Potential:

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry.

(6

Lectures)

Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole.

(6

Lectures)

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere.

Conductors in an electrostatic Field. Surface charge and force on a conductor.

Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

(10

Lectures)

Dielectric Properties of Matter:

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D . Relations between E , P and D . Gauss' Law in dielectrics. (8

Lectures)

Magnetic Field:

Magnetic force between current elements and definition of Magnetic Field B . Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B : curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.

(9 Lectures)

Magnetic Properties of Matter:

Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B , H , M . Ferromagnetism. B - H curve and hysteresis. (4

Lectures)

Electromagnetic Induction:

Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

(6 Lectures)

Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.

(4

Lectures)

Network theorems: Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.

(4 Lectures)

Ballistic Galvanometer: Torque on a current Loop. Ballistic Galvanometer:

Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping. CDR.

(3 Lectures)

Reference Books:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

PHY C3 LAB: ELECTRICITY AND MAGNETISM

60 Lectures

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series(a) RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De' Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. To verify the Thevenin and Norton theorems.
8. To verify the Superposition, and Maximum power transfer theorems.
9. To determine self inductance of a coil by Anderson's bridge.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer
13. Determine a high resistance by leakage method using Ballistic Galvanometer.
14. To determine self-inductance of a coil by Rayleigh's method.
15. To determine the mutual inductance of two coils by Absolute method.
16. To study the characteristics of a series LR Circuit.
17. Measurement of the resistance of a mirror galvanometer by the half deflection method and to determine its figure of merit.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop,

- 1971, Asia Publishing House
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
 - Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
 - A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

PHY-C4: WAVES AND OPTICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.

(5

Lectures)

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses.(2 Lectures)

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves.

(4

Lectures)

Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction. **(6 Lectures)**

Superposition of Two Harmonic Waves:

Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves.

(7 Lectures)

Wave Optics: Electromagnetic nature of light. Definition and properties of wave front.

Huygens Principle. Temporal and Spatial Coherence. (3 Lectures)

Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination

(Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. (9 Lectures)

Interferometer: Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive

Index, and (5) Visibility of Fringes. Fabry-Perot interferometer. (4 Lectures)

Diffraction: Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula and its

application to rectangular slit. (5 Lectures)

Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. (8 Lectures)

Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple

Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. (7 Lectures)

Reference Books

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

PHY C4 LAB : WAVES AND OPTICS

60 Lectures

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify X^2 -T law.

2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Familiarization with: Schuster's focusing; determination of angle of prism.
5. To determine refractive index of the Material of a prism using sodium source.
6. To determine the dispersive power of the material of a prism using mercury source.
7. To determine the wavelength of sodium source using Michelson's interferometer.
8. To determine wavelength of sodium light using Fresnel Biprism.
9. To determine wavelength of sodium light using Newton's Rings.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
11. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
12. To determine dispersive power and resolving power of a plane diffraction grating.
13. . To draw the deviation – wavelength of the material of a prism and to find the wavelength of an unknown line from its deviation.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

PHY C5: MATHEMATICAL PHYSICS-II

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of

functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity.

(14

Lectures)

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions and Orthogonality.

(24

Lectures)

Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral).

(4 Lectures)

Theory of Errors: Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. (4 Lectures)

Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes.

(14

Lectures)

Reference Books:

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
- Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
- Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
- Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.
- Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books

PHY-C5
LAB:
**MATHEMATICAL
PHYSICS-
II**

60 Lectures

The aim of this Lab is to use the computational methods to solve physical problems. Course will consist of lectures (both theory and practical) in the Lab. Evaluation done not on the programming but on the basis of formulating the problem

Introduction to Numerical computation numpy, scipy/Matlab/Octave/ Scilab

Introduction to the python numpy module. Arrays in numpy, array operations, array item selection, slicing, shaping arrays. Basic linear algebra using the linalg submodule. Introduction to on line graph plotting using matplotlib. Introduction to the scipy module. Uses in optimization and solution of differential equations.

Curve fitting, Least square fit, Goodness of fit, standard deviation
Ohms law to calculate R, Hooke's law to calculate spring constant

Solution of Linear system of equations by Gauss elimination method and Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems

Solution of mesh equations of electric circuits (3 meshes)
Solution of coupled spring mass systems (3 masses)

Generation of Special functions using User defined functions

Generating and plotting Legendre Polynomials
Generating and plotting Bessel function

Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kutta second order methods Second order differential equation ,Fixed difference method

First order differential equation

- Radioactive decay
- Current in RC, LC circuits with DC source
- Newton's law of cooling
- Classical equations of motion Second order Differential Equation
- Harmonic oscillator (no friction)
- Damped Harmonic oscillator
- Over damped
- Critical damped

- Oscillatory
- Forced Harmonic oscillator
- Transient and
- Steady state solution
- Apply above to LCR circuits also

Partial differential equations

- Wave equation
- Heat equation
- Poisson equation
- Laplac equation

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Complex Variables, A.S. Fokas & M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer
- Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
- Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

PHY-C 6: THERMAL PHYSICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

(Include related problems for each topic)

Introduction to Thermodynamics

Zeroth and First Law of Thermodynamics: Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. (8 Lectures)

Second Law of Thermodynamics: Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale.
(10 Lectures)

Entropy: Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature-Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.

(7

Lectures)

Thermodynamic Potentials: Extensive and Intensive Thermodynamic Variables.

Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations.

(7

Lectures)

Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of C_p-C_v , (3) Tds Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.

(7

Lectures)

Kinetic Theory of Gases

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases.

(7

Lectures)

Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance (4 Lectures)

Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation.

The Virial Equation. Andrew's Experiments on CO₂ Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. p-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule-Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule-Thomson Cooling.

(10

Lectures)

Reference Books:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
- Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press

PHY C6 LAB :

THERMAL PHYSICS

60 Lectures

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature
8. Determination of the boiling point of a liquid by Platinum resistance thermometer
9. Determination of the melting point of a solid with a thermocouple.
10. Measurement of the coefficient of linear expansion of a solid using an optical

lever

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

PHY C 7: DIGITAL SYSTEMS AND APPLICATIONS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment: Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Introduction to CRO: Block Diagram of CRO. Electron Gun, Deflection System and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.

(3

Lectures)

Integrated Circuits (Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital ICs (3 Lectures)

Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers (6 Lectures)

Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map (6 Lectures)

Data processing circuits: Basic idea of Multiplexers, De-multiplexers,

Decoders, Encoders.

(4

Lectures)

Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor. (5

Lectures)

Sequential Circuits: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop.

(6

Lectures)

Timers: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator.

(3 Lectures)

Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and

Parallel-in-Parallel-out Shift Registers (only up to 4 bits). (2

Lectures)

Counters(4 bits): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

(4

Lectures)

Computer Organization: Input/Output Devices. Data storage (idea of RAM and ROM).

Computer memory. Memory organization & addressing. Memory Interfacing. MemoryMap (6

Lectures)

Intel 8085 Microprocessor Architecture: Main features of 8085. Block diagram. Components. Pin-out diagram. Buses. Registers. ALU. Memory. Stack memory. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI.

(8

Lectures)

Introduction to Assembly Language: 1 byte, 2 byte & 3 byte instructions.

(4

Lectures)

Reference Books:

- Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Systems: Principles & Applications, R.J. Tocci, N.S. Widmer, 2001, PHI Learning
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
- Microprocessor Architecture Programming & applications with 8085, 2002,

R.S.
Goankar, Prentice Hall.

PHY C 7: LAB : DIGITAL SYSTEMS AND APPLICATIONS

60 Lectures

1. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.
2. To test a Diode and Transistor using a Multimeter.
3. To design a switch (NOT gate) using a transistor.
4. To verify and design AND, OR, NOT , XOR and using NAND gates.
5. To design a combinational logic system for a specified Truth Table.
6. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
7. To minimize a given logic circuit.
8. Half Adder, Full Adder and 4-bit binary Adder.
9. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
11. To build JK Master-slave flip-flop using Flip-Flop ICs
12. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.
13. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs.
14. To design an astable multivibrator of given specifications using 555 Timer.
15. To design a monostable multivibrator of given specifications using 555 Timer.
16. Write the following programs using 8085 Microprocessor
 - a) Addition and subtraction of numbers using direct addressing mode
 - b) Addition and subtraction of numbers using indirect addressing mode
 - c) Multiplication by repeated addition.
 - d) Division by repeated subtraction.
 - e) Handling of 16-bit Numbers.

Reference Books:

- Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.
- Microprocessor 8085:Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI Learning.

PHY C8: MATHEMATICAL PHYSICS-III

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals. **(30**

Lectures)

Integrals Transforms:

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations. **(15**

Lectures)

Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to Differential Equations: Damped Harmonic Oscillator, Simple

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A.Krzywicki, 1967, Dover Publications
- Complex Variables, A.S.Fokas & MJ.Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett

**PHY C 8 LAB : MATHEMATICAL PHYSICS-
III**

60 Lectures

Numerical computation using Python/Matlab/Octave/Fortran:

1. Solve differential equations:

$$dy/dx = e^{-x}, \text{ with } y = 0 \text{ for } x = 0$$

$$dy/dx + e^{-x} = x^2$$

$$dy/dx + e^{-x} = x^2$$

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$$

2. Dirac Delta Function:

$$\frac{1}{\sqrt{2\pi\sigma^2}} \int_{-\infty}^{\infty} \frac{e^{-(x-2)^2}}{e^{-x^2}} (x+3) dx, \text{ for } \sigma=1, .1, .01 \text{ and show it tends to } 5$$

3. Fourier Series:

Program to sum

$$\sum_{n=1}^{\infty} (2)^n \text{ Evaluate the Fourier coefficients of a given periodic function (square wave)}$$

1. Frobenius method and Special functions: $\int_{-1}^1 P_n(\mu)P_m(\mu) d\mu = \delta_{nm}$, Plot $P_n(x), J_n(x)$

Show recursion relation

5. Calculation of error for each data point of observations recorded in

experiments
done in previous semesters (choose any two).

6. Calculation of least square fitting manually without giving weightage to error.
Confirmation of least square fitting of data through computer program.
7. Evaluation of trigonometric functions e.g. $\sin 6$, Given Bessel's function at N
points find its value at an intermediate point. Complex analysis:
Integrate $1/(x^2+2)$ numerically and check with computer integration.
8. Compute the nth roots of unity for $n = 2, 3$, and 4.
9. Find the two square roots of $-5+12j$.
10. Integral transform: FFT of e^{-x}

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernandez. 2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
- Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

PHY C 9: ELEMENTS OF MODERN PHYSICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions.

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to virtual particles and range of an interaction.

(5

Lectures)

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.

(10

Lectures)

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical scattering and tunnelling in one dimension-across a step potential & rectangular potential barrier.

(10

Lectures)

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers.

(6

Lectures)

Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus.

(8

Lectures)

Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions).

(3

Lectures)

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and

Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. (4 Lectures)

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
- Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
- Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.
- Quantum Mechanics: Theory & Applications, A.K.Ghatak & S.Lokanathan, 2004, Macmillan

Additional Books for Reference

- Modern Physics, J.R. Taylor, C.D. Zafiratos, M. A. Dubson, 2004, PHI Learning.
- Theory and Problems of Modern Physics, Schaurif s outline, R. Gautreau and W. Savin, 2nd Edn, Tata McGraw-Hill Publishing Co. Ltd.
- Quantum Physics, Berkeley Physics, Vol.4. E.H.Wichman, 1971, Tata McGraw-Hill Co.
- Basic ideas and concepts in Nuclear Physics, K.Heyde, 3rd Edn., Institute of Physics Pub.
- Six Ideas that Shaped Physics: Particle Behave like Waves, T.A.Moore, 2003, McGraw Hill

**PHY C 9 LAB :
ELEMENTS OF
MODERN PHYSICS**

60 Lectures

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine work function of material of filament of directly heated vacuum diode.
4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the ionization potential of mercury.
7. To determine the absorption lines in the rotational spectrum of Iodine vapour.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To show the tunnelling effect in tunnel diode using I-V characteristics.
11. To determine the slit width (a) using diffraction of single slit.
12. To determine the slit width (a,b) using diffraction of double slits.

13. To determine (1) wavelength and of He-Ne light /~~laser~~ using plane diffraction grating
14. To draw the I-V characteristics of a valve diode and to verify the laws of thermionic emission.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011 ,Kitab Mahal

PHYSICS-C 10: ANALOG SYSTEMS AND APPLICATIONS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Semiconductor Diodes: P and N type semiconductors. Energy Level Diagram.

Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. **(10**

Lectures)

Two-terminal Devices and their Applications: (1) Rectifier Diode: Half-wave

Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, (2) Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell.

(6

Lectures)

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β . Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions. **(6 Lectures)**

Amplifiers: Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers.

(10

Lectures)

Coupled Amplifier: RC-coupled amplifier and its frequency response. (4 Lectures)

Feedback in Amplifiers: Effects of Positive and Negative Feedback on Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise.

(4

Lectures)

Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency. Hartley & Colpitts oscillators.

(4 Lectures)

Operational Amplifiers (Black Box approach): Characteristics of an Ideal and Practical Op-Amp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground.

(4

Lectures)

Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator.

(9

Lectures)

Conversion: Resistive network (Weighted and R-2R Ladder). Accuracy and Resolution. A/D Conversion (successive approximation) (3

Lectures)

Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- Solid State Electronic Devices, B.G. Streetman & S.K. Banerjee, 6th Edn., 2009, PHI Learning
- Electronic Devices & circuits, S. Salivahanan & N.S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
- Electronic circuits: Handbook of design & applications, U. Tietze, C. Schenk, 2008, Springer
- Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India
- Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

PHY C10 LAB :ANALOG SYSTEMS AND APPLICATIONS

60 Lectures

1. To study V-I characteristics of PN junction diode, ~~and~~ / Light emitting diode.
2. To study the V-I characteristics of a Zener diode and its use as voltage

regulator.

3. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
4. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5. To study the various biasing configurations of BJT for normal class A operation.
6. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
7. To study the frequency response of voltage gain of a RC-coupled transistor amplifier.
8. To design a Wien bridge oscillator for given frequency using an op-amp.
9. To design a phase shift oscillator of given specifications using BJT.
10. To study the Colpitts oscillator.
11. To design a digital to analog converter (DAC) of given specifications.
12. To study the analog to digital converter (ADC) IC.
13. To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain
14. To design inverting amplifier using Op-amp (741,351) and study its frequency response
15. To design non-inverting amplifier using Op-amp (741,351) & study its frequency response
16. To study the zero-crossing detector and comparator
17. To add two dc voltages using Op-amp in inverting and non-inverting mode
18. To design a precision Differential amplifier of given I/O specification using Op-amp.
19. To investigate the use of an op-amp as an Integrator.
20. To investigate the use of an op-amp as a Differentiator.
21. To design a circuit to simulate the solution of a 1st/2nd order differential equation.

22. To study the characteristics of a Bipolar Junction Transistor in CB configuration

Reference Books:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
- Electronic Devices & circuit Theory, R.L. Boylestad & L.D. Nashelsky, 2009, Pearson

PHY C 11: QUANTUM MECHANICS AND APPLICATIONS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle.

(6

Lectures)

Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle.

(10 Lectures)

General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle.

(12 Lectures)

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wavefunctions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum quantum numbers l and m ; s , p , d ,.. shells.

(10 Lectures)

Atoms in Electric & Magnetic Fields: Electron angular momentum. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

(8

Lectures)

Atoms in External Magnetic Fields:- Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only).

(4

Lectures)

Many electron atoms: Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave

Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for

Atomic States. Total angular momentum. Vector Model. Spin-orbit coupling in atoms- L-S and J-J couplings. Hund's Rule. Term symbols. Spectra of Hydrogen and AlkaliAtoms (Na etc.). (10

Lectures)

Reference Books: A test book of

- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics, G. Aruldas, 2nd Edn. 2002, PHI Learning of India.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
- Quantum Mechanics: Foundations & Applications, Arno Bohm, 3rd Edn., 1993, Springer
- Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press

Additional Books for Reference

- Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
- Introduction to Quantum Mechanics, D. J. Griffith, 2nd Ed. 2005, Pearson Education
- Quantum Mechanics, Walter Greiner, 4th Edn., 2001, Springer

PHYC 11 LAB :

QUANTUM MECHANICS AND APPLICATIONS

60 Lectures

Use Fortran/Python/Matlab/Octave/ C/C++/Scilab for solving the following problems based on Quantum Mechanics like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

$$\frac{d^2 y}{dr^2} = \frac{2m}{\hbar^2} (E - V(r))y$$

where $V(r) = -\frac{e}{r}$

Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wavefunctions. Remember that the ground state energy of the hydrogen atom is $\ll -13.6$ eV. Take $e = 3.795$ (eVA)^{1/2}, $\hbar e = 1973$ (eVA) and $m = 0.511 \times 10^6$ eV/c².

2. Solve the s-wave radial Schrodinger equation for an atom:

where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0,$$

where $V(r) = -\frac{e}{r} e^{-r/a}$

Find the energy (in eV) of the ground state of the atom to an accuracy of three significant digits. Also, plot the corresponding wavefunction. Take $e = 3.795$ (eVÅ)^{1/2}, $m = 0.51 \times 10^{-6}$ eV/c², and $a = 3$ Å, 5 Å, 7 Å. In these units $\hbar c = 1973$ (eVÅ). The ground state energy is expected to be above -12 eV in all three cases.

3. Solve the s-wave radial Schrodinger equation for a particle of mass m :

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0,$$

where $V(r) = -\frac{e}{r} e^{-r/a}$

For the anharmonic oscillator potential

$$V(r) = \frac{1}{4} k_1 r^4 + \frac{1}{3} k_2 r^3$$

for the ground state energy (in MeV) of particle to an accuracy of three significant

digits. Also, plot the corresponding wave function. Choose $m = 940$ MeV/c², $k = 100$ MeV fm⁻², $b = 0, 10, 30$ MeV fm⁻³. In these units, $\hbar c = 197.3$ MeV fm. The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

3. Solve the s-wave radial Schrodinger equation for the vibration of hydrogen molecule:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = D(e^{-2\alpha(r-r_0)} - e^{-2\alpha r}), r' = \frac{r-r_0}{r}$$

Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function. Take $m=940 \times 10^{-6}$ eV/c, $D=0.755501$ eV, $\alpha=1.44$, $r_0=0.131349$ Å

Laboratory based experiments:

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
7. To show the tunneling effect in tunnel diode using I-V characteristics.
8. Quantum efficiency of C CD s

Reference Books:

- Schaum's outline of Programming with C++. J.Hubbard, 2 0 0 0, McGraw-Hill Publication
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al., 3rd Edn., 2007, Cambridge University Press.
- An introduction to computational Physics, T.Pang, 2nd Edn., 2006, Cambridge

Univ. Press

- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific & Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer.
- Scilab (A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand & Co.
- Scilab Image Processing: L.M.Surhone. 2010 Betascript Publishing ISBN:978-6133459274

PHY C 12: SOLID STATE PHYSICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis - Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

(12

Lectures)

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law
(10 Lectures)

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. (8

Lectures)

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeier relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons, TO modes. (8

Lectures)

Ferroelectric Properties of Materials: Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

(6 lectures)

Elementary band theory: Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient. (10

Lectures)

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation) (6 Lectures)

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
- Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

PHY C 12 LAB : SOLID STATE PHYSICS

60 Lectures

1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency
5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
6. To determine the refractive index of a dielectric layer using SPR
7. To study the PE Hysteresis loop of a Ferroelectric Crystal.
8. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
9. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150 °C) and to determine its band gap.
10. To determine the Hall coefficient of a semiconductor sample.

11. To measure the mutual inductance of two coaxial coils at various relative orientations using a ballistic galvanometer.
12. Verification of the inverse cube law for magnetic dipoles (study of the dependence of the field of a magnetic dipole on distance) and determination of the horizontal component of the earth's magnetic field by deflection and oscillation magnetometers.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India.

PHY C 13: ELECTROMAGNETIC THEORY

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75 (Theory - 40, Internal Assessment - 15)

Internal Assessment : Class Attendance (Theory) - 05,

Theory (Class Test/ Assignment/ Tutorial) - 05,

Practical (Sessional Viva-voce) - 05]

Maxwell Equations: Review of Maxwell's equations. Displacement Current.

Vector

and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge.

Boundary

Conditions at Interface between Different Media. Wave Equations. Plane Waves in

Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM)

Energy Density. Physical Concept of Electromagnetic Field Energy Density,

Momentum

Density and Angular Momentum Density. (12

Lectures)

EM Wave Propagation in Unbounded Media: Plane EM waves through vacuum and

isotropic dielectric medium, transverse nature of plane EM waves, refractive index and

dielectric constant, wave impedance. Propagation through conducting media, relaxation

time, skin depth. Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation

through ionosphere. (10

Lectures)

EM Wave in Bounded Media: Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection &

Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection (normal Incidence)

(10 Lectures)

Polarization of Electromagnetic Waves: Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Analysis of Polarized Light (12 Lectures)

Rotatory Polarization: Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel's theory. Specific rotation. Laurent's half-shade polarimeter. (5

Lectures)

Wave Guides: Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission. (8 Lectures)

Optical Fibres:- Numerical Aperture. Step and Graded Indices (Definitions Only). Single and Multiple Mode Fibres (Concept and Definition Only). (3 Lectures)

Reference Books:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.
- Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
- Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
- Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill
- Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

Additional Books for Reference

- Electromagnetic Fields & Waves, P.Lorrain & D.Corson, 1970, W.H.Freeman & Co.
- Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGraw Hill.
- Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004, Cambridge University Press

PHY C 13 LAB :

ELECTROMAGNETIC THEORY

60 Lectures

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.

3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves
7. To study Polarization and double slit interference in microwaves.
8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
11. To verify the Stefan's law of radiation and to determine Stefan's constant.
12. To determine the Boltzmann constant using V-I characteristics of PN junction diode.
13. To verify Brewster's law and Fresnel formulae for reflection of electromagnetic waves with the help of a spectrometer, a prism and two polaroids

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

PHY C 14: STATISTICAL MECHANICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Classical Statistics: Macrostate & Microstate, Elementary Concept of Ensemble, Phase

Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) - Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature.

Lectures)

Classical Theory of Radiation: Properties of Thermal Radiation. Blackbody Radiation.

Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law. Ultraviolet Catastrophe. (9

Lectures)

Quantum Theory of Radiation: Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law.

(5)

Lectures)

Bose-Einstein Statistics: B-E distribution law, Thermodynamic functions of a strongly

Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative

description), Radiation as a photon gas and Thermodynamic functions of photon gas.

Bose derivation of Planck's law. (13

Lectures)

Fermi-Dirac Statistics: Fermi-Dirac Distribution Law, Thermodynamic functions of a

Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass Limit.

(15)

Lectures)**Reference Books:**

- Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
- Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill
- Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall
- Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
- An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ. Press

PHY C 14 LAB: STATISTICAL MECHANICS

60 Lectures

Use C/C++/Scilab for solving the problems based on Statistical Mechanics like

1. Plot Planck's law for Black Body radiation and compare it with Wein's Law and Raleigh-Jeans Law at high temperature (room temperature) and low temperature.
2. Plot Specific Heat of Solids by comparing (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature (room temperature) and low temperature and compare them for these two cases
3. Plot Maxwell-Boltzmann distribution function versus temperature.
4. Plot Fermi-Dirac distribution function versus temperature.
5. Plot Bose-Einstein distribution function versus temperature.

Reference Books:

- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn. 2007, Wiley India Edition
- Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
- Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014
Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
- Scilab Image Processing: L.M. Surhone. 2010, Betascript Pub., ISBN: 978-6133459274

Skill Enhancement Course (any four may be chosen for GENERAL/PASS course) (Credit: 02 each)

PHY SEC 1: PHYSICS WORKSHOP SKILL (Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

30 Lectures

The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode

Introduction: Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

(4 Lectures)

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothing of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

(10 Lectures)

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay

(10 Lectures)

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

(6 Lectures)

Reference Books:

- A text book in Electrical Technology - B L Theraja - S. Chand and Company.
- Performance and design of AC machines - M.G. Say, ELBS Edn.
- Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
- Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
- New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

PHY SEC 2-COMPUTATIONAL PHYSICS

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

The aim of this course is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- *Highlights the use of computational methods to solve physical problems*
- *Use of computer language as a tool in solving physics problems (applications)*
- *Course will consist of hands on training on the Problem solving on Computers.*

Introduction: Importance of computers in Physics, paradigm for solving physics problems for solution. Usage of linux as an Editor. **Algorithms and Flowcharts:** Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots

of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of $\sin(x)$ as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal. **(4 Lectures)**

Scientific Programming: Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Operators: Arithmetic, Relational, Logical and Assignment Operators. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic. Examples from physics problems. **(5 Lectures)**

Control Statements: Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DO-WHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements, open a file, writing in a file, reading from a file. Examples from physics problems.

Programming:

1. Exercises on syntax on usage of FORTRAN
2. Usage of GUI Windows, Linux Commands, familiarity with DOS commands and working in an editor to write sources codes in FORTRAN.
3. To print out all natural even/ odd numbers between given limits.
4. To find maximum, minimum and range of a given set of numbers.
5. Calculating Euler number using $\exp(x)$ series evaluated at $x=1$ **(6 Lectures)**

Scientific word processing: Introduction to LaTeX: TeX/LaTeX word processor, preparing a basic LaTeX file, Document classes, Preparing an input file for LaTeX, Compiling LaTeX File, LaTeX tags for creating different environments, Defining LaTeX commands and environments, Changing the type style, Symbols from other languages. **Equation representation:** Formulae and equations, Figures and other floating bodies, Lining in columns- Tabbing and tabular environment, Generating table

of contents, bibliography and citation, Making an index and glossary, List making environments, Fonts, Picture environment and colors, errors. **(6 Lectures)**

Visualization: Introduction to graphical analysis and its limitations. Introduction to Gnuplot. importance of visualization of computational and computational data, basic Gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Gnuplot (equations, building functions, user defined variables and functions), Understanding data with Gnuplot

Hands on exercises:

1. To compile a frequency distribution and evaluate mean, standard deviation etc.
2. To evaluate sum of finite series and the area under a curve.
3. To find the product of two matrices
4. To find a set of prime numbers and Fibonacci series.
5. To write program to open a file and generate data for plotting using Gnuplot.
6. Plotting trajectory of a projectile projected horizontally.
7. Plotting trajectory of a projectile projected making an angle with the horizontally.
8. Creating an input Gnuplot file for plotting a data and saving the output for seeing on the screen. Saving it as an eps file and as a pdf file.
9. To find the roots of a quadratic equation.
10. Motion of a projectile using simulation and plot the output for visualization.
11. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization.
12. Motion of particle in a central force field and plot the output for visualization.

(9 Lectures)

Reference Books:

- Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
- Computer Programming in Fortran 77". V. Rajaraman (Publisher: PHI).
- LaTeX-A Document Preparation System", Leslie Lamport (Second Edition, Addison-Wesley, 1994).
- Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
- Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.

- Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi(1999)
- A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning
- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition.

PHY SEC 3-ELECTRICAL CIRCUIT NETWORK SKILLS

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. **(3 Lectures)**

Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. **(4 Lectures)**

Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. **(4 Lectures)**

Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. **(3 Lectures)**

Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. **(4 Lectures)**

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers.

Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources **(3 Lectures)**

Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device) **(4 Lectures)**

Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board. **(5 Lectures)**

Reference Books:

- A text book in Electrical Technology - B L Theraja - S Chand & Co.
- A text book of Electrical Technology - A K Theraja
- Performance and design of AC machines - M G Say ELBS Edn.

PHY SEC 4-BASIC INSTRUMENTATION SKILLS

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments listed below are to be done in continuation of the topics.

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. **(4 Lectures)**

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC **millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance. **(4 Lectures)**

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only- no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. **(6 Lectures)**

Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working. **(3 Lectures)**

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. **(4 Lectures)**

Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges. **(3 Lectures)**

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. (3 Lectures)

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time- base stability, accuracy and resolution. (3 Lectures)

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of

bridges

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal

bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

Reference Books:

- A text book in Electrical Technology - B L Theraja - S Chand and Co.
- Performance and design of AC machines - M G Say ELBS Edn.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
- Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
- Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

PHY SEC 5-RENEWABLE ENERGY AND ENERGY HARVESTING

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **(3 Lectures)**

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **(6 Lectures)**

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. **(3 Lectures)**

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(3 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass. **(2 Lectures)**

Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(2 Lectures)**

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources. **(2 Lectures)**

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **(4 Lectures)**

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications **(2 Lectures)**

Carbon captured technologies, cell, batteries, power consumption **(2 Lectures)**

Environmental issues and Renewable sources of energy, sustainability. **(1 Lecture)**

Demonstrations and Experiments

1. Demonstration of Training modules on Solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials

3. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
- Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

PHY SEC 6-TECHNICAL DRAWING

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

Introduction: Drafting Instruments and their uses. lettering: construction and uses of various scales: dimensioning as per I.S.I. 696-1972. Engineering Curves: Parabola: hyperbola: ellipse: cycloids, involute: spiral: helix and loci of points of simple moving mechanism. 2D geometrical construction. Representation of 3D objects. Principles of projections. **(4 Lectures)**

Projections: Straight lines, planes and solids. Development of surfaces of right and oblique solids. Section of solids. **(6 Lectures)**

Object Projections: Orthographic projection. Interpenetration and intersection of solids. Isometric and oblique parallel projection of solids. **(4 Lectures)**

CAD Drawing: Introduction to CAD and Auto CAD, precision drawing and drawing aids, Geometric shapes, Demonstrating CAD- specific skills (graphical user interface. Create, retrieve, edit, and use symbol libraries. Use inquiry commands to extract drawing data). Control entity properties. Demonstrating basic skills to produce 2-D and 3-D drawings. 3D modeling with Auto CAD (surfaces and solids), 3D modeling with sketch up, annotating in Auto CAD with text and hatching, layers, templates & design center, advanced plotting (layouts, viewports), office standards, dimensioning, internet and collaboration, Blocks, Drafting symbols, attributes, extracting data. basic printing, editing tools, Plot/Print drawing to appropriate scale. **(16 Lectures)**

Reference Books:

- K. Venugopal, and V. Raja Prabhu. Engineering Graphic, New Age International
- AutoCAD 2014 & AutoCAD 2014/Donnie Gladfelter/Sybex/ISBN:978-1-118-57510-9
- Architectural Design with Sketchup/Alexander Schreyer/John Wiley & Sons/ISBN: 978-1-118-12309-6

PHY SEC 7-RADIATION SAFETY**(Credits: 02)****F.M. = 50 (Theory - 40, Internal Assessment – 10)****Internal Assessment [Class Attendance (Theory) – 05, Theory****(Class Test/ Assignment/ Tutorial) – 05]****Theory: 30 Lectures**

The aim of this course is for awareness and understanding regarding radiation hazards and safety. The list of laboratory skills and experiments listed below the course are to be done in continuation of the topics

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

(6 Lectures)

Interaction of Radiation with matter: Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources,

Interaction of Photons - Photo electric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients,

Interaction of Charged Particles: Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), **Interaction of Neutrons-** Collision, slowing down and Moderation. **(7 Lectures)**

Radiation detection and monitoring devices: Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

Radiation detection: Basic concept and working principle of *gas detectors* (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters

(MWPC) and Geiger Muller Counter), *Scintillation Detectors* (Inorganic and Organic Scintillators), *Solid States Detectors* and *Neutron Detectors*, *Thermo luminescent Dosimetry*.
(7 Lectures)

Radiation safety management: *Biological effects of ionizing radiation*, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub-critical system (ADS) for waste management. (5 Lectures)

Application of nuclear techniques: Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. *Industrial Uses:* Tracing, Gauging, Material Modification, Sterilization, Food preservation. (5 Lectures)

Experiments:

1. Study the background radiation levels using Radiation meter

Characteristics of Geiger Muller (GM) Counter:

- 2) Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
- 3) Study of counting statistics using background radiation using GM counter.
- 4) Study of radiation in various materials (e.g. K₂SO₄ etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
- 5) Study of absorption of beta particles in Aluminum using GM counter.
- 6) Detection of a particles using reference source & determining its half life using spark counter
- 7) Gamma spectrum of Gas Light mantle (Source of Thorium)

Reference Books:

1. W.E. Burcham and M. Jobes - Nuclear and Particle Physics - Longman (1995)
2. G.F.Knoll, Radiation detection and measurements
3. Thermoluminescence Dosimetry, Mcknlly, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology". John Wright and Sons, UK, 1989.
5. J.R. Greening, "Fundamentals of Radiation Dosimetry", Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001
7. A. Martin and S. A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.

9. W.R. Hendee, "Medical Radiation Physics", Year Book - Medical Publishers
Inc. London, 1981

PHY SEC 8-APPLIED OPTICS

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

THEORY: 30 Lectures

Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections.

Sources and Detectors(No. of Lectures:7)

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients,

Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.

Experiments on Lasers:

1. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid statelaser.
2. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid statelaser.
3. To find the polarization angle of laser light using polarizer and analyzer
4. Thermal expansion of quartz using

laser Experiments on Semiconductor

Sources and Detectors

1. V-I characteristics ofLED
2. Study the characteristics of solid statelaser
3. Study the characteristics ofLDR
4. PhotovoltaicCell
Characteristics of IRsensor

Fourier Optics(No. of Lectures:7)

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Experiments on Fourier Optics:

1. Fourier optic and imageprocessing
 - a. Optical imageaddition/subtraction
 - b. Opticalimagedifferentiation
 - c. Fourier opticalfiltering
 - d. Construction of an optical 4fsystem

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science. Experiment:

1.To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. There sulting interferogram is the Fouriertrans form of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done. Urier Transform Spectroscopy

Holography(No. of Lectures:6)

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

Experiments on Holography and interferometry

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perotinterferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer

White light Hologram

Photonics: Fibre Optics(No. of Lectures:10)

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating

Experiments on Photonics: Fibre Optics

1. To measure the numerical aperture of an optical fibre
2. To study the variation of the bending loss in a multimode fibre
3. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by measurements of its far field Gaussian pattern
4. Tomeasurethenearfieldintensityprofileofafibreandstudyitsrefractiveindexprofi le

To determine the power loss at a splice between two multimode fibre

Reference Books

- Fundamentalsofoptics,F.A.Jenkins&H.E.White,1981,TataMcGrawhill.
- LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010,TataMcGrawHill
- Fibre optics through experiments, M.R.Shenoy, S.K.Khijwania, et.al. 2009, VivaBooks
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008,Elsevier.
- Optics, Karl Dieter Moller, Learning by computing with model examples, 2007,Springer.
- OpticalSystemsandProcesses,JosephShamir,2009,PHILearningPvt.Ltd.
- Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt.Ltd.
- Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

PHY SEC 9-WEATHER FORECASTING

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

The aim of this course is not just to impart theoretical knowledge to the students but to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Introduction to atmosphere: Elementary idea of atmosphere: physical structure and composition; compositional layering of the atmosphere; variation of pressure and temperature with height; air temperature; requirements to measure air temperature; temperature sensors: types; atmospheric pressure: its measurement; cyclones and anticyclones: its characteristics. **(9 Periods)**

Measuring the weather: Wind; forces acting to produce wind; wind speed direction: units, its direction; measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere; radiation laws. **(4 Periods)**

Weather systems: Global wind systems; air masses and fronts: classifications; jet streams; local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes. **(3 Periods)**

Climate and Climate Change: Climate: its classification; causes of climate change; global warming and its outcomes; air pollution; aerosols, ozone depletion, acid rain, environmental issues related to climate. **(6 Periods)**

Basics of weather forecasting: Weather forecasting: analysis and its historical background; need of measuring weather; types of weather forecasting; weather forecasting methods; criteria of choosing weather

station; basics of choosing site and exposure; satellites observations in weather forecasting; weather maps; uncertainty and predictability; probability forecasts.

(8 Periods)

Demonstrations and Experiments:

1. Study of synoptic charts & weather reports, working principle of weather station.
2. Processing and analysis of weather data:
 - (a) To calculate the sunniest time of the year.
 - (b) To study the variation of rainfall amount and intensity by wind direction.
 - (c) To observe the sunniest/driest day of the week.
 - (d) To examine the maximum and minimum temperature throughout the year.
 - (e) To evaluate the relative humidity of the day.
 - (f) To examine the rainfall amount month wise.
3. Exercises in chart reading: Plotting of constant pressure charts, surfaces charts, upper wind charts and its analysis.
4. Formats and elements in different types of weather forecasts/ warning (both aviation and non aviation)

Reference books:

- Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
- The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
- Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
- Text Book of Agrometeorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur.
- Why the weather, Charls Franklin Brooks, 1924, Chpraman & Hall, London.
- Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.

Discipline specific elective course (DSE) (any two for Pass/General course only): (Credit: 06 each)

PHY GE 1: MECHANICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Vectors: Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. **(4 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. **(6 Lectures)**

Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. **(10 Lectures)**

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets. **(6 Lectures)**

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. **(5 Lectures)**

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts. **(8 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. **(6 Lectures)**

Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q , rj and o by Searles method. **(8 Lectures)**

Speed Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of

velocities.

(7 Lectures)

Note: Students are not familiar with vector calculus. Hence all examples involve differentiation either in one dimension or with respect to the radial coordinate

Reference Books:

- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
- Physics - Resnick, Halliday & Walker 9/e, 2010, Wiley
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

PHY: GE1 LAB: MECHANICS

60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To study the Motion of a Spring and calculate (a) Spring Constant, (b) g.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

PHY GE 2: ELECTRICITY AND MAGNETISM

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Vector Analysis: Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

(12 Lectures)

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

(22 Lectures)

Magnetism:

Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferro magnetic materials.

(10 Lectures)

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.

(6 Lectures)

Maxwell's equations and Electromagnetic wave propagation: Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

(10 Lectures)

Reference Books:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
- Electricity & Magnetism, J.H. Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

GE 2 LAB: ELECTRICITY AND MAGNETISM

60 Lectures

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
 - (i) Measurement of charge and current sensitivity
 - (ii) Measurement of CDR
 - (iii) Determine a high resistance by Leakage Method
 - (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.

4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)
5. To study the Characteristics of a Series RC Circuit.
6. To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorems
10. To verify the Superposition, and Maximum Power Transfer Theorems

Reference Books

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed.2011, Kitab Mahal

PHY GE 3: THERMAL PHYSICS AND STATISTICAL MECHANICS (Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Laws of Thermodynamics: Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

(22 Lectures)

Thermodynamical Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (CP - CV), CP/CV, TdS equations.

(10

Lectures)

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to

specific heat of gases; mono-atomic and diatomic gases.

(10 Lectures)

Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

(6 Lectures)

Statistical Mechanics: Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Phase space - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

(12 Lectures)

Reference Books:

- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and G.L. Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

GE 3 LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS

60 Lectures

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo e.m.f across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Reference Books:

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P.Khandelwal, 1985, Vani Publication.

PHY GE 4: WAVES AND OPTICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Superposition of Two Collinear Harmonic oscillations: Linearity & Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). **(4 Lectures)**

Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses. **(2 Lectures)**

Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity. **(7 Lectures)**

Fluids: Surface Tension: Synclastic and anticlastic surface - Excess of pressure - Application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature - Jaegar's method. Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of viscosity of liquid with temperature- lubrication. **(6 Lectures)**

Sound: Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria. **(6 Lectures)**

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. **(3 Lectures)**

Interference: Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. **(10 Lectures)**

Michelson's Interferometer: (1) Idea of form of fringes (no theory needed), (2) Determination of wavelength, (3) Wavelength difference, (4) Refractive index, and (5) Visibility of fringes. **(3 Lectures)**

Diffraction: Fraunhofer diffraction- Single slit; Double Slit. Multiple slits and

Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

(14
Lectures)

Polarization: Transverse nature of light waves. Plane polarized light - production and analysis. Circular and elliptical polarization.

(5
Lectures)

Reference Books:

- Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
- Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications
- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley

GE 4 LAB: WAVES AND OPTICS

60 Lectures

1. To investigate the motion of coupled oscillators
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $X^2 - T$ Law.
3. To study Lissajous Figures
4. Familiarization with Schuster's focussing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a Prism using Mercury Light
8. To determine the value of Cauchy Constants.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of monochromatic/Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits.
16. To draw the deviation – wavelength of the material of a prism and to find the wavelength of an unknown line from its deviation.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th

Edition, 2011, Kitab Mahal, New Delhi.

PHY-GE 5: DIGITAL, ANALOG CIRCUITS AND INSTRUMENTATION

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

UNIT-1: Digital Circuits

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. **(4 Lectures)**

De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **(5 Lectures)**

Binary Addition. Binary Subtraction using 2's Complement Method). Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor. **(4 Lectures)**

UNIT-2: Semiconductor Devices and Amplifiers:

Semiconductor Diodes: P and N type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell. **(5 Lectures)**

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains a and p . Relations between a and p . Load Line analysis of Transistors. DC Load line & Q-point. Active, Cutoff & Saturation regions. Voltage Divider Bias Circuit for CE Amplifier. h-parameter Equivalent Circuit. Analysis of single-stage CE amplifier using hybrid Model. Input & output Impedance. Current, Voltage and Power gains. Class A, B & C Amplifiers. **(12 Lectures)**

UNIT-3: Operational Amplifiers (Black Box approach):

Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop and closed-loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Zero crossing detector. **(13 Lectures)**

Sinusoidal Oscillators: Barkhausen's Criterion for Self-sustained Oscillations.

Determination of Frequency of RC Oscillator **(5 Lectures)**

UNIT-4: Instrumentations: Introduction to CRO: Block Diagram of CRO.

Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. **(3 Lectures)**

Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers
Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor
filter, Zener Diode and Voltage Regulation. (6 Lectures)
Timer IC: IC 555 Pin diagram and its application as Astable and Monostable
Multivibrator. (3 Lectures)

Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronic devices & circuits, S. Salivahanan & N.S. Kumar, 2012, Tata Mc-Graw Hill
- Microelectronic Circuits, M.H. Rashid, 2nd Edn., 2011, Cengage Learning.
- Modern Electronic Instrumentation and Measurement Tech., Helfrick and Cooper, 1990, PHI Learning
- Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw Hill
- Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
- OP-AMP & Linear Digital Circuits, R. A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

GE5 LAB: DIGITAL, ANALOG CIRCUITS AND INSTRUMENTS

60 Lectures

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To minimize a given logic circuit.
4. Half adder, Full adder and 4-bit Binary Adder.
5. Adder-Sub tractor using Full Adder I.C.
6. To design an astable multivibrator of given specifications using 555 Timer.
7. To design a monostable multivibrator of given specifications using 555 Timer.
8. To study IV characteristics of PN diode, Zener and Light emitting diode
9. To study the characteristics of a Transistor in CE configuration.
10. To design a CE amplifier of given gain (mid-gain) using voltage divider bias.
11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response.
13. To study Differential Amplifier of given I/O specification using Op-amp.
14. To investigate a differentiator made using op-amp.
15. To design a Wien Bridge Oscillator using an op-amp.

Reference Books:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- OP-Amps & Linear Integrated Circuit, R.A. Gayakwad, 4th Edn, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

PHY-GE 6: ELEMENTS OF MODERN PHYSICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Planck's quantum, Planck's constant and light as a collection of photons; Photo electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. **(8 Lectures)**

Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. **(4 Lectures)**

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. **(4 Lectures)**

Two slit interference experiment with photons, atoms & particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension. **(11 Lectures)**

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier. **(12 Lectures)**

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.

Radioactivity: stability of nucleus; Law of radioactive decay; Mean life and half-life; a decay; (3 decay - energy released, spectrum and Pauli's prediction of neutrino; y-ray emission. **(11 Lectures)**

Fission and fusion - mass deficit, relativity and generation of energy; Fission – nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions. **(4**

Lectures)

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
- Modern Physics, J.R. Taylor, C.D. Zafiratos, M. A. Dubson, 2009, PHI Learning
- Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill

- Quantum Physics, Berkeley Physics, Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
- Modern Physics, R.A. Serway, C.J. Moses, and C.A. Moyer, 2005, Cengage Learning

GE 6 LAB: ELEMENTS OF MODERN PHYSICS 60 Lectures

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine the ionization potential of mercury.
4. To determine value of Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. To study the diffraction patterns of single and double slits using laser and measure its intensity variation using Photosensor & compare with incoherent source – Na.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
9. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
10. To set up the Millikan oil drop apparatus and determine the charge of an electron.
11. To determine the slit width (a) the wavelength of monochromatic/ laser a source using diffraction of single slit.
12. To determine the slit width (a,b) the wavelength of monochromatic/ laser a source using diffraction of double slits.
13. To determine (1) wavelength of He-Ne light / laser using plane diffraction grating
14. To draw the I-V characteristics of a valve diode and to verify the laws of thermionic emission.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

PHY GE 7: SOLID STATE PHYSICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Prerequisites: Knowledge of "Elements of Modern Physics"

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis - Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor. **(12 Lectures)**

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law **(10 Lectures)**

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia - and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **(12 Lectures)**

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeier relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons. **(10 Lectures)**

Elementary band theory: Kronig Penny model. Band Gaps. Conductors, Semiconductors and insulators. P and N type Semiconductors. Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient. **(10 Lectures)**

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. **(6 Lectures)**

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
- Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

GE7 LAB: SOLID STATE PHYSICS

60 Lectures

1. Measurement of susceptibility of paramagnetic solution (Quinckf s Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.

4. To measure the Dielectric Constant of a dielectric Materials with frequency
5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
6. To determine the refractive index of a dielectric layer using SPR
7. To study the PE Hysteresis loop of a Ferroelectric Crystal.
8. To study the BH curve of iron using a Solenoid and determine the energy loss.
9. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (room temperature to 150 °C) and to determine its band gap.
10. To determine the Hall coefficient of a semiconductor sample.
11. To measure the mutual inductance of two coaxial coils at various relative orientations using a ballistic galvanometer.
12. Verification of the inverse cube law for magnetic dipoles (study of the dependence of the field of a magnetic dipole on distance) and determination of the horizontal component of the earth's magnetic field by deflection and oscillation magnetometers.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn., 2011, Kitab Mahal
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

PHY GE 8: QUANTUM MECHANICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Prerequisites: Knowledge of (1) "Mathematical Physics" and (2) "Elements of Modern Physics "

Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum & Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. **(6 Lectures)**

Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to the spread of Gaussian wavepacket for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle.

(10 Lectures)

General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to

one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method.

(12 Lectures)

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wavefunctions from Frobenius method; Orbital angular momentum quantum numbers l and m ; s, p, d,... shells (idea only)

(10 Lectures)

Atoms in Electric and Magnetic Fields:- Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment & Magnetic Energy, Gyromagnetic Ratio & Bohr Magneton. (8 Lectures)

Atoms in External Magnetic Fields: Normal and Anomalous Zeeman Effect.

(4 Lectures)

Many electron atoms: Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular Momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings.

(10 Lectures)

Reference Books:

- A Text book < McGraw Hill
- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics, G. Aruldas, 2nd Edn. 2002, PHI Learning of India.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
- Quantum Mechanics for Scientists and Engineers, D.A.B. Miller, 2008, Cambridge University Press

Additional Books for Reference

- Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
- Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education
- Quantum Mechanics, Walter Greiner, 4th Edn., 2001, Springer

GE 8 LAB: QUANTUM MECHANICS

60 Lectures

Use Fortran/Python/Matlab/Octave/ C/C++/Scilab for solving the following problems based on Quantum Mechanics like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = -\frac{e}{r}$$

Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wavefunctions. Remember that the ground state energy of the hydrogen atom is ≈ -13.6 eV. Take $e = 3.795$ (eVA)^{1/2}, $\hbar = 1973$ (eVA) and $m = 0.511 \times 10^6$ eV/c².

2. Solve the s-wave radial Schrodinger equation for an atom:

where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = -\frac{e}{r} e^{-r/a}$$

Find the energy (in eV) of the ground state of the atom to an accuracy of three significant digits. Also, plot the corresponding wavefunction. Take $e = 3.795$ (eVA)^{1/2}, $m = 0.511 \times 10^6$ eV/c², and $a = 3$ A, 5 A, 7 A. In these units $\hbar = 1973$ (eVA). The ground state energy is expected to be above -12 eV in all three cases.

3. Solve the s-wave radial Schrodinger equation for a particle of mass m:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = -\frac{e}{r} e^{-r/a}$$

For the anharmonic oscillator potential

$$V(r) = \frac{1}{2} kr^2 + \frac{1}{3} kr^3$$

for the ground state energy (in MeV) of particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose $m = 940$ MeV/c², $k = 100$ MeV fm⁻², $b = 0, 10, 30$ MeV fm⁻³. In these units, $\hbar = 197.3$ MeV fm. The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

4. Solve the s-wave radial Schrodinger equation for the vibration of hydrogen molecule:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = D(e^{-2\alpha r} - e^{-2\alpha r_0}), r_0 = \frac{r - r_0}{r}$$

Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function. Take $m = 940 \times 106$ eV/c, $D = 0.755501$ eV, $\alpha = 1.44$, $r_0 = 0.131349$ A

Laboratory based experiments:

8. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
9. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
10. To show the tunneling effect in tunnel diode using I-V characteristics.
8. Quantum efficiency of CCDs

Some laboratory based experiments:

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
7. To study the quantum tunnelling effect with solid state device, e.g. tunnelling current in backward diode or tunnel diode.

Reference Books:

- Schaum's Outline of Programming with C++. J.Hubbard, 2000, McGraw-Hill Pub.
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al., 3rd Edn., 2007, Cambridge University Press.
- Elementary Numerical Analysis, K.E. Atkinson, 3rd Ed. 2007, Wiley India Edition
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific & Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer
- Scilab by example: M. Affouf, 2012, ISBN: 978-1479203444
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.

PHY GE 9: NUCLEAR AND PARTICLE PHYSICS

(Credits: Theory-05, Tutorials-01)

F.M. = 75 (Theory - 60, Internal Assessment – 15)

**Internal Assessment [Class Attendance – 05,
Class Test/ Assignment/ Tutorial – 10]**

Theory: 75 Lectures

Prerequisites: Knowledge of "Elements of Modern Physics"

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excited states. **(10 Lectures)**

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force. **(12 Lectures)**

Radioactivity decay:(a) Alpha decay: basics of α -decay processes, theory of α -emission, Gamow factor, Geiger Nuttall law, α -decay spectroscopy. (b) β -decay: energy kinematics for β -decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. **(9 Lectures)**

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering(Rutherford scattering). **(8 Lectures)**

Nuclear Astrophysics: Early universe, primordial nucleosynthesis (particle nuclear interactions), stellar nucleosynthesis, concept of gamow window, heavy element production: r- and s- process path. **(5 Lectures)**

Interaction of Nuclear Radiation with matter: Energy loss due to ionization (Bethe- Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter. **(6 Lectures)**

Detector for Nuclear Radiations: Gas detectors: estimation of electric field,

mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector. **(6 Lectures)**

Particle Accelerators: Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

(5 Lectures)

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. **(14 Lectures)**

Reference Books:

- Introductory nuclear Physics by Kenneth S.Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L.Cohen. (Tata Mcgraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A.Dunlap. (Thomson Asia, 2004)
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D.Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).

Draft syllabus

for

B.Sc. (Honours) Physics

University of Kalyani

Under

Choice Based Credit System

**CHOICE BASED CREDIT
SYSTEM
B. SC. HONOURS WITH
PHYSICS**

PREAMBLE

The University Grants Commission (UGC), as a part of its policy, has taken several measures to improve the higher education system in India. The mission is to provide uniform standard of higher education and equality across the higher educational institutions. To achieve this, new regulations and guidelines have been formulated which provide parallel movement of the choice of subjects of any course. Further steps include introduction of up-to-date and innovative course curricula, improved teaching-learning method, more scientific examination and evaluation systems. The introduction of Choice Based Credit System (CBCS) is one such measure which is important to improve higher education system with diversity of courses across all higher educational institutes in the country. The CBCS course curriculum has provisions to provide Core, Elective, Skill Enhancement and Ability Enhancement courses. The semester-wise grading system is to be followed to evaluate the students, which is better than conventional points systems. This will enable the students to carry their grade points from one institute to other to begin with courses of their choice. Moreover uniform grading system will provide uniform assessment of the candidates for job or for any other required purpose.

Outline of the Choice Based Credit System being introduced

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.
 - 2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - 2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.
3. **Ability Enhancement Courses/ Skill Enhancement Courses:**
 - 3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.
 - 3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

A. TOTAL Number of courses in UG-CBCS (B.Sc. PHYSICS Hons.):

Types of course	Core course (CC)	Elective course		Ability enhancement course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course (GE)	Ability Enhancement compulsory course (AECC)	Skill Enhancement course (SEC)	
No. of course	14	4	4	2	2	26
Credit/course	6	6	6	2	2	140

Structure of B.Sc. Honours in PHYSICS under CBCS

Core Courses (CC) – 14 compulsory courses

1. Mathematical Physics-I (4 + 2)
2. Mechanics (4 + 2)
3. Electricity and Magnetism (4 + 2)
4. Waves and Optics (4 + 2)
5. Mathematical Physics-II (4 + 2)
6. Thermal Physics (4 + 2)
7. Digital Systems and Applications (4 + 2)
8. Mathematical Physics III (4 + 2)
9. Elements of Modern Physics (4 + 2)
10. Analog Systems and Applications (4 + 2)
11. Quantum Mechanics and Applications (4 + 2)
12. Solid State Physics (4 + 2)
13. Electromagnetic Theory (4 + 2)
14. Statistical Mechanics (4 + 2)

Discipline Specific Elective Courses (DSEC) –to be opted for in Semesters V and VI

Semesters V	Semesters VI
Advanced Mathematical Physics/Advanced Mathematical Physics II/Classical Dynamics/Applied Dynamics	Medical Physics/Nano Materials and Applications/Communication Electronics/Digital Signal Processing
Nuclear and Particle Physics/Astronomy and Astrophysics/Atmospheric Physics/Earth Physics	Biological Physics or Biophysics/ Experimental Techniques/Dissertation

Generic Elective Courses (GEC) – Courses offered to students of other Departments

1. Mechanics/ Electricity and Magnetism (Semester-I)
2. Thermal Physics and Statistical Mechanics/ Waves and Optics (Semester-II)
3. Digital, Analog and Instrumentation/ Elements of Modern Physics (Semester-III)
4. Solid State Physics/ Quantum Mechanics/ Nuclear and Particle Physics (Semester-IV)

Ability Enhancement Compulsory Courses (AECC) – Two compulsory courses in Semesters I & II

1. Environmental Science
2. Bengali / English communication

Skill Enhancement Courses (SEC): Two courses in Semesters III and IV

1. Physics Workshop Skills/ Computational Physics Skills/ Electrical circuits & Network Skills/ Basic Instrumentation Skills (Semester III)
2. Renewable Energy & Energy harvesting/ Radiation Safety/ Technical Drawing/ Applied Optics/ Weather Forecasting (Semester-IV)

TABLE-1: DETAILS OF COURSES & CREDIT OF B.SC. PHYSICS (HONOURS) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
		Theory + Practical	Theory + Tutorial
1.	Core Course: 14 Papers		
1.A.	Core Course: Theory (14 papers)	14x4 = 56	14x5 = 70
1.B.	Core Course (Practical/Tutorial)*(14 papers)	14x2 = 28	14x1 = 14
2.	Elective Courses: (8 papers)		
2.A.	A. Discipline specific Elective(DSE)(4 papers)	4x4 = 16	4x5 = 20
2.B.	DSE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
2C.	General Elective(GE) (Interdisciplinary) (4 papers)	4x4 = 16	4x5 = 20
2.D.	GE (Practical / Tutorial)* (4 papers)	4x2 =8	4x1 =4
#Optional Dissertation/ Project Work in place of one DSE paper (6 credits) in 6th semester			
3. Ability Enhancement Courses			
A.	AECC(2 papers of 2 credits each) ENVS, English Communication/ MIL	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course(SEC) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
Total Credit:		140	140
## Wherever there is a practical, there will be no tutorial and vice-versa.			

TABLE-2: SEMESTERWISE DISTRIBUTION OF COURSE & CREDITS IN B.SC. PHYSICS (HONOURS) UNDER CBCS

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC (6)	2	2	3	3	2	2	14	84
DSE (6)	--	--	--	--	2	2	04	24
GE (6)	1	1	1	1	--	--	04	24
AECC (2)	1	1			--	--	02	04
SEC (2)	--	--	1	1	--	--	02	04
Total No. of Course/ Sem.	4	4	5	5	4	4	26	--
Total Credit /Semester	20	20	26	26	24	24	-----	140

TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN B.SC. PHYSICS (HONOURS) UNDER CBCS**(6 Credit: 75 Marks)**

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
UG-H-PHY- CC-T-1	Mathematical Physics-I	Core (60L)	4
UG-H-PHY- CC-P-1		Core (60P)	2
UG-H-PHY- CC-T-2	Mechanics	Core (60L)	4
UG-H-PHY- CC-P-2		Core (60P)	2
UG-H-PHY- GE-T-1	Mechanics/ Electricity and Magnetism	Generic Elective(60L)	4
UG-H-PHY- GE-P-1		Generic Elective(60P)	2
UG-H-AECC-1	Environmental Science	Ability Enhancement Compulsory (30L)	2
Total	4 courses	Total	20

SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
UG-H-PHY-CC-T-3	Electricity and Magnetism	Core (60L)	4
UG-H-PHY-CC-P-3		Core (60P)	2
UG-H-PHY-CC-T-4	Waves and Optics	Core (60L)	4
UG-H-PHY-CC-P-4		Core (60P)	2
UG-H-PHY-GE-T-2	Thermal Physics and Statistical Mechanics/ Waves and Optics	Generic Elective(60L)	4
UG-H-PHY-GE-P-2		Generic Elective(60P)	2
UG-H-AECC-2	Bengali / English communication	Ability Enhancement Compulsory (30L)	2
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
UG-H-PHY-CC-T-5	Mathematical Physics-II	Core (60L)	4
UG-H-PHY-CC-P-5		Core (60P)	2
UG-H-PHY-CC-T-6	Thermal Physics	Core (60L)	4
UG-H-PHY-CC-P-6		Core (60P)	2
UG-H-PHY-CC-T-7	Digital Systems and Applications	Core (60L)	4
UG-H-PHY-CC-P-7		Core (60P)	2
UG-H-PHY-GE-T-3	Digital, Analog and Instrumentation/ Elements of Modern Physics	Generic Elective(60L)	4
UG-H-PHY-GE-P-3		Generic Elective(60P)	2
UG-H-PHY-SEC-T-01	Physics Workshop Skills/ Computational Physics Skills/ Electrical circuits & Network Skills/ Basic Instrumentation Skills	Skill Enhancement (30L)	2
Total	5 courses	Total	26
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
UG-H-PHY-CC-T-8	Mathematical Physics III	Core (60L)	4
UG-H-PHY-CC-P-8		Core (60P)	2
UG-H-PHY-CC-T-9	Elements of Modern Physics	Core (60L)	4
UG-H-PHY-CC-P-9		Core (60P)	2
UG-H-PHY-CC-T-10	Analog Systems and Applications	Core (60L)	4

UG-H-PHY-CC-P-10		Core (60P)	2
UG-H-PHY-GE- T -4	Solid State Physics/ Quantum Mechanics/ Nuclear and Particle Physics	Generic Elective(60L)	4
UG-H-PHY-GE-P-4		Generic Elective(60P)	2
UG-H-PHY-SEC- T -2	Renewable Energy & Energy harvesting/ Radiation Safety/ Technical Drawing/ Applied Optics/ Weather Forecasting	Skill Enhancement (30L)	2
Total	5 courses	Total	26
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
UG-H-PHY-CC- T -11	Quantum Mechanics & Applications	Core (60L)	4
UG-H-PHY-CC-P-11		Core (60P)	2
UG-H-PHY-CC- T -12	Solid State Physics	Core (60L)	4
UG-H-PHY-CC-P-12		Core (60P)	2
UG-H-PHY-DSE- T -01	Advanced Mathematical Physics/Advanced Mathematical Physics II/Classical Dynamics/Applied Dynamics	Discipline Specific Elective (60L+60P)	6
UG-H-PHY-DSE-P-01			
UG-H-PHY-DSE- T -02	Nuclear and Particle Physics/Astronomy and Astrophysics/Atmospheric Physics/Earth Physics	Discipline Specific Elective (60L+60P)	6
UG-H-PHY-DSE-P-02			
Total	4 courses	Total	24
SEMESTER-VI			
Course Code	Course Title	Course Nature	Credit
PHY-H-CC- T -13	Electro-magnetic Theory	Core (60L)	4
PHY-H-CC-P-13		Core (60P)	2
PHY-H-CC- T -14	Statistical Mechanics	Core (60L)	4
PHY-H-CC-P-14		Core (60P)	2
UG-H-PHY-DSE- T -03	Medical Physics/Nano Materials and Applications/Communication Electronics/Digital Signal Processing	Discipline Specific Elective (60L+60P)	6
UG-H-PHY-DSE-P-03			
UG-H-PHY-DSE- T -04	Biological Physics or Biophysics/ Experimental Techniques/Dissertation	Discipline Specific Elective (60L+60P)	6
UG-H-PHY-DSE-P-04			
Total	4 courses	Total	24
Total (All semesters)	26 courses	Total	140

CORE COURSE (HONOURS IN PHYSICS)

PHY-C I: MATHEMATICAL PHYSICS-I

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,
Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

The emphasis of course is on applications in solving problems of interest to physicists.

The students are to be examined entirely on the basis of problems, seen and unseen.

Calculus:

Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation.

Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only). First

Order Differential Equations and Integrating Factor. (6 Lectures)

Second Order Differential equations: Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness

Theorem for Initial Value Problems. Particular Integral. (12 Lectures)

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization

using Lagrange Multipliers. (6 Lectures)

Vector Calculus:

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields. (5 Lectures)

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities, Gradient, divergence, curl and Laplacian in spherical and cylindrical coordinates. (10 Lectures)

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs). (14 Lectures)

Orthogonal Curvilinear Coordinates:

Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. (5 Lectures)

Dirac Delta function and its properties:

Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function. **(2 Lectures)**

Reference Books:

- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
- An introduction to ordinary differential equations, E. A. Coddington, 2009, PHI learning
- Differential Equations, George F. Simmons, 2007, McGraw Hill.
- Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
- Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
- Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
- Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press

PHY- C I LAB: MATHEMATICAL PHYSICS-I

60 Lectures

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- *Highlights the use of computational methods to solve physical problems*
- *The course will consist of lectures (both theory and practical) in the Lab*
- *Evaluation done not on the programming but on the basis of formulating the problem*
- *Aim at teaching students to construct the computational problem to be solved*

• *Students can use any one operating system Linux or Microsoft Windows*

Introduction and Overview

Introduction and Overview

Computer architecture and organization, memory and Input/output devices

Basics of scientific computing

Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods

Errors and error Analysis

Truncation and round off errors, Absolute and relative errors, Floating point computations.

Introduction to plotting graphs with Gnuplot/Origin/Excel

Basic 2D and 3D graph plotting - plotting functions and datafiles, fitting data using gnuplot's fit function, polar and parametric plots, modifying the appearance of graphs, Surface and contour plots, exporting plots

Introduction to programming in python/Fortran/Matlab/C,C++:

Introduction to programming, constants, variables and data types, dynamical typing, operators and expressions, modules, I/O statements, iterables, compound statements, indentation in python, the if-elif-else block, for and while loops, nested compound statements, lists, tuples, dictionaries and strings, basic ideas of object oriented programming.

Programs:

Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search

Random number generation

Area of circle, area of square, volume of sphere, value of pi (π)

Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods

Solution of linear and quadratic equation, solving $\alpha = \tan\alpha$, $I = I_0 \left\{ \frac{\sin\alpha}{\alpha} \right\}^2$, in optics

Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation

Evaluation of trigonometric functions e.g. $\sin \theta$, $\cos \theta$, $\tan \theta$, etc.

Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method

Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop

Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods

First order differential equation

- ▶ Radioactive decay
- ▶ Current in RC, LC circuits with DC source
- ▶ Newton's law of cooling
- ▶ Classical equations of motion

Attempt following problems using RK 4 order method

Also attempt some problems on differential equation like:

1. Solve the coupled first order differential equations

$$dy/dx = y + x - x^2, dx/dx = -x$$

for four initial conditions $x(0) = 0, y(0) = -1, -2, -3, -4$. Plot x vs y for each of the four initial conditions on the same screen for $0 < t < 15$.

2. The ordinary differential equation describing the motion of a pendulum is

$$\theta'' = -\sin\theta.$$

. The pendulum is released from rest at an angular displacement α i.e. $\theta(0) = \alpha, \theta'(0) = 0$. Use the RK4 method to solve the equation for $\alpha = 0.1, 0.5$ and 1.0 and plot θ as a function of time in the range $0 < t < 8\pi$. Also, plot the analytic solution valid in the small θ ($\sin(\theta) \approx \theta$).

Attempt following problems using RK 4 order method

Also attempt some problems on differential equation like:

1. Solve the coupled first order differential equations

$$dy/dx = y + x - x^2, dx/dx = -x$$

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Referred Books:

- Introduction to Numerical Analysis, S.S. Sastry, 5th Edn. , 2012, PHI Learning Pvt. Ltd.
- Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Pub.
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al., 3rd Edn. , 2007, Cambridge University Press.
- A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn. , 2007, Wiley India Edition.
- Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.
- An Introduction to computational Physics, T.Pang, 2nd Edn. , 2006, Cambridge Univ. Press

PHY-C2: MECHANICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Fundamentals of Dynamics: Reference frames. Inertial frames; Galilean transformations; Galilean invariance. Review of Newton's Laws of Motion. Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. Momentum of variable-mass system: motion of rocket. **(6 Lectures)**

Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy. **(4 Lectures)**

Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames. **(3 Lectures)**

Rotational Dynamics: Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation. **(12 Lectures)**

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire. **(3 Lectures)**

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube. **(2 Lectures)**

Gravitation and Central Force Motion: Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. (3 Lectures)

Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). Physiological effects on astronauts. (6 Lectures)

Oscillations: SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. (7 Lectures)

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems. (4 Lectures)

Special Theory of Relativity: Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum. Energy-Momentum Four Vector. (10 Lectures)

Reference Books:

- An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Mechanics, Berkeley Physics, vol. 1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
- Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
- Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
- Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Additional Books for Reference

- Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
- University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
- Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning
- Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

PHY C2 LAB: MECHANICS

60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) g
5. To determine the Moment of Inertia of a Flywheel/ a rigid body.
6. To determine g and velocity for a freely falling body using Digital Timing Technique
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. To determine the Young's Modulus of the material of a bar by flexure method
9. To determine the Modulus of Rigidity of a Wire by - Dynamic Method.
10. To determine the elastic Constants of a wire by Searle's method.
11. To determine the value of g using Bar Pendulum.
12. To determine the value of g using Kater's Pendulum.
13. To draw the frequency – resonance length curve of a sonometer wire and to determine an unknown frequency of a tuning fork
14. Measurement of coefficient of viscosity by Stoke's method.

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal

PHY-C3: ELECTRICITY AND MAGNETISM

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Electric Field and Electric Potential:

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry.

(6 Lectures)

Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole.

(6 Lectures)

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

(10 Lectures)

Dielectric Properties of Matter:

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D . Relations between E , P and D . Gauss' Law in dielectrics.

(8 Lectures)

Magnetic Field:

Magnetic force between current elements and definition of Magnetic Field B . Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B : curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.

(9 Lectures)

Magnetic Properties of Matter:

Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B , H , M . Ferromagnetism. B - H curve and hysteresis.

(4 Lectures)

Electromagnetic Induction:

Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current. **(6 Lectures)**

Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.

(4 Lectures)

Network theorems: Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits. **(4 Lectures)**

Ballistic Galvanometer: Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping. CDR.

(3 Lectures)

Reference Books:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

PHY C3 LAB: ELECTRICITY AND MAGNETISM

60 Lectures

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series(a) RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De' Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. To verify the Thevenin and Norton theorems.

8. To verify the Superposition, and Maximum power transfer theorems.
9. To determine self inductance of a coil by Anderson's bridge.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer
13. Determine a high resistance by leakage method using Ballistic Galvanometer.
14. To determine self-inductance of a coil by Rayleigh's method.
15. To determine the mutual inductance of two coils by Absolute method.
16. To study the characteristics of a series LR Circuit.
17. Measurement of the resistance of a mirror galvanometer by the half deflection method and to determine its figure of merit.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

PHY-C4: WAVES AND OPTICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.

(5 Lectures)

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses.**(2 Lectures)**

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves.

(4 Lectures)

Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction.

(6 Lectures)

Superposition of Two Harmonic Waves:

Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves.

(7 Lectures)

Wave Optics: Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence.

(3 Lectures)

Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index.

(9 Lectures)

Interferometer: Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer.

(4 Lectures)

Diffraction: Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula and its application to rectangular slit.

(5 Lectures)

Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating.

(8 Lectures)

Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

(7 Lectures)

Reference Books

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

PHY C4 LAB: WAVES AND OPTICS

60 Lectures

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify X^2 -T law.
2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Familiarization with: Schuster's focusing; determination of angle of prism.
5. To determine refractive index of the Material of a prism using sodium source.
6. To determine the dispersive power of the material of a prism using mercury source.
7. To determine the wavelength of sodium source using Michelson's interferometer.
8. To determine wavelength of sodium light using Fresnel Biprism.
9. To determine wavelength of sodium light using Newton's Rings.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
11. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
12. To determine dispersive power and resolving power of a plane diffraction grating.
13. . To draw the deviation – wavelength of the material of a prism and to find the wavelength of an unknown line from its deviation.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

PHY C5: MATHEMATICAL PHYSICS-II

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity.

(14 Lectures)

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions and Orthogonality.

(24 Lectures)

Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral).

(4 Lectures)

Theory of Errors: Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. **(4 Lectures)**

Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes.

(14 Lectures)

Reference Books:

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
- Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
- Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
- Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.
- Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books

PHY-C5 LAB: MATHEMATICAL PHYSICS-II

60 Lectures

The aim of this Lab is to use the computational methods to solve physical problems. Course will consist of lectures (both theory and practical) in the Lab. Evaluation done not on the programming but on the basis of formulating the problem

Introduction to Numerical computation numpy, scipy/Matlab/Octave/ Scilab

Introduction to the python numpy module. Arrays in numpy, array operations, array item selection, slicing, shaping arrays. Basic linear algebra using the linalg submodule. Introduction to on line graph plotting using matplotlib. Introduction to the scipy module. Uses in optimization and solution of differential equations.

Curve fitting, Least square fit, Goodness of fit, standard deviation

Ohms law to calculate R, Hooke's law to calculate spring constant

Solution of Linear system of equations by Gauss elimination method and Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems

Solution of mesh equations of electric circuits (3 meshes)

Solution of coupled spring mass systems (3 masses)

Generation of Special functions using User defined functions

Generating and plotting Legendre Polynomials
Generating and plotting Bessel function

Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kutta second order methods Second order differential equation ,Fixed difference method

First order differential equation

- Radioactive decay
- Current in RC, LC circuits with DC source
- Newton's law of cooling
- Classical equations of motion
- Second order Differential Equation
- Harmonic oscillator (no friction)
- Damped Harmonic oscillator
- Over damped
- Critical damped
- Oscillatory
- Forced Harmonic oscillator
- Transient and
- Steady state solution
- Apply above to LCR circuits also

Partial differential equations

- Wave equation
- Heat equation
- Poisson equation
- Laplac equation

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Complex Variables, A.S. Fokas & M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer
- Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
- Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

PHY-C 6: THERMAL PHYSICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

(Include related problems for each topic)

Introduction to Thermodynamics

Zeroth and First Law of Thermodynamics: Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. (8 Lectures)

Second Law of Thermodynamics: Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. (10 Lectures)

Entropy: Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature-Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.

(7 Lectures)

Thermodynamic Potentials: Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations.

(7 Lectures)

Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of $C_p - C_v$, (3) Tds Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.

(7 Lectures)

Kinetic Theory of Gases

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases.

(7 Lectures)

Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance.

(4 Lectures)

Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO₂ Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. p-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule-Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule-Thomson Cooling.

(10 Lectures)

Reference Books:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
- Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press

PHY C6 LAB : THERMAL PHYSICS

60 Lectures

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.

7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature
8. Determination of the boiling point of a liquid by Platinum resistance thermometer
9. Determination of the melting point of a solid with a thermocouple.
10. Measurement of the coefficient of linear expansion of a solid using an optical lever

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

PHY C 7: DIGITAL SYSTEMS AND APPLICATIONS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75 (Theory - 40, Internal Assessment – 15)

Internal Assessment: Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Introduction to CRO: Block Diagram of CRO. Electron Gun, Deflection System and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.

(3 Lectures)

Integrated Circuits (Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital ICs.

(3 Lectures)

Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers.

(6 Lectures)

Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

(6 Lectures)

Data processing circuits: Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders.

(4 Lectures)

Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor.

(5 Lectures)

Sequential Circuits: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop.

(6 Lectures)

Timers: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator.

(3 Lectures)

Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

(2 Lectures)

Counters(4 bits): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

(4 Lectures)

Computer Organization: Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. MemoryMap

(6 Lectures)

Intel 8085 Microprocessor Architecture: Main features of 8085. Block diagram. Components. Pin-out diagram. Buses. Registers. ALU. Memory. Stack memory. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI.

(8 Lectures)

Introduction to Assembly Language: 1 byte, 2 byte & 3 byte instructions.

(4 Lectures)

Reference Books:

- Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Systems: Principles & Applications, R.J. Tocci, N.S. Widmer, 2001, PHI Learning
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
- Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.

PHY C 7: LAB : DIGITAL SYSTEMS AND APPLICATIONS

60 Lectures

1. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.
2. To test a Diode and Transistor using a Multimeter.
3. To design a switch (NOT gate) using a transistor.
4. To verify and design AND, OR, NOT , XOR and using NAND gates.
5. To design a combinational logic system for a specified Truth Table.
6. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
7. To minimize a given logic circuit.
8. Half Adder, Full Adder and 4-bit binary Adder.
9. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
11. To build JK Master-slave flip-flop using Flip-Flop ICs
12. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.
13. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs.
14. To design an astable multivibrator of given specifications using 555 Timer.
15. To design a monostable multivibrator of given specifications using 555 Timer.
16. Write the following programs using 8085 Microprocessor
 - a) Addition and subtraction of numbers using direct addressing mode
 - b) Addition and subtraction of numbers using indirect addressing mode
 - c) Multiplication by repeated addition.
 - d) Division by repeated subtraction.
 - e) Handling of 16-bit Numbers.

Reference Books:

- Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.
- Microprocessor 8085:Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI Learning.

PHY C8: MATHEMATICAL PHYSICS-III

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals. **(30 Lectures)**

Integrals Transforms:

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations. **(15 Lectures)**

Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits. **(15 Lectures)**

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A.Krzywicki, 1967, Dover Publications
- Complex Variables, A.S.Fokas & MJ.Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett

PHY C 8 LAB : MATHEMATICAL PHYSICS-III

60 Lectures

Numerical computation using Python/Matlab/Octave/Fortran:

1. Solve differential equations:

$$dy/dx = e^{-x}, \text{ with } y = 0 \text{ for } x = 0$$

$$dy/dx + e^{-x} = x^2$$

$$dy/dx + e^{-x} = x^2$$

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$$

2. Dirac Delta Function:

$$\frac{1}{\sqrt{2\pi\sigma^2}} \int e^{-\frac{(x-3)^2}{2\sigma^2}} (x+3) dx, \text{ for } \sigma=1, .1, .01 \text{ and show it tends to } 5$$

3. Fourier Series:

Program to sum

$$\sum_{n=1}^{\infty} (2)^n \text{ Evaluate the Fourier coefficients of a given periodic function (square wave)}$$

1. Frobenius method and Special functions: $\int_{-1}^1 P_n(\mu)P_m(\mu) d\mu = \delta_{nm}$, Plot $P_n(x), J_n(x)$

Show recursion relation

5. Calculation of error for each data point of observations recorded in experiments done in previous semesters (choose any two).
6. Calculation of least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program.
7. Evaluation of trigonometric functions e.g. $\sin 6$, Given Bessel's function at N points find its value at an intermediate point. Complex analysis:

- Integrate $1/(x^2+2)$ numerically and check with computer integration.
8. Compute the n th roots of unity for $n = 2, 3,$ and 4 .
 9. Find the two square roots of $-5+12j$.
 10. Integral transform: FFT of e^{-x}

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernandez. 2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
- Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

PHY C 9: ELEMENTS OF MODERN PHYSICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions.

(14 Lectures)

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle-application to virtual particles and range of an interaction.

(5 Lectures)

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.

(10 Lectures)

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical scattering and tunnelling in one dimension-across a step potential & rectangular potential barrier.

(10 Lectures)

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers.

(6 Lectures)

Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus.

(8 Lectures)

Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions).

(3 Lectures)

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser.

(4 Lectures)

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
- Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
- Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.
- Quantum Mechanics: Theory & Applications, A.K.Ghatak & S.Lokanathan, 2004, Macmillan

Additional Books for Reference

- Modern Physics, J.R. Taylor, C.D. Zafiratos, M. A. Dubson, 2004, PHI Learning.
- Theory and Problems of Modern Physics, Schaurf's outline, R. Gautreau and W. Savin, 2nd Edn, Tata McGraw-Hill Publishing Co. Ltd.
- Quantum Physics, Berkeley Physics, Vol.4. E.H. Wichman, 1971, Tata McGraw-Hill Co.
- Basic ideas and concepts in Nuclear Physics, K. Heyde, 3rd Edn., Institute of Physics Pub.
- Six Ideas that Shaped Physics: Particle Behave like Waves, T.A. Moore, 2003, McGraw Hill

PHY C 9 LAB : ELEMENTS OF MODERN PHYSICS

60 Lectures

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light;
maximum energy of photo-electrons versus frequency of light
3. To determine work function of material of filament of directly heated vacuum diode.
4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the ionization potential of mercury.
7. To determine the absorption lines in the rotational spectrum of Iodine vapour.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To show the tunnelling effect in tunnel diode using I-V characteristics.
11. To determine the slit width (a) using diffraction of single slit.
12. To determine the slit width (a,b) using diffraction of double slits.
13. To determine (1) wavelength and of He-Ne light /~~laser~~ using plane diffraction grating
14. To draw the I-V characteristics of a valve diode and to verify the laws of thermionic emission.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal

PHYSICS-C 10: ANALOG SYSTEMS AND APPLICATIONS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Semiconductor Diodes: P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. **(10 Lectures)**

Two-terminal Devices and their Applications: (1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, (2) Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell.

(6 Lectures)

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β . Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions. **(6 Lectures)**

Amplifiers: Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers.

(10 Lectures)

Coupled Amplifier: RC-coupled amplifier and its frequency response. **(4 Lectures)**

Feedback in Amplifiers: Effects of Positive and Negative Feedback on Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise.

(4 Lectures)

Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency. Hartley & Colpitts oscillators. **(4 Lectures)**

Operational Amplifiers (Black Box approach): Characteristics of an Ideal and Practical Op-Amp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground.

(4 Lectures)

Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator.

(9 Lectures)

Conversion: Resistive network (Weighted and R-2R Ladder). Accuracy and Resolution. A/D Conversion (successive approximation) **(3 Lectures)**

Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- Solid State Electronic Devices, B.G. Streetman & S.K. Banerjee, 6th Edn., 2009, PHI Learning
- Electronic Devices & circuits, S. Salivahanan & N.S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
- Electronic circuits: Handbook of design & applications, U. Tietze, C. Schenk, 2008, Springer
- Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India
- Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

PHY C10 LAB :ANALOG SYSTEMS AND APPLICATIONS

60 Lectures

1. To study V-I characteristics of PN junction diode, ~~and~~ / Light emitting diode.
2. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
3. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
4. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5. To study the various biasing configurations of BJT for normal class A operation.
6. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
7. To study the frequency response of voltage gain of a RC-coupled transistor amplifier.
8. To design a Wien bridge oscillator for given frequency using an op-amp.
9. To design a phase shift oscillator of given specifications using BJT.
10. To study the Colpitts oscillator.
11. To design a digital to analog converter (DAC) of given specifications.
12. To study the analog to digital converter (ADC) IC.
13. To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain
14. To design inverting amplifier using Op-amp (741,351) and study its frequency response
15. To design non-inverting amplifier using Op-amp (741,351) & study its frequency response

16. To study the zero-crossing detector and comparator
17. To add two dc voltages using Op-amp in inverting and non-inverting mode
18. To design a precision Differential amplifier of given I/O specification using Op-amp.
19. To investigate the use of an op-amp as an Integrator.
20. To investigate the use of an op-amp as a Differentiator.
21. To design a circuit to simulate the solution of a 1st/2nd order differential equation.

22. To study the characteristics of a Bipolar Junction Transistor in CB configuration

Reference Books:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
- Electronic Devices & circuit Theory, R.L. Boylestad & L.D. Nashelsky, 2009, Pearson

PHY C 11: QUANTUM MECHANICS AND APPLICATIONS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle.

(6 Lectures)

Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle.

(10 Lectures)

General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle. **(12 Lectures)**

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wavefunctions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum quantum numbers l and m ; s , p , d ,.. shells. **(10 Lectures)**

Atoms in Electric & Magnetic Fields: Electron angular momentum. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

(8 Lectures)

Atoms in External Magnetic Fields:- Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only). **(4 Lectures)**

Many electron atoms: Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total angular momentum. Vector Model. Spin-orbit coupling in atoms- L-S and J-J couplings. Hund's Rule. Term symbols. Spectra of Hydrogen and Alkali Atoms (Na etc.). **(10 Lectures)**

Reference Books: A test book of

- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics, G. Aruldas, 2nd Edn. 2002, PHI Learning of India.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
- Quantum Mechanics: Foundations & Applications, Arno Bohm, 3rd Edn., 1993, Springer
- Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press

Additional Books for Reference

- Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
- Introduction to Quantum Mechanics, D. J. Griffith, 2nd Ed. 2005, Pearson Education
- Quantum Mechanics, Walter Greiner, 4th Edn., 2001, Springer

PHYC 11 LAB : QUANTUM MECHANICS AND APPLICATIONS

60 Lectures

Use Fortran/Python/Matlab/Octave/ C/C++/Scilab for solving the following problems based on Quantum Mechanics like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

$$\frac{d^2 y}{dr^2} = \frac{2m}{\hbar^2} (E - V(r))y$$

where $V(r) = -\frac{e}{r}$

Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wavefunctions. Remember that the ground state energy of the hydrogen atom is ≈ -13.6 eV. Take $e = 3.795$ (eVA)^{1/2}, $\hbar = 1973$ (eVA) and $m = 0.511 \times 10^6$ eV/c².

2. Solve the s-wave radial Schrodinger equation for an atom:

where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r))y(r) = 0,$$

where $V(r) = -\frac{e}{r} e^{-r/a}$

Find the energy (in eV) of the ground state of the atom to an accuracy of three significant digits. Also, plot the corresponding wavefunction. Take $e = 3.795$ (eVA)^{1/2}, $m = 0.51 \times 10^6$ eV/c², and $a = 3$ A, 5 A, 7 A. In these units $\hbar = 1973$ (eVA). The ground state energy is expected to be above -12 eV in all three cases.

3. Solve the s-wave radial Schrodinger equation for a particle of mass m:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r))y(r) = 0,$$

where $V(r) = -\frac{e}{r} e^{-r/a}$

For the anharmonic oscillator potential

$$V(r) = \frac{1}{2}kr^2 + \frac{1}{3}kr^3$$

for the ground state energy (in MeV) of particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose $m = 940$ MeV/c², $k = 100$ MeV fm⁻², $b = 0, 10, 30$ MeV fm⁻³. In these units, $\hbar = 197.3$ MeV fm. The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

3. Solve the s-wave radial Schrodinger equation for the vibration of hydrogen

molecule:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = D(e^{-2\alpha r'} - e^{-2\alpha r}), r' = \frac{r-r_0}{r}$$

Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function. Take $m=940 \times 106 \text{ eV}/c$, $D=0.755501 \text{ eV}$, $\alpha=1.44$, $r_0=0.131349 \text{ \AA}$

Laboratory based experiments:

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
7. To show the tunneling effect in tunnel diode using I-V characteristics.
8. Quantum efficiency of C CD s

Reference Books:

- Schaum's outline of Programming with C++. J.Hubbard, 2 0 0 0, McGraw-Hill Publication
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al., 3rd Edn., 2007, Cambridge University Press.
- An introduction to computational Physics, T.Pang, 2nd Edn., 2006, Cambridge Univ. Press
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific & Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer.
- Scilab (A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand & Co.
- Scilab Image Processing: L.M.Surhone. 2010 Betascript Publishing ISBN:978-6133459274

PHY C 12: SOLID STATE PHYSICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75 (Theory - 40, Internal Assessment - 15)

Internal Assessment : Class Attendance (Theory) - 05,

Theory (Class Test/ Assignment/ Tutorial) - 05,

Practical (Sessional Viva-voce) - 05]

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis - Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

(12 Lectures)

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law **(10 Lectures)**

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **(8 Lectures)**

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeier relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons, TO modes. **(8 Lectures)**

Ferroelectric Properties of Materials: Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop. **(6 lectures)**

Elementary band theory: Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient. **(10 Lectures)**

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation) **(6 Lectures)**

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
- Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

PHY C 12 LAB : SOLID STATE

PHYSICS

60 Lectures

1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency
5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)

6. To determine the refractive index of a dielectric layer using SPR
7. To study the PE Hysteresis loop of a Ferroelectric Crystal.
8. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
9. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150 °C) and to determine its band gap.
10. To determine the Hall coefficient of a semiconductor sample.
11. To measure the mutual inductance of two coaxial coils at various relative orientations using a ballistic galvanometer.
12. Verification of the inverse cube law for magnetic dipoles (study of the dependence of the field of a magnetic dipole on distance) and determination of the horizontal component of the earth's magnetic field by deflection and oscillation magnetometers.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India.

PHY C 13: ELECTROMAGNETIC THEORY

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75 (Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Maxwell Equations: Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density. **(12 Lectures)**

EM Wave Propagation in Unbounded Media: Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere. **(10 Lectures)**

EM Wave in Bounded Media: Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection (normal Incidence) **(10 Lectures)**

Polarization of Electromagnetic Waves: Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Analysis of Polarized Light (12 Lectures)

Rotatory Polarization: Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel's theory. Specific rotation. Laurent's half-shade polarimeter. (5 Lectures)

Wave Guides: Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission. (8 Lectures)

Optical Fibres:- Numerical Aperture. Step and Graded Indices (Definitions Only). Single and Multiple Mode Fibres (Concept and Definition Only). (3 Lectures)

Reference Books:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.
- Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
- Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
- Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill
- Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

Additional Books for Reference

- Electromagnetic Fields & Waves, P.Lorrain & D.Corson, 1970, W.H.Freeman & Co.
- Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGraw Hill.
- Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004, Cambridge University Press

PHY C 13 LAB :

ELECTROMAGNETIC THEORY

60 Lectures

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves
7. To study Polarization and double slit interference in microwaves.
8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.

9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
11. To verify the Stefan's law of radiation and to determine Stefan's constant.
12. To determine the Boltzmann constant using V-I characteristics of PN junction diode.
13. To verify Brewster's law and Fresnel formulae for reflection of electromagnetic waves with the help of a spectrometer, a prism and two polaroids

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

PHY C 14: STATISTICAL MECHANICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75 (Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Classical Statistics: Macrostate & Microstate, Elementary Concept of Ensemble, Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) - Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature.

(18 Lectures)

Classical Theory of Radiation: Properties of Thermal Radiation. Blackbody Radiation. Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law. Ultraviolet Catastrophe.

(9 Lectures)

Quantum Theory of Radiation: Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law.

(5 Lectures)

Bose-Einstein Statistics: B-E distribution law, Thermodynamic functions of a strongly Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative

description), Radiation as a photon gas and Thermodynamic functions of photon gas. Bose derivation of Planck's law. **(13 Lectures)**

Fermi-Dirac Statistics: Fermi-Dirac Distribution Law, Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass Limit.

(15 Lectures)

Reference Books:

- Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
- Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill
- Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall
- Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
- An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ. Press

PHY C 14 LAB: STATISTICAL MECHANICS

60 Lectures

Use C/C++/Scilab for solving the problems based on Statistical Mechanics like

1. Plot Planck's law for Black Body radiation and compare it with Wein's Law and Raleigh-Jeans Law at high temperature (room temperature) and low temperature.
2. Plot Specific Heat of Solids by comparing (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature (room temperature) and low temperature and compare them for these two cases
3. Plot Maxwell-Boltzmann distribution function versus temperature.
4. Plot Fermi-Dirac distribution function versus temperature.
5. Plot Bose-Einstein distribution function versus temperature.

Reference Books:

- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn. 2007, Wiley India Edition
- Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
- Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
- Scilab Image Processing: L.M. Surhone. 2010, Betascript Pub., ISBN: 978-6133459274

PHYSICS-DSE 1-4 (ELECTIVES)

PHY DSE 1: ADVANCED MATHEMATICAL PHYSICS

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

Laplace Transform(No. of Lectures:15)

Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1st order. Solution of heat flow along infinite bar using Laplace transform.

Linear Vector Spaces(No. of Lectures:15)

Abstract Systems. Binary Operations and Relations. Introduction to Groups and Fields. Vector Spaces and Subspaces. Linear Independence and Dependence of Vectors. Basis and Dimensions of a Vector Space. Change of basis. Homomorphism and Isomorphism of Vector Spaces. Linear Transformations. Algebra of Linear Transformations. Non-singular Transformations. Representation of Linear Transformations by Matrices. Inner products. Gram-Schmidt orthogonalization. Orthogonal and unitary transformations and their matrix representations.

Cartesian Tensors(No. of Lectures:15)

Transformation of Co-ordinates. Einstein's Summation Convention. Relation between Direction Cosines. Tensors. Algebra of Tensors. Sum, Difference and Product of Two Tensors. Contraction. Quotient Law of Tensors. Symmetric and Anti-symmetric Tensors. Invariant Tensors: Kronecker and Alternating Tensors. Association of Antisymmetric Tensor of Order Two and Vectors. Vector Algebra and Calculus using Cartesian Tensors: Scalar and Vector Products, Scalar and Vector Triple Products. Differentiation. Gradient, Divergence and Curl of Tensor Fields. Vector Identities. Tensorial Formulation of Analytical Solid Geometry: Equation of a Line. Angle Between Lines. Projection of a Line on another Line. Condition for Two Lines to be Coplanar. Foot Perpendicular from a Point on a Line. Rotation Tensor(NoDerivation). Isotropic Tensors. Tensorial Character of Physical Quantities. Moment of Inertia Tensor. Stress and Strain Tensors: Symmetric Nature. Elasticity Tensor. Generalized Hooke's Law.

General Tensors(No. of Lectures:15)

Transformation of Co-ordinates. Minkowski Space. Contravariant & Covariant Vectors. Contravariant, Covariant and Mixed Tensors. Kronecker Delta and Permutation Tensors. Algebra of Tensors. Sum, Difference & Product of Two Tensors. Contraction. Quotient Law of Tensors. Symmetric and Anti-symmetric Tensors. Metric Tensor.

Reference Books

- Mathematical Tools for Physics, James Nearing, 2010, Dover Publications
- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, and F.E. Harris, 1970, Elsevier.
- Modern Mathematical Methods for Physicists and Engineers, C.D. Cantrell, 2011, Cambridge University Press
- Introduction to Matrices and Linear Transformations, D.T. Finkbeiner, 1978, Dover Pub.
- Linear Algebra, W. Cheney, E.W. Cheney & D.R. Kincaid, 2012, Jones & Bartlett Learning
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole
- Mathematical Methods for Physics & Engineers, K.F. Riley, M.P. Hobson, S.J. Bence, 3rd Ed., 2006, Cambridge University Press

PHY DSE 1 LAB: ADVANCED MATHEMATICAL PHYSICS

60 Lectures

Use Python, Matlab/Octave/Fortran /Scilab to solve Mathematical Physics problems like

1. Linear algebra:
 - Multiplication of two 3 x 3 matrices.
 - Eigenvalue and eigenvectors of

$$\begin{pmatrix} 2 & 1 & 1 \\ 1 & 3 & 2 \\ 3 & 1 & 4 \end{pmatrix} \begin{pmatrix} 1 & -i & 3+4i \\ i & 2 & 4 \\ 3-4i & 4 & 3 \end{pmatrix} \begin{pmatrix} 2 & -i & 2i \\ i & 4 & 3 \\ -2i & 3 & 5 \end{pmatrix}$$

2. Orthogonal polynomials as eigenfunctions of Hermitian differential operators.
3. Determination of the principal axes of moment of inertia through diagonalization.
4. Vector space of wave functions in Quantum Mechanics: Position and momentum differential operators and their commutator, wave functions for stationary states as eigenfunctions of Hermitian differential operator.
5. Lagrangian formulation in Classical Mechanics with constraints.
6. Study of geodesics in Euclidean and other spaces (surface of a sphere, etc).
7. Estimation of ground state energy and wave function of a quantum system.

Reference Books:

- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernandez. 2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012, ISBN: 978-1479203444
- Scilab Image Processing: L.M.Surhone. 2010, Betascript Pub., ISBN: 978-6133459274

PHY DSE 2: ADVANCED MATHEMATICAL PHYSICS II

(Credits: Theory-05, Tutorials-01)

F.M. = 75 (Theory - 60, Internal Assessment – 15)

Theory:75 Lectures

Internal Assessment [Class Attendance – 05, Class Test/ Assignment/ Tutorial – 10]

Calculus of Variations: (No. of Lectures:15)

Variational Calculus: Recapitulation of the Variational Principle, Euler-Lagrange's Equations of Motion Eulerangles, sphericaltop and symmetrictop. Symmetry and conservationlaws. Canonical Pair of Variables. Definition of Generalized Force: Definition of Hamiltonian (Legendre Transformation). Hamilton's Principle. Poisson Brackets and their properties. Canonical transformations. Action-angle variables for simplesystems.

Group Theory(No. of Lectures:45)

Review of sets, Mapping and Binary Operations, Relation, Types of Relations.

Groups: Elementary properties of groups, uniqueness of solution, Subgroup, Centre of a group, Co-sets of a subgroup, cyclic group, Permutation/Transformation. Homomorphism and Isomorphism of group. Normal and conjugate subgroups, Completeness and Kernel. Some special groups with operators. Matrix Representations: Reducible and Irreducible representations. Schur's lemma. Orthogonality theorems. Character tables and their uses. Application to small vibrations.

Advanced Probability Theory: (No. of Lectures:15)

Fundamental Probability Theorems. Conditional Probability, Bayes' Theorem, Repeated Trials, Binomial and Multinomial expansions. Random Variables and probability distributions, Expectation and Variance, Special Probability distributions: Thebinomial distribution,The poisson distribution, Continuous distribution: The Gaussian (ornormal) distribution,The principle of leastsquares

Reference Books

- Mathematical Methods for Physicists: Weber and Arfken, 2005, Academic Press.
- Mathematical Methods for Physicists: A Concise Introduction: Tai L. Chow, 2000,Cambridge Univ.Press.
- ElementsofGroupTheoryforPhysicistsbyA.W.Joshi,1997,JohnWiley.
- Group Theory and its Applications to Physical Problems by MortonHamermesh,1989,Dover

PHY DSE 3: CLASSICAL DYNAMICS

(Credits: Theory-05, Tutorials-01)

Theory: 75 Lectures

F.M. = 75 (Theory - 60, Internal Assessment – 15)

**Internal Assessment [Class Attendance – 05,
Class Test/ Assignment/ Tutorial – 10]**

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

Classical Mechanics of Point Particles: Generalised coordinates and velocities. Hamilton's Principle, Lagrangian and Euler-Lagrange equations. Applications to simple systems such as coupled oscillators. Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, particle in a central force field. Poisson brackets. Canonical transformations. **(22 Lectures)**

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz Transformations. Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams. Time-dilation, length contraction & twin paradox. Four-vectors: space-like, time-like & light-like. Four-velocity and acceleration. Metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle. The Electromagnetic field tensor and its transformation under Lorentz transformations: relation to known transformation properties of E and B. Electric and magnetic fields due to a uniformly moving charge. Equation of motion of charged particle & Maxwell's equations in tensor form. Motion of charged particles in external electric and magnetic fields. **(38 Lectures)**

Electromagnetic radiation: Review of retarded potentials. Potentials due to a moving charge: Lienard Wiechert potentials. Electric & Magnetic fields due to a moving charge: Power radiated, Larmor's formula and its relativistic generalisation.

(15

Lectures)Reference Books:

- Classical Mechanics, H.Goldstein, C.P. Poole, J.L. Safko, 3rd Edn. 2002, Pearson Education.
- Mechanics, L. D. Landau and E. M. Lifshitz, 1976, Pergamon.
- Classical Electrodynamics, J.D. Jackson, 3rd Edn., 1998, Wiley.
- The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Edn., 2003, Elsevier.
- Introduction to Electrodynamics, D.J. Griffiths, 2012, Pearson Education.
- Classical Mechanics: An introduction, Dieter Strauch, 2009, Springer.
- Solved Problems in classical Mechanics, O.L. Delange and J. Pierrus, 2010, Oxford Press

PHY DSE 4 : APPLIED DYNAMICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Introduction to Dynamical systems: Definition of a continuous first order dynamical system. The idea of phase space, flows and trajectories. Simple mechanical systems as first order dynamical systems : the free particle, particle under uniform gravity, simple and damped harmonic oscillator. Sketching flows and trajectories in phase space; sketching variables as functions of time, relating the equations and pictures to the underlying physical intuition. Other examples of dynamical systems -

In Biology: Population models e.g. exponential growth and decay, logistic growth, species competition, predator-prey dynamics, simple genetic circuits

In Chemistry: Rate equations for chemical reactions e.g. auto catalysis, bistability

In Economics: Examples from game theory. Illustrative examples from other disciplines.

Fixed points, attractors, stability of fixed points, basin of attraction, notion of qualitative analysis of dynamical systems, with applications to the above examples.

Computing and visualizing trajectories on the computer using a software packages.

Discrete dynamical systems. The logistic map as an example. **(26 Lectures)**

Introduction to Chaos and Fractals: Examples of 2-dimensional billiard, Projection of the trajectory on momentum space. Sinai Billiard and its variants. Computational visualization of trajectories in the Sinai Billiard. Randomization and ergodicity in the divergence of nearby phase space trajectories, and dependence of time scale of divergence on the size of obstacle. Electron motion in mesoscopic conductors as a chaotic billiard problem. Other examples of chaotic systems; visualization of their trajectories on the computer.

Self similarity and fractal geometry: Fractals in nature - trees, coastlines, earthquakes, etc. Need for fractal dimension to describe self-similar structure. Deterministic fractal vs. self-similar fractal structure. Fractals in dynamics - Sierpinski gasket and DLA. Chaos in nonlinear finite-difference equations- Logistic map: Dynamics from time series. Parameter dependence- steady, periodic and chaos states. Cobweb iteration. Fixed points. Defining chaos- aperiodic, bounded, deterministic and sensitive dependence on initial conditions. Period- Doubling route to chaos.

Nonlinear time series analysis and chaos characterization: Detecting chaos from return map. Power spectrum, autocorrelation, Lyapunov exponent, correlation dimension.

(20 Lectures)

Elementary Fluid Dynamics: Importance of fluids: Fluids in the pure sciences, fluids in technology. Study of fluids: Theoretical approach, experimental fluid dynamics, computational fluid dynamics. Basic physics of fluids: The continuum hypothesis- concept of fluid element or fluid parcel; Definition of a fluid- shear stress; Fluid

properties- viscosity, thermal conductivity, mass diffusivity, other fluid properties and equation of state; Flow phenomena- flow dimensionality, steady and unsteady flows, uniform & non-uniform flows, viscous & inviscid flows, incompressible & compressible flows, laminar and turbulent flows, rotational and irrotational flows, separated & unseparated flows. Flow visualization - streamlines, pathlines, Streaklines

(14 Lectures)

Reference Books

- Nonlinear Dynamics and Chaos, S.H. Strogatz, Levant Books, Kolkata, 2007
- Understanding Nonlinear Dynamics, Daniel Kaplan and Leon Glass, Springer.
- An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge Univ. Press, 2002
- Fluid Mechanics, 2nd Edition, L. D. Landau and E. M. Lifshitz, Pergamon Press, Oxford, 1987.

PHY DSE 4 LAB: APPLIED DYNAMICS 60 Lectures

Laboratory/Computing and visualizing trajectories using software such as Scilab, Maple, Octave, XPPAUT based on Applied Dynamics problems like

1. To determine the coupling coefficient of coupled pendulums.
2. To determine the coupling coefficient of coupled oscillators.
3. To determine the coupling and damping coefficient of damped coupled oscillator.
4. To study population models e.g. exponential growth and decay, logistic growth, species competition, predator-prey dynamics, simple genetic circuits.
5. To study rate equations for chemical reactions e.g. auto catalysis, bistability.
6. To study examples from game theory.
7. Computational visualization of trajectories in the Sinai Billiard.
8. Computational visualization of trajectories Electron motion in mesoscopic conductors as a chaotic billiard problem.
9. Computational visualization of fractal formations of Deterministic fractal.
10. Computational visualization of fractal formations of self-similar fractal.
11. Computational visualization of fractal formations of Fractals in nature - trees, coastlines, earthquakes.
12. Computational Flow visualization - streamlines, pathlines, Streaklines.

Reference Books

- Nonlinear Dynamics and Chaos, Steven H. Strogatz, Levant Books, Kolkata, 2007
- Understanding Nonlinear Dynamics, Daniel Kaplan and Leon Glass, Springer.
- An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge Univ. Press, 2002
- Fluid Mechanics, 2nd Edn, L.D.Landau & E.M. Lifshitz, Pergamon Press, Oxford, 1987
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012, ISBN: 978-1479203444
- Scilab Image Processing: L.M.Surhone. 2010, Betascript Pub., ISBN: 978-6133459274

PHY DSE 5: NUCLEAR AND PARTICLE PHYSICS

(Credits: Theory-05, Tutorials-01)

Theory: 75 Lectures

F.M. = 75 (Theory - 60, Internal Assessment – 15)

Internal Assessment [Class Attendance – 05,

Class Test/ Assignment/ Tutorial – 10]

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excited states.

(10 Lectures)

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

(12 Lectures)

Radioactivity decay:(a) Alpha decay: basics of α -decay processes, theory of α -emission, Gamow factor, Geiger Nuttall law, α -decay spectroscopy. (b) β -decay: energy kinematics for β -decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion.

(9 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

(8 Lectures)

Nuclear Astrophysics: Early universe, primordial nucleosynthesis (particle nuclear interactions), stellar nucleosynthesis, concept of gamow window, heavy element production: r- and s- process path.

(5 Lectures)

Interaction of Nuclear Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

(6 Lectures)

Detector for Nuclear Radiations: Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector. **(6 Lectures)**

Particle Accelerators: Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

(5 Lectures)

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

(14 Lectures)

Reference Books:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
- Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
- Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press, Elsevier, 2007).
- Theoretical Nuclear Physics, J.M. Blatt & V.F. Weisskopf (Dover Pub.Inc., 1991)

PHY DSE 6 : ASTRONOMY & ASTROPHYSICS

(Credits: Theory-05, Tutorials-01) Theory: 75 Lectures

F.M. = 75 (Theory - 60, Internal Assessment – 15)

Internal Assessment [Class Attendance – 05,

Class Test/ Assignment/ Tutorial – 10]

Astronomical Scales: Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature.

Basic concepts of positional astronomy: Celestial Sphere, Geometry of a Sphere, Spherical Triangle, Astronomical Coordinate Systems, Geographical Coordinate Systems, Horizon System, Equatorial System, Diurnal Motion of the Stars, Conversion of Coordinates. Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Calendar. Basic Parameters of Stars:

Determination of Distance by Parallax Method; Brightness, Radiant Flux and Luminosity, Apparent and Absolute magnitude scale, Distance Modulus; Determination of Temperature and Radius of a star; Determination of Masses from Binary orbits; Stellar Spectral Classification, Hertzsprung-Russell Diagram.

(22 Lectures)

Astronomical techniques: Basic Optical Definitions for Astronomy (Magnification Light Gathering Power, Resolving Power and Diffraction Limit, Atmospheric Windows), Optical Telescopes (Types of Reflecting Telescopes, Telescope Mountings, Space Telescopes, Detectors and Their Use with Telescopes (Types of Detectors, detection Limits with Telescopes).

Physical principles: Gravitation in Astrophysics (Virial Theorem, Newton versus Einstein), Systems in Thermodynamic Equilibrium, Theory of Radiative Transfer (Radiation Field, Radiative Transfer Equation), Optical Depth; Solution of Radiative Transfer Equation, Local Thermodynamic Equilibrium **(6 Lectures)**

The sun (Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magnetohydrodynamics. Helioseismology). **The solar family** (Solar System: Facts and Figures, Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, Extra-Solar Planets.

Stellar spectra and classification Structure (Atomic Spectra Revisited, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H R Diagram, Luminosity Classification) **(7 Lectures)**

Stellar structure: Hydrostatic Equilibrium of a Star, Some Insight into a Star: Virial Theorem, Sources of Stellar Energy, Modes of Energy Transport, Simple Stellar Model, Polytropic Stellar Model. **Star formation:** Basic composition of Interstellar medium, Interstellar Gas, Interstellar Dust, Formation of Protostar, Jeans criterion, Fragmentation of collapsing clouds, From protostar to Pre-Main Sequence, Hayashi Line. **(8 Lectures)**

Nucleosynthesis and stellar evolution: Cosmic Abundances, Stellar Nucleosynthesis, Evolution of Stars (Evolution on the Main Sequence, Evolution beyond the Main Sequence), Supernovae. **Compact stars:** Basic Familiarity with Compact Stars, Equation of State and Degenerate Gas of Fermions, Theory of White Dwarf, Chandrasekhar Limit, Neutron Star (Gravitational Red-shift of Neutron Star, Detection of Neutron Star: Pulsars), Black Hole. **The milky way:** Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way (Differential Rotation of the Galaxy and Oort Constant, Rotation Curve of the Galaxy and the Dark Matter, Nature of the Spiral Arms), Stars and Star Clusters of the Milky Way, Properties of and around the Galactic Nucleus **(11 Lectures)**

Galaxies: Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies (The Intrinsic Shapes of Elliptical, de Vaucouleurs Law, Stars and Gas). Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms, Active Galaxies **(5 Lectures)**

Active galaxies: 'Activities' of Active Galaxies, How 'Active' are the Active Galaxies? Classification of the Active Galaxies, Some Emission Mechanisms Related to the Study of Active Galaxies, Behaviour of Active Galaxies (Quasars and Radio Galaxies, Seyferts, BL Lac Objects and Optically Violent Variables), The Nature of the Central Engine, Unified Model of the Various Active Galaxies

(8 Lectures)

Large scale structure & expanding universe: Cosmic Distance Ladder (An Example from Terrestrial Physics, Distance Measurement using Cepheid Variables), Hubble's Law (Distance- Velocity Relation), Clusters of Galaxies (Virial theorem and Dark Matter), Friedmann Equation and its Solutions, Early Universe and Nucleosynthesis (Cosmic Background Radiation, Evolving vs. Steady State Universe)

(8 Lectures)

Reference Books:

- Modern Astrophysics, B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co.
- Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, 4th Edition, Saunders College Publishing.
- The physical universe: An introduction to astronomy, F.Shu, Mill Valley: University Science Books.
- Fundamental of Astronomy (Fourth Edition), H. Karttunen et al. Springer
- K.S. Krishnasamy, 'Astro Physics a modern perspective,' Reprint, New Age International (p) Ltd, New Delhi,2002.
- Baidyanath Basu, 'An introduction to Astro physics', Second printing, Prentice - Hall of India Private limited, New Delhi,2001.
- Textbook of Astronomy and Astrophysics with elements of cosmology, V.B. Bhatia, Narosa Publication.

PHY DSE 7 : ATMOSPHERIC PHYSICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce-05)

General features of Earth's atmosphere: Thermal structure of the Earth's Atmosphere, Ionosphere, Composition of atmosphere, Hydrostatic equation, Atmospheric Thermodynamics, Greenhouse effect and effective temperature of Earth, Local winds, monsoons, fogs, clouds, precipitation, Atmospheric boundary layer, Sea breeze and land breeze. Instruments for meteorological observations, including RS/RW, meteorological processes and different systems, fronts, Cyclones and anticyclones, thunderstorms.

(12 Lectures)

Atmospheric Dynamics: Scale analysis, Fundamental forces, Basic conservation laws, The Vectorial form of the momentum equation in rotating coordinate system, scale analysis of equation of motion, Applications of the basic equations, Circulations and vorticity, Atmospheric oscillations, Mesoscale circulations, The general circulations, Tropical dynamics. **(12 Lectures)**

Atmospheric Waves: Surface water waves, wave dispersion, acoustic waves, buoyancy waves, propagation of atmospheric gravity waves (AGWs) in a nonhomogeneous medium, Lamb wave, Rossby waves and its propagation in three dimensions and in sheared flow, wave absorption, non-linear consideration **(12 Lectures)**

Atmospheric Radar and Lidar: Radar equation and return signal, Signal processing and detection, Various type of atmospheric radars, Application of radars to study atmospheric phenomena, Lidar and its applications, Application of Lidar to study atmospheric phenomenon. Data analysis tools and techniques. **(12 Lectures)**

Atmospheric Aerosols: Spectral distribution of the solar radiation, Classification and properties of aerosols, Production and removal mechanisms, Concentrations and size distribution, Radiative and health effects, Observational techniques for aerosols, Absorption and scattering of solar radiation, Rayleigh scattering and Mie scattering, Bouguert-Lambert law, Principles of radiometry, Optical phenomena in atmosphere, Aerosol studies using Lidars. **(12 Lectures)**

Reference Books:

- Fundamental of Atmospheric Physics - Murry L Salby; Academic Press, Vol 61, 1996
- The Physics of Atmosphere - John T. Houghton; Cambridge University press; 3rd edn. 2002.
- An Introduction to dynamic meteorology - James R Holton; Academic Press, 2004
- Radar for meteorological and atmospheric observations - S Fukao and K Hamazu, Springer Japan, 2014

PHY DSE 7 LAB: ATMOSPHERIC PHYSICS

60 Lectures

1. Numerical Simulation for atmospheric waves using dispersion relations

2. Atmospheric gravity waves
 - (b) Kelvin waves
 - (c) Rossby waves, and mountain waves
3. Offline and online processing of radar data
 - (a) VHF radar,
 - (b) X-band radar, and
 - (c) UHF radar
4. Offline and online processing of LIDAR data
5. Radiosonde data and its interpretation in terms of atmospheric parameters using vertical profiles in different regions of the globe.
6. Handling of satellite data and plotting of atmospheric parameters using radio occultation technique
7. Time series analysis of temperature using long term data over metropolitan cities in India - an approach to understand the climate change

Reference Books:

- Fundamental of Atmospheric Physics - Murry L Salby; Academic Press, Vol 61, 1996
- The Physics of Atmosphere - J.T. Houghton; Cambridge Univ. Press; 3rd edn. 2002.
- An Introduction to dynamic meteorology - James R Holton; Academic Press, 2004
- Radar for meteorological and atmospheric observations - S Fukao and K Hamazu, Springer Japan, 2014

PHYSICS-DSE 8 : EARTH SCIENCE

(Credits: Theory-05, Tutorials - 10)

Theory: 75 Lectures

F.M. = 75 (Theory - 60, Internal Assessment – 15)

Internal Assessment [Class Attendance – 05,

Class Test/ Assignment/ Tutorial – 10]

1. **The Earth and the Universe: (17 Lectures)**
 - (a) Origin of universe, creation of elements and earth. A Holistic understanding of our dynamic planet through Astronomy, Geology, Meteorology and Oceanography. Introduction to various branches of Earth Sciences.
 - (b) General characteristics and origin of the Universe. The Milky Way galaxy, solar system, Earth's orbit and spin, the Moon's orbit and spin. The terrestrial and Jovian planets. Meteorites & Asteroids. Earth in the Solar system, origin, size, shape, mass, density, rotational and revolution parameters and its age.
 - (c) Energy and particle fluxes incident on the Earth.
 - (d) The Cosmic Microwave Background.
2. **Structure: (18 Lectures)**
 - (a) The Solid Earth: Mass, dimensions, shape and topography, internal structure, magnetic field, geothermal energy. How do we learn about Earth's interior?
 - (b) The Hydrosphere: The oceans, their extent, depth, volume, chemical composition. River systems.

- (c) The Atmosphere: variation of temperature, density and composition with altitude, clouds.
- (d) The Cryosphere: Polar caps and ice sheets. Mountain glaciers.
- (e) The Biosphere: Plants and animals. Chemical composition, mass. Marine and land organisms.

3 Dynamical Processes: (18 Lectures)

- (a) The Solid Earth: Origin of the magnetic field. Source of geothermal energy. Convection in Earth's core and production of its magnetic field. Mechanical layering of the Earth. Introduction to geophysical methods of earth investigations. Concept of plate tectonics; sea-floor spreading and continental drift. Geodynamic elements of Earth: Mid Oceanic Ridges, trenches, transform faults and island arcs. Origin of oceans, continents, mountains and rift valleys. Earthquake and earthquake belts. Volcanoes: types products and distribution.
- (b) The Hydrosphere: Ocean circulations. Oceanic current system and effect of coriolis forces. Concepts of eustasy, land - air-sea interaction; wave erosion and beach processes. Tides. Tsunamis.
- (c) The Atmosphere: Atmospheric circulation. Weather and climatic changes. Earth's heat budget. Cyclones.

Climate:

- i. Earth's temperature and greenhouse effect,
- ii. Paleoclimate and recent climate changes,
- iii. The Indian monsoon system.
- (d) Biosphere: Water cycle, Carbon cycle, Nitrogen cycle, Phosphorous cycle. The role of cycles in maintaining a steady state.

4 Evolution: (18 Lectures)

Nature of stratigraphic records, Standard stratigraphic time scale and introduction to the concept of time in geological studies. Introduction to geochronological methods in their application in geological studies. History of development in concepts of uniformitarianism, catastrophism and neptunism. Law of superposition and faunal succession. Introduction to the geology and geomorphology of Indian subcontinent.

1. Time line of major geological and biological events.
2. Origin of life on Earth.
3. Role of the biosphere in shaping the environment.
4. Future of evolution of the Earth and solar system: Death of the Earth.

5. Disturbing the Earth - Contemporary dilemmas (4 Lectures)

- (a) Human population growth.
- (b) Atmosphere: Green house gas emissions, climate change, air pollution.
- (c) Hydrosphere: Fresh water depletion.
- (d) Geosphere: Chemical effluents, nuclear waste.
- (e) Biosphere: Biodiversity loss. Deforestation. Robustness and fragility of ecosystems.

Reference Books:

- Planetary Surface Processes, H. Jay Melosh, Cambridge University Press, 2011.
- Consider a Spherical Cow: A course in environmental problem solving, John Harte. University Science Books
- Holme's Principles of Physical Geology. 1992. Chapman & Hall.
- Emiliani, C, 1992. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment. Cambridge University Press.

PHY-DSE 9 : MEDICAL PHYSICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce-05)

PHYSICS OF THE BODY-I

Mechanics of the body: Skeleton, forces, and body stability. Muscles and the dynamics of body movement, Physics of body crashing. **Energy household of the body:** Energy balance in the body, Energy consumption of the body, Heat losses of the body, **Pressure system of the body:** Physics of breathing, Physics of cardiovascular system.

(10 Lectures)

PHYSICS OF THE BODY-II

Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound. **Optical system of the body:** Physics of the eye. **Electrical system of the body:** Physics of the nervous system, Electrical signals and information transfer.

(10 Lectures)

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-I

X-RAYS: Electromagnetic spectrum - production of x-rays - x-ray spectra- Brehmsstrahlung- Characteristic x-ray - X-ray tubes - Coolidge tube - x-ray tube design - tube cooling stationary mode - Rotating anode x-ray tube - Tube rating - quality and intensity of x-ray. X-ray generator circuits - half wave and full wave rectification - filament circuit - kilo voltage circuit - high frequency generator - exposure timer - HT cables.

(7 Lectures)

RADIATION PHYSICS: Radiation units - exposure - absorbed dose - units: rad, gray - relative biological effectiveness - effective dose - inverse square law - interaction of radiation with matter - linear attenuation coefficient. Radiation Detectors -Thimble chamber- condenser chambers - Geiger counter - Scintillation counter - ionization chamber - Dosimeters - survey methods - area monitors - TLD and semiconductor detectors.

(7 Lectures)

MEDICAL IMAGING PHYSICS: X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR) - NMR imaging - MRI Radiological imaging - Radiography - Filters - grids - cassette - X-ray film - film processing - fluoroscopy - computed tomography scanner - principle function - display - generations - mammography. Ultrasound imaging - magnetic resonance imaging - thyroid uptake system - Gamma camera (Only Principle, function and display)

(9 Lectures)

RADIATION THERAPY PHYSICS: Radiotherapy - kilo voltage machines - deep therapy machines - Telecobalt machines - Medical linear accelerator. Basics of Teletherapy units - deep x-ray, Telecobalt units, medical linear accelerator - Radiation protection - external beam characteristics - phantom - dose maximum and build up - bolus - percentage depth dose - tissue - air ratio - back scatter factor. **(6 Lectures)**

RADIATION AND RADIATION PROTECTION: Principles of radiation protection - protective materials-radiation effects - somatic, genetic stochastic & deterministic effect, Personal monitoring devices - TLD film badge - pocket dosimeter. Radiation dosimetry, Natural radioactivity, Biological effects of radiation, Radiation monitors. **(6 Lectures)**

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II

Diagnostic nuclear medicine: Radiopharmaceuticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography. Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment **(5 Lectures)**

Reference Books:

- Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978)
- Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
- Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
- Physics of the human body, Irving P. Herman, Springer (2007).
- Physics of Radiation Therapy : F M Khan - Williams and Wilkins, 3rd edition (2003)
- The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
- The Physics of Radiology-H E Johns and Cunningham.

PHY-DSE 9 LAB: MEDICAL PHYSICS

60 Lectures

1. Understanding the working of a manual Hg Blood Pressure monitor and measure the Blood Pressure.
2. Understanding the working of a manual optical eye-testing machine and to learn eye-testing procedure.
3. Correction of Myopia (short sightedness) using a combination of lenses on an optical bench/breadboard.
4. Correction of Hypermetropia/Hyperopia (long sightedness) using a combination of lenses on an optical bench/breadboard.
5. To learn working of Thermoluminescent dosimeter (TLD) badges and measure the background radiation.

6. Familiarization with Geiger-Muller (GM) Counter and to measure background radiation.
7. Familiarization with Radiation meter and to measure background radiation.
8. Familiarization with the construction of speaker-receiver system and to design a speaker-receiver system of given specification.

Reference Books:

- Basic Radiological Physics, Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
- Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
- Physics of Radiation Therapy : F M Khan - Williams and Wilkins, 3rd edition (2003)
- The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
- The Physics of Radiology-H E Johns and Cunningham.

PHY DSE 10 : NANO MATERIALS AND APPLICATIONS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce-05)

NANOSCALE SYSTEMS: Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.

(10 Lectures)

SYNTHESIS OF NANOSTRUCTURE MATERIALS: Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spraypyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots.

(8 Lectures)

CHARACTERIZATION: X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy.

(8 Lectures)

OPTICAL PROPERTIES: Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostructures and nanostructures.

(14 Lectures)

ELECTRON TRANSPORT: Carrier transport in nanostructures. Coulomb blockade effect, thermionic emission, tunneling and hopping conductivity. Defects and impurities: Deep level and surface defects.

(6 Lectures)

APPLICATIONS: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS).

(14 Lectures)

Reference books:

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company)
3. K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
5. M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook (Elsevier, 2007).
6. Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).

PHY DSE 10 LAB: NANO MATERIALS AND APPLICATIONS

60 Lectures

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. XRD pattern of nanomaterials and estimation of particle size.
5. To study the effect of size on color of nanomaterials.
6. To prepare composite of CNTs with other materials.
7. Growth of quantum dots by thermal evaporation.

8. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
9. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
10. Prepare a thin film capacitor and measure capacitance as a function of temperature or frequency.
11. Fabricate a PN diode by diffusing Al over the surface of N-type Si and study its V-I characteristic.

Reference Books:

- C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
- S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
- K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology (PHI Learning Private Limited).
- Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

PHY DSE 11 - COMMUNICATION ELECTRONICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Internal Assessment – 15)

Internal Assessment :

Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Electronic communication(No. of Lectures:8)

Introduction to communication – means and modes. Need for modulation. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI). Electromagnetic communication spectrum, band designations and usage. Channels and base-band signals. Concept of Noise, signal-to-noise (S/N) ratio.

Analog Modulation(No. of Lectures:12)

Amplitude Modulation, modulation index and frequency spectrum. Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection. Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super heterodyne receiver

Analog Pulse Modulation(No. of Lectures:9)

Channel capacity, Sampling theorem, Basic Principles- PAM, PWM, PPM, modulation and detection technique for PAM only, Multiplexing.

Digital Pulse Modulation(No. of Lectures:10)

Need for digital transmission, Pulse Code Modulation, Digital Carrier Modulation Techniques, Sampling, Quantization and Encoding. Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Binary Phase Shift Keying (BPSK).

Introduction to Communication and Navigation systems: (No. of Lectures:21)

Satellite Communication– Introduction, need, Geosynchronous satellite orbits geostationary satellite advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink. Mobile Telephony System – Basic concept of mobile communication, frequency bands used in mobile communication, concept of cellsectoring and cell splitting, SI Mnumber, IME Inumber, need for data encryption, architecture (blockdiagram) of mobile communication network, ideaofGSM, CDMA, TDMA and FDMA technologies, simplified block diagram of mobile phone handset, 2G, 3G and 4G concepts (qualitativeonly).
GPS navigation system (qualitative idea only)

Reference Books

- Electronic Communications, D. Roddy and J. Coolen, Pearson EducationIndia.
- Advanced Electronics Communication Systems- Tomasi, 6th edition, PrenticeHall.
- Electronic Communication systems, G. Kennedy, 3rd Edn, 1999, Tata McGrawHill.
- PrinciplesofElectroniccommunicationsystems–Frenzel,3rdedition,McGrawHill
- Communication Systems, S. Haykin, 2006, Wiley India
- Electronic Communication system, Blake, Cengage, 5thedition.
- Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press

PHY DSE 11 LAB: COMMUNICATION ELECTRONICS

List of Practical

1. To design an Amplitude Modulator using Transistor
2. To study envelope detector for demodulation of AM signal
3. To study FM - Generator and Detector circuit
4. To study AM Transmitter and Receiver
5. To study FM Transmitter and Receiver
6. To study Time Division Multiplexing (TDM)

7. To study Pulse Amplitude Modulation(PAM)
8. To study Pulse Width Modulation(PWM)
9. To study PulsePositionModulation(PPM)
10. To study ASK, PSK and FSK modulators

Reference Books

- Electronic Communication systems, G. Kennedy, 1999, Tata McGrawHill.
- Electronic Communication system, Blake, Cengage, 5thedition.

PHY DSE 12:DIGITAL SIGNAL PROCESSING

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Internal Assessment – 15)

Theory: 60 Lectures

Internal Assessment :

Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05,

Practical (Sessional Viva-voce) - 05]

Discrete-Time Signals andSystems(No. of Lectures:10)

Classification of Signals, Transformations of the Independent Variable, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals, Discrete-Time Systems, System Properties. Impulse Response, Convolution Sum; Graphical Method; Analytical Method, Properties of Convolution; Commutative; Associative; Distributive; Shift; Sum Property System Response to Periodic Inputs, Relationship Between LTI System Properties and the Impulse Response; Causality; Stability; Invertibility, Unit Step Response.

Discrete-Time Fourier Transform(No. of Lectures:10)

Fourier Transform Representation of Aperiodic Discrete-Time Signals, Periodicity of DTFT, Properties; Linearity; Time Shifting; Frequency Shifting; Differencing in Time Domain; Differentiation in Frequency Domain; Convolution Property. The z-Transform: Bilateral (Two- Sided) z-Transform, Inverse z-Transform, Relationship Between z-Transform and Discrete-Time Fourier Transform, z-plane, Region-of-Convergence; Properties of ROC, Properties; Time Reversal; Differentiation in the z-Domain; Power Series Expansion Method (or Long Division Method);AnalysisandCharacterizationofLTISystems;TransferFunctionandDifference-Equation System. Solving DifferenceEquations.

Filter Concepts(No. of Lectures:10)

Phase Delay and Group delay, Zero-Phase Filter, Linear-Phase Filter, Simple FIR Digital Filters, Simple IIR Digital Filters, All pass Filters, Averaging Filters, Notch Filters.

Discrete Fourier Transform(No. of Lectures:10)

Frequency Domain Sampling (Sampling of DTFT), The Discrete Fourier Transform (DFT) and its Inverse, DFT as a Linear transformation, Properties; Periodicity; Linearity; Circular Time Shifting; Circular Frequency Shifting; Circular Time Reversal; Multiplication Property; Parseval's Relation, Linear Convolution Using the DFT (Linear Convolution Using Circular Convolution), Circular Convolution as Linear Convolution withaliasing.

Fast Fourier Transform(No. of Lectures:10)

Direct Computation of the DFT, Symmetry and Periodicity Properties of the Twiddle factor (WN), Radix-2 FFT Algorithms; Decimation-In-Time (DIT) FFT Algorithm; Decimation-In-Frequency (DIF) FFT Algorithm, Inverse DFT Using FFT Algorithms.

Realization of Digital Filters(No. of Lectures:10)

Non Recursive and Recursive Structures, Canonic and Non Canonic Structures, Equivalent Structures (Transposed Structure), FIR Filter structures; Direct-Form; Cascade-Form; Basic structures for IIR systems; Direct-Form I. Finite Impulse Response Digital Filter: Advantages and Disadvantages of Digital Filters, Types of Digital Filters: FIR and IIR Filters; Difference Between FIR and IIR Filters, Desirability of Linear-Phase Filters, Frequency Response of Linear-Phase FIR Filters, Impulse Responses of Ideal Filters, Windowing Method; Rectangular; Triangular; Kaiser Window, FIR Digital Differentiators.

Infinite Impulse Response Digital Filter: Design of IIR Filters from Analog Filters, IIR Filter Design by Approximation of Derivatives, Backward Difference Algorithm, Impulse Invariance Method.

Reference Books

- Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India
- Digital Signal Processing, S.K. Mitra, McGraw Hill, India.
- Modern Digital and Analog Communication Systems, B.P. Lathi, 1998, 3rd Edn. Oxford University Press.
- Fundamentals of Digital Signal Processing using MATLAB, R.J. Schilling and S.L. Harris, 2005, Cengage Learning.
- Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.
- Digital Signal Processing Principles Algorithm & Applications, J.G. Proakis and D.G. Manolakis, 2007, 4th Edn., Prentice Hall.

PHY DSE 12 LAB: DIGITAL SIGNAL PROCESSING**Numerical computation using Python/Matlab/Octave/Fortran****List of Practical**

Simulations experiments based problems like:

1. Write a program to generate and plot the following sequences: (a) Unit sample sequence $o(n)$, (b) unit step sequence $u(n)$, (c) ramp sequence $r(n)$, (d) real valued exponential sequence $x(n) = (0.8)^n u(n)$ for $0 \leq n \leq 50$
2. Write a program to compute the convolution sum of a rectangular signal (orgate

function) with itself for $N = 5$

$$x(n) = \text{rect}\left(\frac{n}{2N}\right) = \Pi\left(\frac{n}{2N}\right) = \begin{cases} 1 & -N \leq n \leq N \\ 0 & \text{otherwise} \end{cases}$$

1. An LTI system is specified by the difference equation

$$y(n] = 0.8y(n-1) + x(n)$$

- a. Determine $H(e^{j\omega})$
- b. Calculate and plot the steady state response $y_{ss}(n)$ to $x(n) = \cos(0.5\pi n)u(n)$

$$x(n) = \cos(0.5\pi n)u(n)$$

2. Given a causal system

$$y(n] = 0.9y(n-1) + x(n)$$

- a. Find $H(z)$ and sketch its pole-zero plot
 - b. Plot the frequency response $|H(e^{j\omega})|$ and $\angle H(e^{j\omega})$
3. Design a digital filter to eliminate the lower frequency sinusoid of $x(t) = \sin 7t + \sin 200t$. The sampling frequency is $f_s = 500$ Hz. Plot its pole zero diagram, magnitude response, input and output of the filter.

4. Let $x(n)$ be a 4-point sequence:

$$x(n) = \begin{matrix} \{1, 1, 1, 1\} \\ \uparrow \\ \{0 \text{ otherwise} \} \end{matrix} = \begin{cases} 1 & 0 \leq n \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

Compute the DTFT $X(e^{j\omega})$ and plot its magnitude

- a. Compute and plot the 4 point DFT of $x(n)$
- b. Compute and plot the 8 point DFT of $x(n)$ (by appending 4 zeros)
- c. Compute and plot the 16 point DFT of $x(n)$ (by appending 12 zeros)

Let $x(n)$ and $h(n)$ be the two 4-point sequences

$$x(n) = \begin{matrix} \{1, 2, 2, 1\} \\ \uparrow \end{matrix}$$

$$h(n) = \begin{matrix} \{1, -1, -1, 1\} \\ \uparrow \end{matrix}$$

Write a program to compute their linear convolution using circular convolution.

7. Using a rectangular window, design a FIR low-pass filter with a pass-band gain of unity, cutoff frequency of 1000 Hz and working at a sampling frequency of 5 KHz. Take the length of the impulse response as 17.
8. Design an FIR filter to meet the following specifications: pass band edge $F_p = 2$ KHz, stop band edge $F_s = 5$ KHz, Pass band attenuation $A_p = 2$ dB, Stop band attenuation $A_s = 42$ dB, Sampling frequency $F_s = 20$ KHz

9. The frequency response of a linear phase digital differentiator is given by

$$H_d(e^{j\omega}) = j\omega e^{-j\tau\omega} \quad |\omega| \leq \pi$$

Using a Hamming window of length $M=21$, design a digital FIR differentiator. Plot the amplitude response.

Reference Books

- Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press, India.
- A Guide to MATLAB, B. R. Hunt, R. L. Lipsman, J. M. Rosenberg, 2014, 3rd Edn., Cambridge University Press
- Fundamentals of Digital Signal processing using MATLAB, R. J. Schilling and S. L. Harris, 2005, Cengage Learning.
- Digital Signal Processing, S. K. Mitra, Mc Graw Hill, India.
- Fundamentals of signals and systems, P. D. Chaand J. I. Molinder, 2007, Cambridge University Press.
- ► Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer

PHYSICS-DSE 13 : Bio-Physics

(Credits: Theory-05, Tutorials-01)

Theory: 75 Lectures

F.M. = 75 (Theory - 60, Internal Assessment – 15)

Internal Assessment [Class Attendance – 05, Class Test/ Assignment/ Tutorial – 10]

Building Blocks & Structure of Living State: Atoms and ions, molecules essential for life, what is life. **Living state interactions:** Forces and molecular bonds, electric & thermal interactions, electric dipoles, casimir interactions, domains of physics in biology. **(18 Lectures)**

Heat Transfer in biomaterials: Heat Transfer Mechanism, The Heat equation, Joule heating of tissue. **Living State Thermodynamics:** Thermodynamic equilibrium, first law of thermodynamics and conservation of energy. Entropy and second law of thermodynamics, Physics of many particle systems, Two state systems, continuous energy distribution, Composite systems, Casimir contribution of free energy, Protein folding and unfolding. **(19 Lectures)**

Open systems and chemical thermodynamics: Enthalpy, Gibbs Free Energy and chemical potential, activation energy and rate constants, enzymatic reactions, ATP hydrolysis & synthesis, Entropy of mixing, The grand canonical ensemble, Hemoglobin.

Diffusion and transport Maxwell-Boltzmann statistics, Fick's law of diffusion, sedimentation of Cell Cultures, diffusion in a centrifuge, diffusion in an electric field, Lateral diffusion in membranes, Navier stokes equation, low Reynold's Number Transport, Active and passive membrane transport. **(19 Lectures)**

Fluids: Laminar and turbulent fluid flow, Bernoulli's equation, equation of continuity, ventur effect, Fluid dynamics of circulatory systems, capillary action.

Bioenergetics and Molecular motors: Kinesins, Dyneins, and microtubule dynamics, Brownian motion, ATP synthesis in Mitochondria, Photosynthesis in Chloroplasts, Light absorption in biomolecules, vibrational spectra of bio-biomolecules. **(19 Lectures)**

Reference Books:

- Introductory Biophysics, J. Claycomb, JQP Tran, Jones & Bartlett Publishers
- Aspects of Biophysics, Hughe S W, John Willy and Sons.
- Essentials of Biophysics by P Narayanan, New Age International

PHY DSE 14: EXPERIMENTAL TECHNIQUES

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

F.M. = 75(Theory - 40, Internal Assessment – 15)

Internal Assessment : Class Attendance (Theory) – 05,

Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Measurements: Accuracy and precision. Significant figures. Error and uncertainty analysis. Types of errors: Gross error, systematic error, random error. Statistical analysis of data (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square) and curve fitting. Guassian distribution.

(7 Lectures)

Signals and Systems: Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first and second order systems. Fluctuations and Noise in measurement system. S/N ratio and Noise figure. Noise in frequency domain. Sources of Noise: Inherent fluctuations, Thermal noise, Shot noise, 1/f noise

(7 Lectures)

Shielding and Grounding: Methods of safety grounding. Energy coupling. Grounding. Shielding: Electrostatic shielding. Electromagnetic Interference.

(4 Lectures)

Transducers & industrial instrumentation (working principle, efficiency, applications):

Static and dynamic characteristics of measurement Systems. Generalized performance of systems, Zero order first order, second order and higher order systems. Electrical, Thermal and Mechanical systems. Calibration. Transducers and sensors. Characteristics of Transducers. Transducers as electrical element and their signal conditioning. Temperature transducers: RTD, Thermistor, Thermocouples, Semiconductor type temperature sensors (AD590, LM35, LM75) and signal conditioning. Linear Position transducer: Strain gauge, Piezoelectric. Inductance change transducer: Linear variable differential transformer (LVDT), Capacitance change transducers. Radiation Sensors: Principle of Gas filled detector, ionization chamber, scintillation detector.

(21 Lectures)

Digital Multimeter: Comparison of analog and digital instruments. Block diagram of digital multimeter, principle of measurement of I, V, C. Accuracy and resolution of measurement

(5 Lectures)

Impedance Bridges and Q-meter: Block diagram and working principles of RLC bridge. Q-meter and its working operation. Digital LCR bridge. **(4 Lectures)**

Vacuum Systems: Characteristics of vacuum: Gas law, Mean free path. Application of vacuum. Vacuum system- Chamber, Mechanical pumps, Diffusion pump & Turbo Modular pump, Pumping speed, Pressure gauges (Pirani, Penning, ionization).

(12 Lectures)

Reference Books:

- Measurement, Instrumentation and Experiment Design in Physics and Engineering, M. Sayer and A. Mansingh, PHI Learning Pvt. Ltd.
- Experimental Methods for Engineers, J.P. Holman, McGraw Hill
- Introduction to Measurements and Instrumentation, A.K. Ghosh, 3rd Edition, PHI Learning Pvt. Ltd.
- Transducers and Instrumentation, D.V.S. Murty, 2nd Edition, PHI Learning Pvt. Ltd.
- Instrumentation Devices and Systems, C.S. Rangan, G.R. Sarma, V.S.V. Mani, Tata McGraw Hill
- Principles of Electronic Instrumentation, D. Patranabis, PHI Learning Pvt. Ltd.
- Electronic circuits: Handbook of design & applications, U.Tietze, Ch.Schenk, Springer

PHY DSE 14 LAB: EXPERIMENTAL TECHNIQUES

60 Lectures

1. Determine output characteristics of a LVDT & measure displacement using LVDT
2. Measurement of Strain using Strain Gauge.
3. Measurement of level using capacitive transducer.
4. To study the characteristics of a Thermostat and determine its parameters.
5. Study of distance measurement using ultrasonic transducer.
6. Calibrate Semiconductor type temperature sensor (AD590, LM35, or LM75)
7. To measure the change in temperature of ambient using Resistance Temperature Device (RTD).
8. Create vacuum in a small chamber using a mechanical (rotary) pump and measure the chamber pressure using a pressure gauge.
9. Comparison of pickup of noise in cables of different types (co-axial, single shielded, double shielded, without shielding) of 2m length, understanding of importance of grounding using function generator of mV level & an oscilloscope.
10. To design and study the Sample and Hold Circuit.
11. Design and analyze the Clippers and Clampers circuits using junction diode

12. To plot the frequency response of a microphone.
13. To measure Q of a coil and influence of frequency, using a Q-meter.

Reference Books:

- Electronic circuits: Handbook of design and applications, U. Tietze and C. Schenk, 2008, Springer
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1990, Mc-Graw Hill
- Measurement, Instrumentation and Experiment Design in Physics & Engineering, M. Sayer and A. Mansingh, 2005, PHI Learning.

PHY-DSE-15: DISSERTATION

Guidelines:

Topic: Any advance topic in the domain of ‘recent advances of Physics’

- Students can consult the information available in the internet, but under any circumstances the candidate shall not use the information without proper acknowledgement. If plagiarism is detected the candidate will be disqualified from this paper.
- Allotment of the supervisor will be made through the approval of the department duly endorsed by the Principal. Maximum two supervisors can be allotted for each candidate.

Evaluation procedure :

- Total marks = 75 (Credit = 6)
- Internal Assessment = 35

Internal Assessment will be done by all the teachers in the department. For this evaluation marks will be distributed as follows :

- Preparation of the dissertation : 15
- Presentation of the dissertation : 10
- Merit of the dissertation and Viva-voce : 10

End of Semester Evaluation: 40 Marks

The department of Physics of the college shall arrange for the assessment of the dissertation using the following method:

- A board consisting of all teachers of the department and an expert from other college/ university shall be formed after getting approval of the departmental committee meeting.
- Marks distribution:

Preparation of the dissertation : 15
Presentation of the dissertation : 20
Merit of the dissertation and Viva-voce : 5

Skill Enhancement Course (any two for Hons. & any four may be chosen for pass course) (Credit: 02 each)

PHY SEC 1: PHYSICS WORKSHOP SKILL (Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

30 Lectures

The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode

Introduction: Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

(4 Lectures)

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothing of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

(10 Lectures)

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay

(10 Lectures)

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

(6 Lectures)

Reference Books:

- A text book in Electrical Technology - B L Theraja - S. Chand and Company.
- Performance and design of AC machines - M.G. Say, ELBS Edn.
- Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
- Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
- New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

PHY SEC 2-COMPUTATIONAL PHYSICS

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

The aim of this course is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- *Highlights the use of computational methods to solve physical problems*
- *Use of computer language as a tool in solving physics problems (applications)*
- *Course will consist of hands on training on the Problem solving on Computers.*

Introduction: Importance of computers in Physics, paradigm for solving physics problems for solution. Usage of linux as an Editor. **Algorithms and Flowcharts:** Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots

of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of $\sin(x)$ as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal. **(4 Lectures)**

Scientific Programming: Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Operators: Arithmetic, Relational, Logical and Assignment Operators. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic. Examples from physics problems. **(5 Lectures)**

Control Statements: Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DO-WHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements, open a file, writing in a file, reading from a file. Examples from physics problems.

Programming:

1. Exercises on syntax on usage of FORTRAN
2. Usage of GUI Windows, Linux Commands, familiarity with DOS commands and working in an editor to write sources codes in FORTRAN.
3. To print out all natural even/ odd numbers between given limits.
4. To find maximum, minimum and range of a given set of numbers.
5. Calculating Euler number using $\exp(x)$ series evaluated at $x=1$ **(6 Lectures)**

Scientific word processing: Introduction to LaTeX: TeX/LaTeX word processor, preparing a basic LaTeX file, Document classes, Preparing an input file for LaTeX, Compiling LaTeX File, LaTeX tags for creating different environments, Defining LaTeX commands and environments, Changing the type style, Symbols from other languages. **Equation representation:** Formulae and equations, Figures and other floating bodies, Lining in columns- Tabbing and tabular environment, Generating table

of contents, bibliography and citation, Making an index and glossary, List making environments, Fonts, Picture environment and colors, errors. **(6 Lectures)**

Visualization: Introduction to graphical analysis and its limitations. Introduction to Gnuplot. importance of visualization of computational and computational data, basic Gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Gnuplot (equations, building functions, user defined variables and functions), Understanding data with Gnuplot

Hands on exercises:

1. To compile a frequency distribution and evaluate mean, standard deviation etc.
2. To evaluate sum of finite series and the area under a curve.
3. To find the product of two matrices
4. To find a set of prime numbers and Fibonacci series.
5. To write program to open a file and generate data for plotting using Gnuplot.
6. Plotting trajectory of a projectile projected horizontally.
7. Plotting trajectory of a projectile projected making an angle with the horizontally.
8. Creating an input Gnuplot file for plotting a data and saving the output for seeing on the screen. Saving it as an eps file and as a pdf file.
9. To find the roots of a quadratic equation.
10. Motion of a projectile using simulation and plot the output for visualization.
11. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization.
12. Motion of particle in a central force field and plot the output for visualization.

(9 Lectures)

Reference Books:

- Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
- Computer Programming in Fortran 77". V. Rajaraman (Publisher: PHI).
- LaTeX-A Document Preparation System", Leslie Lamport (Second Edition, Addison-Wesley, 1994).
- Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
- Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.

- Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi(1999)
- A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning
- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition.

PHY SEC 3-ELECTRICAL CIRCUIT NETWORK SKILLS

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. **(3 Lectures)**

Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. **(4 Lectures)**

Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. **(4 Lectures)**

Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. **(3 Lectures)**

Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. **(4 Lectures)**

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers.

Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources **(3 Lectures)**

Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device) **(4 Lectures)**

Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board. **(5 Lectures)**

Reference Books:

- A text book in Electrical Technology - B L Theraja - S Chand & Co.
- A text book of Electrical Technology - A K Theraja
- Performance and design of AC machines - M G Say ELBS Edn.

PHY SEC 4-BASIC INSTRUMENTATION SKILLS

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments listed below are to be done in continuation of the topics.

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. **(4 Lectures)**

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC **millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance. **(4 Lectures)**

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only- no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. **(6 Lectures)**

Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working. **(3 Lectures)**

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. **(4 Lectures)**

Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges. **(3 Lectures)**

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. (3 Lectures)

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time- base stability, accuracy and resolution. (3 Lectures)

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of

bridges

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

Reference Books:

- A text book in Electrical Technology - B L Theraja - S Chand and Co.
- Performance and design of AC machines - M G Say ELBS Edn.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
- Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
- Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

PHY SEC 5-RENEWABLE ENERGY AND ENERGY HARVESTING

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **(3 Lectures)**

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **(6 Lectures)**

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. **(3 Lectures)**

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(3 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass. **(2 Lectures)**

Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(2 Lectures)**

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources. **(2 Lectures)**

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **(4 Lectures)**

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications **(2 Lectures)**

Carbon captured technologies, cell, batteries, power consumption **(2 Lectures)**

Environmental issues and Renewable sources of energy, sustainability. **(1 Lecture)**

Demonstrations and Experiments

1. Demonstration of Training modules on Solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials

3. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
- Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

PHY SEC 6-TECHNICAL DRAWING

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

Introduction: Drafting Instruments and their uses. lettering: construction and uses of various scales: dimensioning as per I.S.I. 696-1972. Engineering Curves: Parabola: hyperbola: ellipse: cycloids, involute: spiral: helix and loci of points of simple moving mechanism. 2D geometrical construction. Representation of 3D objects. Principles of projections. **(4 Lectures)**

Projections: Straight lines, planes and solids. Development of surfaces of right and oblique solids. Section of solids. **(6 Lectures)**

Object Projections: Orthographic projection. Interpenetration and intersection of solids. Isometric and oblique parallel projection of solids. **(4 Lectures)**

CAD Drawing: Introduction to CAD and Auto CAD, precision drawing and drawing aids, Geometric shapes, Demonstrating CAD- specific skills (graphical user interface. Create, retrieve, edit, and use symbol libraries. Use inquiry commands to extract drawing data). Control entity properties. Demonstrating basic skills to produce 2-D and 3-D drawings. 3D modeling with Auto CAD (surfaces and solids), 3D modeling with sketch up, annotating in Auto CAD with text and hatching, layers, templates & design center, advanced plotting (layouts, viewports), office standards, dimensioning, internet and collaboration, Blocks, Drafting symbols, attributes, extracting data. basic printing, editing tools, Plot/Print drawing to appropriate scale. **(16 Lectures)**

Reference Books:

- K. Venugopal, and V. Raja Prabhu. Engineering Graphic, New Age International
- AutoCAD 2014 & AutoCAD 2014/Donnie Gladfelter/Sybex/ISBN:978-1-118-57510-9
- Architectural Design with Sketchup/Alexander Schreyer/John Wiley & Sons/ISBN: 978-1-118-12309-6

PHY SEC 7-RADIATION SAFETY**(Credits: 02)****F.M. = 50 (Theory - 40, Internal Assessment – 10)****Internal Assessment [Class Attendance (Theory) – 05, Theory****(Class Test/ Assignment/ Tutorial) – 05]****Theory: 30 Lectures**

The aim of this course is for awareness and understanding regarding radiation hazards and safety. The list of laboratory skills and experiments listed below the course are to be done in continuation of the topics

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

(6 Lectures)

Interaction of Radiation with matter: Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources,

Interaction of Photons - Photo electric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients,

Interaction of Charged Particles: Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), **Interaction of Neutrons-** Collision, slowing down and Moderation. **(7 Lectures)**

Radiation detection and monitoring devices: Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

Radiation detection: Basic concept and working principle of *gas detectors* (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters

(MWPC) and Geiger Muller Counter), *Scintillation Detectors* (Inorganic and Organic Scintillators), *Solid States Detectors* and *Neutron Detectors*, *Thermo luminescent Dosimetry*.
(7 Lectures)

Radiation safety management: *Biological effects of ionizing radiation*, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub-critical system (ADS) for waste management. (5 Lectures)

Application of nuclear techniques: Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. *Industrial Uses:* Tracing, Gauging, Material Modification, Sterilization, Food preservation. (5 Lectures)

Experiments:

1. Study the background radiation levels using Radiation meter

Characteristics of Geiger Muller (GM) Counter:

- 2) Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
- 3) Study of counting statistics using background radiation using GM counter.
- 4) Study of radiation in various materials (e.g. K₂SO₄ etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
- 5) Study of absorption of beta particles in Aluminum using GM counter.
- 6) Detection of a particles using reference source & determining its half life using spark counter
- 7) Gamma spectrum of Gas Light mantle (Source of Thorium)

Reference Books:

1. W.E. Burcham and M. Jobes - Nuclear and Particle Physics - Longman (1995)
2. G.F.Knoll, Radiation detection and measurements
3. Thermoluminescence Dosimetry, Mcknlly, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology". John Wright and Sons, UK, 1989.
5. J.R. Greening, "Fundamentals of Radiation Dosimetry", Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001

7. A. Martin and S. A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.
9. W.R. Hendee, "Medical Radiation Physics", Year Book - Medical Publishers Inc. London, 1981

PHY SEC 8-APPLIED OPTICS

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

THEORY: 30 Lectures

Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections.

Sources and Detectors(No. of Lectures:7)

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients,

Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.

Experiments on Lasers:

1. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid statelaser.
2. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid statelaser.
3. To find the polarization angle of laser light using polarizer and analyzer
4. Thermal expansion of quartz using

laser Experiments on Semiconductor

Sources and Detectors

1. V-I characteristics ofLED
2. Study the characteristics of solid statelaser
3. Study the characteristics ofLDR
4. PhotovoltaicCell
Characteristics of IRsensor

Fourier Optics(No. of Lectures:7)

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Experiments on Fourier Optics:

1. Fourier optic and imageprocessing
 - a. Optical imageaddition/subtraction
 - b. Opticalimagedifferentiation
 - c. Fourier opticalfiltering
 - d. Construction of an optical 4fsystem

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science. Experiment:

1.To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. There sulting interferogram is the Fouriertrans form of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done. Urier Transform Spectroscopy

Holography(No. of Lectures:6)

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

Experiments on Holography and interferometry

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perotinterferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer

White light Hologram

Photonics: Fibre Optics(No. of Lectures:10)

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating

Experiments on Photonics: Fibre Optics

1. To measure the numerical aperture of an optical fibre
2. To study the variation of the bending loss in a multimode fibre
3. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by measurements of its far field Gaussian pattern
4. To measure the near field intensity profile of a fibre and study its refractive index profile

To determine the power loss at a splice between two multimode fibre

Reference Books

- Fundamental of optics, F.A. Jenkins & H.E. White, 1981, Tata McGraw Hill.
- LASERS: Fundamentals & applications, K. Thyagrajan & A.K. Ghatak, 2010, Tata McGraw Hill
- Fibre optics through experiments, M.R. Shenoy, S.K. Khijwania, et.al. 2009, Viva Books
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
- Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
- Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
- Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
- Optical Physics, A. Lipson, S.G. Lipson, H. Lipson, 4th Edn., 1996, Cambridge Univ. Press

PHY SEC 9-WEATHER FORECASTING

(Credits: 02)

F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]

Theory: 30 Lectures

The aim of this course is not just to impart theoretical knowledge to the students but to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Introduction to atmosphere: Elementary idea of atmosphere: physical structure and composition; compositional layering of the atmosphere; variation of pressure and temperature with height; air temperature; requirements to measure air temperature; temperature sensors: types; atmospheric pressure: its measurement; cyclones and anticyclones: its characteristics. **(9 Periods)**

Measuring the weather: Wind; forces acting to produce wind; wind speed direction: units, its direction; measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere; radiation laws. **(4 Periods)**

Weather systems: Global wind systems; air masses and fronts: classifications; jet streams; local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes. **(3 Periods)**

Climate and Climate Change: Climate: its classification; causes of climate change; global warming and its outcomes; air pollution; aerosols, ozone depletion, acid rain, environmental issues related to climate. **(6 Periods)**

Basics of weather forecasting: Weather forecasting: analysis and its historical background; need of measuring weather; types of weather forecasting; weather forecasting methods; criteria of choosing weather station; basics of choosing site and exposure; satellites observations in weather forecasting; weather maps; uncertainty and predictability; probability forecasts.

(8 Periods)

Demonstrations and Experiments:

1. Study of synoptic charts & weather reports, working principle of weather station.
2. Processing and analysis of weather data:
 - (a) To calculate the sunniest time of the year.
 - (b) To study the variation of rainfall amount and intensity by wind direction.
 - (c) To observe the sunniest/driest day of the week.
 - (d) To examine the maximum and minimum temperature throughout the year.
 - (e) To evaluate the relative humidity of the day.
 - (f) To examine the rainfall amount month wise.
3. Exercises in chart reading: Plotting of constant pressure charts, surfaces charts, upper wind charts and its analysis.
4. Formats and elements in different types of weather forecasts/ warning (both aviation and non aviation)

Reference books:

- Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
- The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
- Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
- Text Book of Agrometeorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur.
- Why the weather, Charls Franklin Brooks, 1924, Chpraman & Hall, London.
- Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.

Generic Elective Papers (GE) (Minor-Physics) (any four) for other Departments/Disciplines: (Credit: 06 each)

PHY GE 1: MECHANICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Vectors: Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. **(4 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. **(6 Lectures)**

Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. **(10 Lectures)**

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets. **(6 Lectures)**

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. **(5 Lectures)**

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts. **(8 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. **(6 Lectures)**

Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q , r_j and o by Searles method. **(8 Lectures)**

Speed Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities. (7 Lectures)

Note: Students are not familiar with vector calculus. Hence all examples involve differentiation either in one dimension or with respect to the radial coordinate

Reference Books:

- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
- Physics - Resnick, Halliday & Walker 9/e, 2010, Wiley
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

PHY: GE1 LAB: MECHANICS

60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To study the Motion of a Spring and calculate (a) Spring Constant, (b) g .

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

PHY GE 2: ELECTRICITY AND MAGNETISM

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Vector Analysis: Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields,

Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

(12 Lectures)

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

(22 Lectures)

Magnetism:

Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferro magnetic materials.

(10

Lectures)

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.

(6 Lectures)

Maxwell's equations and Electromagnetic wave propagation: Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

(10 Lectures)

Reference Books:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
- Electricity & Magnetism, J.H. Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

GE 2 LAB: ELECTRICITY AND MAGNETISM

60 Lectures

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
 - (i) Measurement of charge and current sensitivity
 - (ii) Measurement of CDR
 - (iii) Determine a high resistance by Leakage Method
 - (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)
5. To study the Characteristics of a Series RC Circuit.
6. To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorems
10. To verify the Superposition, and Maximum Power Transfer Theorems

Reference Books

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed.2011, Kitab Mahal

PHY GE 3: THERMAL PHYSICS AND STATISTICAL MECHANICS (Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Laws of Thermodynamics: Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P and C_V , Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

(22 Lectures)

Thermodynamical Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for $(C_P - C_V)$, C_P/C_V , TdS equations.

(10

Lectures)

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

(10 Lectures)

Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

(6 Lectures)

Statistical Mechanics: Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Phase space - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

(12 Lectures)

Reference Books:

- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and G.L. Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

GE 3 LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS

60 Lectures

1. To determine Mechanical Equivalent of Heat, J , by Callender and Barne's

- constant flow method.
2. Measurement of Planck's constant using black body radiation.
 3. To determine Stefan's Constant.
 4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
 5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
 6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
 7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
 8. To study the variation of thermo e.m.f across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system
 10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Reference Books:

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P.Khandelwal, 1985, Vani Publication.

PHY GE 4: WAVES AND OPTICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Superposition of Two Collinear Harmonic oscillations: Linearity & Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). **(4 Lectures)**

Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses. **(2 Lectures)**

Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity. **(7 Lectures)**

Fluids: Surface Tension: Synclastic and anticlastic surface - Excess of pressure - Application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature - Jaegar's method. Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of

viscosity of liquid with temperature- lubrication.

(6 Lectures)

Sound: Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria.

(6 Lectures)

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.

(3

Lectures)

Interference: Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.

(10 Lectures)

Michelson's Interferometer: (1) Idea of form of fringes (no theory needed), (2) Determination of wavelength, (3) Wavelength difference, (4) Refractive index, and (5) Visibility of fringes.

(3

Lectures)

Diffraction: Fraunhofer diffraction- Single slit; Double Slit. Multiple slits and Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

(14

Lectures)

Polarization: Transverse nature of light waves. Plane polarized light - production and analysis. Circular and elliptical polarization.

(5

Lectures)

Reference Books:

- Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
- Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications
- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley

GE 4 LAB: WAVES AND OPTICS

60 Lectures

1. To investigate the motion of coupled oscillators
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $X^2 - T$ Law.
3. To study Lissajous Figures
4. Familiarization with Schuster's focussing; determination of angle of prism.

5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a Prism using Mercury Light
8. To determine the value of Cauchy Constants.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of monochromatic/Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits.
16. To draw the deviation – wavelength of the material of a prism and to find the wavelength of an unknown line from its deviation.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

PHY-GE 5: DIGITAL, ANALOG CIRCUITS AND INSTRUMENTATION

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

UNIT-1: Digital Circuits

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. **(4 Lectures)**

De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **(5 Lectures)**

Binary Addition. Binary Subtraction using 2's Complement Method). Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor. **(4 Lectures)**

UNIT-2: Semiconductor Devices and Amplifiers:

Semiconductor Diodes: P and N type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell. **(5 Lectures)**

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains a and p . Relations between a and p . Load Line analysis of Transistors. DC Load line & Q-point. Active, Cutoff & Saturation regions. Voltage Divider Bias Circuit for CE Amplifier. h-parameter Equivalent Circuit. Analysis of single-stage CE amplifier using hybrid Model. Input & output Impedance. Current, Voltage and Power gains. Class A, B & C Amplifiers. **(12 Lectures)**

UNIT-3: Operational Amplifiers (Black Box approach):

Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop and closed-loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Zero crossing detector. **(13 Lectures)**

Sinusoidal Oscillators: Barkhausen's Criterion for Self-sustained Oscillations.

Determination of Frequency of RC Oscillator **(5 Lectures)**

UNIT-4: Instrumentations: Introduction to CRO: Block Diagram of CRO.

Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. **(3 Lectures)**

Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation. **(6 Lectures)**

Timer IC: IC 555 Pin diagram and its application as Astable and Monostable Multivibrator. **(3 Lectures)**

Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronic devices & circuits, S. Salivahanan & N.S. Kumar, 2012, Tata Mc-Graw Hill
- Microelectronic Circuits, M.H. Rashid, 2nd Edn., 2011, Cengage Learning.
- Modern Electronic Instrumentation and Measurement Tech., Helfrick and Cooper, 1990, PHI Learning
- Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw Hill
- Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
- OP-AMP & Linear Digital Circuits, R. A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

GE5 LAB: DIGITAL, ANALOG CIRCUITS AND INSTRUMENTS

60 Lectures

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To minimize a given logic circuit.

4. Half adder, Full adder and 4-bit Binary Adder.
5. Adder-Sub tractor using Full Adder I.C.
6. To design an astable multivibrator of given specifications using 555 Timer.
7. To design a monostable multivibrator of given specifications using 555 Timer.
8. To study IV characteristics of PN diode, Zener and Light emitting diode
9. To study the characteristics of a Transistor in CE configuration.
10. To design a CE amplifier of given gain (mid-gain) using voltage divider bias.
11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response.
13. To study Differential Amplifier of given I/O specification using Op-amp.
14. To investigate a differentiator made using op-amp.
15. To design a Wien Bridge Oscillator using an op-amp.

Reference Books:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- OP-Amps & Linear Integrated Circuit, R.A. Gayakwad, 4th Edn, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

PHY-GE 6: ELEMENTS OF MODERN PHYSICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Planck's quantum, Planck's constant and light as a collection of photons; Photo electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. **(8 Lectures)**

Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. **(4 Lectures)**

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. **(4 Lectures)**

Two slit interference experiment with photons, atoms & particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension. **(11 Lectures)**

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier. **(12 Lectures)**

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.

Radioactivity: stability of nucleus; Law of radioactive decay; Mean life and half-life; a decay; (3 decay - energy released, spectrum and Pauli's prediction of neutrino; γ -ray emission. **(11 Lectures)**

Fission and fusion - mass deficit, relativity and generation of energy; Fission – nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions. **(4 Lectures)**

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
- Modern Physics, J.R. Taylor, C.D. Zafiratos, M. A. Dubson, 2009, PHI Learning
- Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill
- Quantum Physics, Berkeley Physics, Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
- Modern Physics, R.A. Serway, C.J. Moses, and C.A. Moyer, 2005, Cengage Learning

GE 6 LAB: ELEMENTS OF MODERN PHYSICS 60 Lectures

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine the ionization potential of mercury.
4. To determine value of Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. To study the diffraction patterns of single and double slits using laser and measure its intensity variation using Photosensor & compare with incoherent source – Na.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
9. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
10. To set up the Millikan oil drop apparatus and determine the charge of an electron.
11. To determine the slit width (a) the wavelength of monochromatic/ laser a source using diffraction of single slit.
12. To determine the slit width (a,b) the wavelength of monochromatic/ laser a source using diffraction of double slits.
13. To determine (1) wavelength of He-Ne light / laser using plane

diffraction grating

14. To draw the I-V characteristics of a valve diode and to verify the laws of thermionic emission.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

PHY GE 7: SOLID STATE PHYSICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Prerequisites: Knowledge of "Elements of Modern Physics"

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis - Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor. **(12 Lectures)**

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law **(10 Lectures)**

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia - and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **(12 Lectures)**

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeier relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons. **(10 Lectures)**

Elementary band theory: Kronig Penny model. Band Gaps. Conductors, Semiconductors and insulators. P and N type Semiconductors. Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient. **(10 Lectures)**

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. **(6 Lectures)**

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
- Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

GE7 LAB: SOLID STATE PHYSICS

60 Lectures

1. Measurement of susceptibility of paramagnetic solution (Quinckf s Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency
5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
6. To determine the refractive index of a dielectric layer using SPR
7. To study the PE Hysteresis loop of a Ferroelectric Crystal.
8. To study the BH curve of iron using a Solenoid and determine the energy loss.
9. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (room temperature to 150 °C) and to determine its band gap.
10. To determine the Hall coefficient of a semiconductor sample.
11. To measure the mutual inductance of two coaxial coils at various relative orientations using a ballistic galvanometer.
12. Verification of the inverse cube law for magnetic dipoles (study of the dependence of the field of a magnetic dipole on distance) and determination of the horizontal component of the earth's magnetic field by deflection and oscillation magnetometers.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn., 2011, Kitab Mahal
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

PHY GE 8: QUANTUM MECHANICS

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory: 60 Lectures

Prerequisites: Knowledge of (1) "Mathematical Physics" and (2) "Elements of Modern Physics "

Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum & Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. **(6 Lectures)**

Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to the spread of Gaussian wavepacket for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle. **(10 Lectures)**

General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method. **(12 Lectures)**

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wavefunctions from Frobenius method; Orbital angular momentum quantum numbers l and m ; s, p, d,... shells (idea only) **(10 Lectures)**

Atoms in Electric and Magnetic Fields:- Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment & Magnetic Energy, Gyromagnetic Ratio & Bohr Magneton. **(8 Lectures)**

Atoms in External Magnetic Fields: Normal and Anomalous Zeeman Effect. **(4 Lectures)**

Many electron atoms: Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular Momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings. **(10 Lectures)**

Reference Books:

- A Text book < McGraw Hill

- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics, G. Aruldas, 2nd Edn. 2002, PHI Learning of India.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
- Quantum Mechanics for Scientists and Engineers, D.A.B. Miller, 2008, Cambridge University Press

Additional Books for Reference

- Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
- Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education
- Quantum Mechanics, Walter Greiner, 4th Edn., 2001, Springer

GE 8 LAB: QUANTUM MECHANICS

60 Lectures

Use Fortran/Python/Matlab/Octave/ C/C++/Scilab for solving the following problems based on Quantum Mechanics like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = -\frac{e}{r}$$

Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wavefunctions. Remember that the ground state energy of the hydrogen atom is $\ll -13.6$ eV. Take $e = 3.795$ (eVA)^{1/2}, $\hbar e = 1973$ (eVA) and $m = 0.511 \times 10^6$ eV/c².

2. Solve the s-wave radial Schrodinger equation for an atom:

where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = -\frac{e}{r} e^{-r/a}$$

Find the energy (in eV) of the ground state of the atom to an accuracy of three significant digits. Also, plot the corresponding wavefunction. Take $e = 3.795$ (eVA)^{1/2}, $m = 0.51 \times 10^6$ eV/c², and $a = 3$ A, 5 A, 7 A. In these units $\hbar e = 1973$ (eVA). The ground state energy is expected to be above -12 eV in all three cases.

3. Solve the s-wave radial Schrodinger equation for a particle of mass m:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0, \text{ where } V(r) = -\frac{e}{r} e^{-r/a}$$

For the anharmonic oscillator potential

$$V(r) = \frac{1}{2} k r^2 + \frac{1}{3} k r^3$$

for the ground state energy (in MeV) of particle to an accuracy of three significant

digits. Also, plot the corresponding wave function. Choose $m = 940$ MeV/c, $k = 100$ MeV fm⁻², $b = 0, 10, 30$ MeV fm⁻³. In these units, $\hbar c = 197.3$ MeV fm. The ground state

energy I expected to lie between 90 and 110 MeV for all three cases.

4. Solve the s-wave radial Schrodinger equation for the vibration of hydrogen molecule:

$$\frac{d^2 y(r)}{dr^2} + \frac{2m}{\hbar^2} (E - V(r)) y(r) = 0$$
, where $V(r) = D(e^{-2\alpha(r-r_0)} - e^{-\alpha(r-r_0)})$, $r_0 = r - r_0$
 Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function. Take $m=940 \times 106 \text{ eV}/c$, $D=0.755501 \text{ eV}$, $\alpha=1.44$, $r_0=0.131349 \text{ \AA}$

Laboratory based experiments:

8. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
9. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
10. To show the tunneling effect in tunnel diode using I-V characteristics.
8. Quantum efficiency of CCDs

Some laboratory based experiments:

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
7. To study the quantum tunnelling effect with solid state device, e.g. tunnelling current in backward diode or tunnel diode.

Reference Books:

- Schaum's Outline of Programming with C++. J.Hubbard, 2000, McGraw-Hill Pub.
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al., 3rd Edn., 2007, Cambridge University Press.
- Elementary Numerical Analysis, K.E. Atkinson, 3rd Ed. 2007, Wiley India Edition
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific & Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer
- Scilab by example: M. Affouf, 2012, ISBN: 978-1479203444
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.

PHY GE 9: NUCLEAR AND PARTICLE PHYSICS

(Credits: Theory-05, Tutorials-01)

F.M. = 75 (Theory - 60, Internal Assessment – 15)

**Internal Assessment [Class Attendance – 05,
Class Test/ Assignment/ Tutorial – 10]**

Theory: 75 Lectures

Prerequisites: Knowledge of "Elements of Modern Physics"

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excited states. **(10 Lectures)**

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic

assumption of shell model, concept of mean field, residual interaction, concept of nuclear force. (12 Lectures)

Radioactivity decay: (a) Alpha decay: basics of α -decay processes, theory of α -emission, Gamow factor, Geiger Nuttall law, α -decay spectroscopy. (b) β -decay: energy kinematics for β -decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. (9 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q -value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering). (8 Lectures)

Nuclear Astrophysics: Early universe, primordial nucleosynthesis (particle nuclear interactions), stellar nucleosynthesis, concept of Gamow window, heavy element production: r - and s - process path. (5 Lectures)

Interaction of Nuclear Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter. (6 Lectures)

Detector for Nuclear Radiations: Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector. (6 Lectures)

Particle Accelerators: Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons. (5 Lectures)

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. (14 Lectures)

Reference Books:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L. Cohen. (Tata McGraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).

The University of Kalyani



Syllabus for Three Year B.A. General

in

Arabic

Under Semester With C B C S

(w.e.f. 2018-2019)

Outline of the Choice Based Credit System

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. **Ability Enhancement Courses/ Skill Enhancement Courses:**

3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

This document contains following sections

A. Total number of course

- a. Table 1: Credit wise distribution
- b. Table-2: Semester wise distribution
- c. Table-3: Course & semester wise distribution

B. Semester-wise detail content of UG-CBCS syllabus

TOTAL Number of courses in UG-CBCS (B.A./B.Sc./B.Com. GENERAL):

Types of course	Core course (CC)	Elective course		Ability Enhancement Course		TOTAL
		Discipline specific elective course (DSE)	Generic elective course(GE)	Ability Enhancement compulsory course(AECC)	Skill Enhancement course (SEC)	
No. of course	12	6(BSc)/4(BA/B.Com)	2((BA/B.Com)	2	2	24
Credit/course	6	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.A./ B.SC./ B.COM.(GENERAL) UNDER CBCS

S. No.	Particulars of Course	Credit Point
1.	Core Course: 14 Papers	Theory + Tutorial
1.A.	Core Course: Theory (12 papers)	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x1 = 12
2.	Elective Courses: (6 papers)	
A.	DSE (6 papers for B.Sc./ 4 papers for B.A. & B.Com.)	4x5 = 20
B.	DSE(Pract./ Tutor.)* (6 papers for B.Sc./4 for B.A. &B.Com.)	4x1 = 4
C.	GE (Interdisciplinary) (2 papers for B.A. & B.Com.)	2x5=10

D.	GE (Pract./Tutor.)* (4 papers) (2 papers for B.A. & B.Com.)	2x1=2
3	Ability Enhancement Courses	
A.	AECC(2 papers of 2 credits each) ENVS, English Communication / MIL	2x2 = 4
B.	Skill Enhancement Course(SEC) (4 papers of 2 credits each)-----	4x2 = 8
Total Credit:		120

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.A./B.COM. GENERAL

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-Vi	Total No. of Courses	Total credit
CC-1,2 (6)	2(1A,2A)	2 1B,2B)	2 (1C,2C)	2 (1D,2D)			8	48
Language CC - 1,2 (6)	1 (L1-1)	1 (L2-1)	1 (L1-2)	1 (L2-2)			4	24
DSE (6)	-	-	-	-	2(1A,2A)	2 (1B,2B)	4	24
GE (6)					1(GE-1)	1(GE-2)	2	12
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total No. of Courses/ Sem.	4	4	4	4	4	4	24	--
Total Credit /Semester	20	20	20	20	20	20	--	120

Semester: 1

Course Code	Course	Course Wise Class	Credit
ARB-G-CC T1A	CC (1A) History of Arabic Literature-(Pre-Islamic to Umayyad Period 500-750 A. D.),Gram. &Translation	Core (60L+15T)	6 (5L+1T)
		Core	6 (5L+1T)
	Language (L1-1)	Core	6 (5L+1T)
AECC-1	Environmental Education	AECC	2 (2L)
Total	4 Courses	Total	20

Semester: 2

Course Code	Course	Course Wise Class	Credit
ARB-G-CC- T-1B	CC (1B) History of Arabic Literature-(Abbasid Period, 750- 1258 A. D.) ,Gram. &Translation	Core (60L+15T)	6 (5L+1T)
		Core	6 (5L+1T)
	Language (L2-1)	Core	6 (5L+1T)
AECC-2	Communicative English	AECC	2 (2L)

Total	4 Courses	Total	20

Semester: 3

Course Code	Course	Course Wise Class	Credit
ARB-G-CC- T-3	CC (1c) Prose : (Islamic, medieval, & Modern Period)	Core (60L+15T)	6 (5L+1T)
		Core	6 (5L+1T)
	Language (L1-2)	Core	6 (5L+1T)
ARB-G-SEC- T-1	SEC: Grammar , Translation & Letter Writing	SEC (25L)	2 (2L)
Total	4 Courses	Total	20

Semester: 4

Course Code	Course	Course Wise Class	Credit
ARB-G-CC T1D	CC (1D): Poetry : (Islamic, medieval, & Modern Period)	Core (60L+15T)	6 (5L+1T)
		Core	6 (5L+1T)
	Language (L2-2)	Core	6 (5L+1T)
ARB-G-SEC- T-2	SEC: Grammar, Translation & Essay Writing	SEC (25L)	2 (2L)
Total	4 Courses	Total	20

Semester: 5

Course Code	Course	Course Wise Class	Credit
ARB-G-DSE-T-1A	DSE: (1A) Rhetoric & Prosody	Core (60L+15T)	6 (5L+1T)
	DSE	Core	6 (5L+1T)
ARB-G-GE –T-1A	Interdisciplinary	GE (60L+15T)	6 (5L+1T)
ARB-G-SEC –T-3	SEC: Specific literary feature of Modern Arabic Literature	SEC (25L)	2 (2L)
Total	4 Courses	Total	20

Semester: 6

Course Code	Course	Course Wise Class	Credit
ARB-G-DSE-T-1B	DSE (1B) Outline History of Modern Arab World	Core (60L+15T)	6 (5L+1T)
	DSE	Core	6 (5L+1T)

ARB-G-GE –T-1B	Interdisciplinary	GE (60L+15T)	6 (5L+1T)
ARB-G-SEC –T-4	SEC: Specific literary feature of Modern Arabic Literature in Exile	SEC (25L)	2 (2L)
Total	4 Courses	Total	20

B.A. General Course in Arabic

Semester -I

CC- 1A : History of Arabic Literature-(Pre- Islamic to Umayyad Period 500-750 A. D.) ,Gram. &Translation

A. History of Arabic Lit.

1) Introduction of Pre-Islamic Period-(500-622 A.D.)

Al-Muallaqat with special reference to Imraul Qais, Zuhair bin Abi Sulma and Labid bin Rabia.

2) Islamic Period & Umayyad Period (622 -750 A.D.)

(a) Al-Quran (b) Al-Hadith (c) Poetry with special reference to-Al-Khansa , Hassan bin Thabit , Al-Akhtal , Al-Farazdaq, Jarir.

B. Grammar & Translation: The following topics-

(ح) الفعل الثلاثي المجرد و أبواب والمزيد فيه	(ا) الكلمة و أقسامها: اسم ، فعل ، حرف
(خ) الضمير وأقسامه	(ب) الأداة : النكرة و المعرفة
(د) المضاف و المضاف اليه	(ت) الجنس: المذكر والمؤنث
(ذ) المبتدأ والخبر	(ث) العدد : الواحد، التثنية ، الجمع
(ر) الموصوف والصفة	(ج) الفعل : الماضي ، المضارع ، الأمر ، النهي

N.B.- Translation (Arabic to English & vice versa) should be exercised on the prescribed Grammatical topics pointed out wherever in the whole syllabus. This type of exercises of the GRAMMAR-BASED-TRANSLATION should be strictly followed .

Semester -II

CC- 1B : History of Arabic Literature-(Abbasid Period, 750- 1258 A. D.) ,Gram. &Translation

A. Abbasid Period

(1) Prose Literature with special reference to :

Ibn-ul-Muqaffa, Al-Jahiz, Al-Hariri and Al-Hamadani

(2) Poetry with Special Reference to:

Bashar ibn Burd, Abu Nuas, Abul Atahiah, Abu Tammam, Al-Mutanabbi

B. Grammar & Translation. The following topics:

(ا) نواصب المضارع	(خ) الحالة : رفع ، نصب ، جر
(ب) جوازم المضارع	(د) حروف الجر
(ت) اسم الإشارة	(ذ) حروف الاستفهام
(ث) اسم الموصول	(ر) حروف الشرط
(ج) اسم الفاعل واسم المفعول	(ز) المعرب والمبني
(ح) إعراب المثني	(س) إعراب الجمع السالم

Semester- III

CC-1C Prose : (Islamic, medieval, & Modern Period)

1) سورة الحجرات	القرآن الكريم
2) الجامع الصحيح (أحاديث منتخبة)	الإمام مسلم بن الحجاج
3) سلمان الفارسي	عبد الرحمن رأفت الباشا
4) أصحاب الفيل	سيرة ابن هشام
5) الدين الصناعي	أحمد أمين

Semester -IV

CC- 1D : Poetry : (Islamic, medieval, & Modern Period)

1) حسان بن ثابت	وقال يرثي النبي صلى الله عليه وسلم
2) أبو العتاهية	وله في الوعظ
3) حافظ ابراهيم	حال لسان اللغة العربية

أيا صوفيا	4) أحمد شوقي
العباس بن مرداس السلمي	5) الحماسة
ألا في سبيل المجد	6) أبو العلاء المعري

Skill Enhancement Courses

Semester-III

SEC-1: Grammar , Translation & Letter Writing

(a) قواعد النحو والترجمة على أساس المواد التالية (on the basis of Following Grammatical rules):
الجملة الاسمية , الجملة الفعلية, الجملة الشرطية, حروف المشبه بالفعل , الأفعال الناقصة , الحال وذو الحال
والتمييز

(b) Letter Writing (Official, Educational , Personal and etc.)

Semester -IV

SEC-2: Grammar, Translation & Essay Writing:

(a) قواعد النحو والترجمة على أساس المواد التالية (on the basis of Following Grammatical rules):
الاستثناء ، لانفي الجنس ، خاصية أبواب: افعال ، تفعيل ، استفعال ، مفاعلة وافتعال

(b) كتابة المقال (Essay Writing): زيارة المدينة المشهورة ، زيارة المكتبة الشهيرة ، زيارة حديقة الحيوانات ،
شخصية تحبه كثيرا (الأدب العربي)

Semester-V

SEC-3: Specific literary feature of Modern Arabic Literature

تاريخ النهضة العربية ، أسباب النهضة ، مدرسة الديوان ومؤسسوها عباس محمود العقاد ، إبراهيم المازني وعبد
الرحمن شكري، مدرسة أبولو ومؤسسوها أحمد زكي أبو شادي ، إبراهيم ناجي ، أبو القاسم الشابي

Semester-VI

SEC-4: Specific literary feature of Modern Arabic Literature in Exile

تاريخ أدب المهجر ، الرابطة القلمية ومؤسسوها جبران خليل جبران ، إيليا أبو ماضي وميخائيل نعيمة و العصابة
الأندلسية ومؤسسوها ميشال معلوف ، رشيد سليم الخوري و الياس فرحات

Discipline Specific Electives

Semester –V

DSE-1A: Rhetoric & Prosody (the Following Items)

- (a) التشبيه وأقسامه ، المجاز ، الاستعارة ، الكناية ، الجناس ، والتورية
- (b) تعريف علم العروض ، سيب ، وتد ، فاصله ، أركان ، البحر الكامل ، البحر الطويل والتقطيع

Semester -VI

DSE-1B: Outline History of Modern Arab World. The Following Countries:

Saudi Arabia, Iraq, Syria, Jordan, UAE, Qatar, Kuwait, Oman & Egypt

Books Recommended for B.A. General

a) History of Arabic Literature:

- | | | |
|--------------------------|-----------------------------|------|
| جرجي زيدان | تاريخ آداب اللغة العربية | .I |
| أحمد حسن الزيات | تاريخ الأدب العرب | .II |
| شوقي ضيف | تاريخ الأدب العرب | .III |
| عمر فروخ | تاريخ الأدب العرب | .IV |
| R.A. Nicholson | A Literary History of Arabs | .V |
| Dr. Mohammed Shahidullah | Arbi Sahiter Itehas | .VI |

b) Arabic Grammar & Translation:

1. النحو الواضح (المراحل الابتدائية والثانوية)
علي الجارم و مصطفى أمين
2. شرح قطر الندى وبل الصدي
أبو محمد عبد الله جمال الدين بن هشام الأنصاري

3. ما يلزم من العربية ربيع العماد فينان
4. اللغة العربية للمبتدئين سيد علي مدراس
5. تعليم اللغة العربية بطريقة عملية ولي أختار الندوي
6. معلم الانشاء (1,2,3) عبد الماجد الندوي و محمد رابع الحسني الندوي
7. Teach Yourself Arabic S. A. Rahman
8. A Grammar of Arabic Laguage Obaidullah Al-Ubaidi Shuharwardi
9. Arbi Byakaran –O-Anubader Dr.Shamsuddin Mallick
Anginai (Part-III)
10. Muslim Jahan Suharabuddin Ahmad
11. The Arabs Peter Mansfield

C) Indian Writers, Arab World, Rhetoric & Prosody

- I. نزهة الخواطر السيد عبد الحي الحسني
- II. سبحة المرجان في آثار هندستان السيد غلام علي آزاد البلغرامي
- III. المسلمون في الهند السيد أبو الحسن علي الندوي
- IV. Muslim Jahan Suharabuddin Ahmad
- V. The Arabs Peter Mansfield
- VI. History of Arabs P. K. Hitti
- VII. A Short History of the Saracens Syed Amir Ali

D) Arabic Prose & Poetry

Arabic Selection- For B. A. General (under Published by University of Calcutta
I+I+I system , New Regulation - 2011)

Interdisciplinary/ Generic Electives (GE)

(For the students of other discipline)

Semester -V

GE-1A : Introduction of Arabic Language and its Learning

a) Introduction of Arabic Language and its Origin (Marks 10)

b) Arabic Text : (Marks 25)

Text Book: Duroos Ul Ashyaa- by Mahbubur Rahman

c) Grammar and Translation : The following items- (Marks-40)

(أ) الكلمة و أقسامها: اسم ، فعل ، حرف

(ب) الأداة : النكرة و المعرفة

(ت) الجنس: المذكر والمؤنث

(ث) العدد : الواحد، التثنية ، الجمع

(ج) الفعل : الماضي ، المضارع ، الأمر ، النهي

(ح) الفعل الثلاثي المجرد و أبواب

(خ) حروف العلة، حروف الجر ، حروف الاستفهام

(د) الضمير وأقسامه

(ذ) المضاف و المضاف اليه

(ر) الموصوف والصفة

GE-1B: Comprehension of Text, Grammar & Translation

a) Arabic Text Book: (Marks 35)

Text Book: Al Qira'atur Rashidah (Part-I) –by Abul Hasan Ali Nadawi

b) Grammar and Translation : The following items.

(Marks 40)

ح) المبتدأ والخبر	ا) الفعل الثلاثي والمزيد فيه
خ) الحروف المشبهة بالفعل	ب) نواصب المضارع و جوازمه
د) الأفعال الناقصة	ت) الحالة : الرفع، النصب ، الجر
ذ) الجملة الفعلية	ث) اسم الفاعل والمفعول و اعرابهما
ر) الجملة الاسمية	ج) اسم الإشارة ، اسم الموصول

Books Recommended (for GE-1A & GE-1B)

- 1- Teach Yourself Arabic – S.A. Rahman
- 2- A Grammar of Arabic Language- Obaidullah Al Ubaidi Shuhrawardi
- 3- Arbi Bakaron O Anubader Anginai (Part-III) – Dr. Md Shamsuddin Mallick
- 4- Annahwul Wazeh (Part- I & II) - Ali Garin & Mustafa Amin
- 5- Muallimul Inshaa'- Abdul Majid Nadwi
- 6- Tasheelul Adab (Part –I for GE-1A, Part –II for GE-1B) – Dr. Md. Shamsuddin Mallick