

U.G. 2nd Semester Examination - 2022

PHYSICS

[PROGRAMME]

Course Code : PHY-G-CC-T-02

(Waves and Optics)

SET-I

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
- The primary focal length of a zone plate is 20cm for light of wavelength 500nm. Calculate the radius of the central zone on the zone plate.
 - The wavelength of a light 589nm incident on a grating with 104 lines/mm. How many orders would be visible?
 - An orange light with wavelength 600nm has a coherence length of approx. 20cm. Calculate the line width in terms of wavelength.

[Turn Over]

- At what temperature would the speed of sound in air be double its value at 0°C.
- Draw the resultant patterns due to superposition of two rectangular simple harmonic motion with same frequencies.
- Explain the formation of Newtons ring with diagram.
- Define spatial and temporal coherence.
- The displacement equation of a simple harmonic motion is $x=a \sin (\omega t+\phi)$. Find out a relation between the velocity (v) and acceleration (f).

GROUP-B

- Answer any **two** questions: 5×2=10
- Calculate the amplitude of the displacement resulting from the linear addition of 'n' no of simple harmonic motion with same amplitude 'a' and frequency ' ω ' but having different initial phase angles of ϕ , 2ϕ , 3ϕ , 4ϕ , ..., $n\phi$. 5
 - Consider a solid rod with Young modulus Y and density ρ . Calculate the velocity of longitudinal sound wave through the solid rod. 5

4. Show that the radius of the n^{th} zone of Fresnel's Half period zone depends on 'n' but the area of the n^{th} zone is independent of 'n'. 5
5. Calculate the fringe width produced on a film when a parallel beam of monochromatic light incident normally on the film. 5

GROUP-C

Answer any **two** questions: 10×2=20

6. a) Write down the conditions for observable interference pattern.
- b) Explain the effect of introducing a thin glass plate in the path of one of the interfering beams in bi-prism experiment. Also show that the velocity of light is maximum in vacuum. 2+8
7. a) Consider a constant tension of stretched string is 'T'. The length of the string is 'L' and mass per unit length is 'm'. Calculate the velocity of transverse vibration of the string.
- b) For a plucked string, show that the amplitude of the s -th harmonic is proportional to $1/s^2$. 3+7

8. a) What is Fresnel diffraction? Discuss the properties of Fresnel diffraction of a cylindrical wave front at a narrow obstacle (cylindrical wire).
- b) What is Holography? Briefly explain the theory of Holography. 1+4+1+4
9. Define resolving power of a grating. Derive the expression for resolving power of a grating.

10