U.G. 2nd Semester Examination - 2020
PHYSICS
[PROGRAMME]
Course Code : PHYG-CC-T-2
(Waves and Optics)

Set–IV

Full Marks : 40   Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP–A

1. Answer any **five** questions: 2×5=10

    a) What is the difference between interference and beats?

    b) Prove that $v = c - \lambda \dfrac{dc}{d\lambda}$ where v, c and λ are the group velocity, phase velocity and wavelength respectively.

    c) Can two real source of light act as coherent sources?

    d) Write down the equation of wave travelling in the negative direction along X-axis and having

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an amplitude 0.01 m, a frequency 550 Hz and speed 330 m/s.

e) How does the interference pattern by reflection in thin films differ from that of refraction(transmission)? Why?

f) Write two differences between interference and diffraction.

g) Calculate the velocity of sound in a gas in which the waves of wavelength 50 cm and 50.5 cm produce 6 beats per second.

h) Define resolving power.

GROUP–B

2. Answer any **two** questions: 5×2=10

    a) A particle is subjected simultaneously to two S.H.M. of the same period but different amplitudes and phases in perpendicular directions. Find the expression for the resultant motion. For what condition the path may be straight line, ellipse or circle?

    3+2

    b) Find an expression for fringe width in case of Young's double slit experiment. You are given

Red and Green light for this experiment. In which case will you observe narrow fringe width? Justify your answer. 3+2

c) Derive an expression for the potential and kinetic energy of a vibrating string. Hence calculate the energy in each normal mode of a vibrating string. 2+3

d) What is plane diffraction grating? Define grating element. Derive the condition for the missing order spectra for a diffraction grating. 1+1+3

GROUP–C

3. Answer any **two** questions: 10×2=20

a) What is Fraunhofer diffraction? In Fraunhofer diffraction pattern due to single slit, derive the condition for production of maxima and minima and their position. Also find the expression for the width of central maxima. What happens when (i) white light is used (ii) the width of slit is increased?
2+3+3+(1+1)

b) With proper derivation show that the velocity of transverse waves along a stretched string of length l, fixed rigidly at two ends, is given by $c = \sqrt{(T/m)}$ where T is the tension and m is the mass per unit length. Now the string is plucked at a distance a from one end of the string and the displacement is h. Apply Fourior theorem to find the general expression for the displacement at any point x at any time t. What would happen if the string is touched at the point of plucking? 4+5+1

c) What do you mean by the term 'interference by division of amplitude'? Discuss the formation of Newton's ring by reflected light and derive the expression of radius of dark and bright ring. Hence show that the fringe width decreases with the order of rings.
$2+(3+1\frac{1}{2}+1\frac{1}{2})+2$

d) Derive an expression for sound intensity in terms of r.m.s. acoustic pressure. What are stationary waves? How do they differ from progressive wave? Show that the energy density in stationary wave is twice that of progressive wave. 3+2+2+3

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