

SASTRA DEEMED UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

End Semester Examinations

February 2023

Course Code: PHY137

Course: **FUNDAMENTALS OF PHYSICS**

QP No. :U026R-1

Duration: 3 hours

Max. Marks:100

PART - A

Answer any Four questions

4 x 20 = 80 Marks

1. (a) Describe in detail, how the Young's double slit experiment can be used to measure the wavelength of the unknown source. (12)
- (b) A diffraction grating has 6×10^5 lines per metre. Find the angular spread in the second order spectrum between red light of wavelength $7.0 \times 10^{-7} \text{m}$ and violet light of wavelength $4.5 \times 10^{-7} \text{m}$. (8)
2. (a) Establish the relation between the radius of curvature and diameter of Newton rings. From the result, determine the wavelength of light and refractive index of the unknown liquid. Also, explain why center fringe of Newton's ring is dark. (14)
- (b) Plane polarized light of wavelength 6000 \AA is incident perpendicularly on a calcite plate of thickness 0.04 mm . Calculate the phase retardation that it will introduce between the e-ray and o-ray. Given that $n_o = 1.642$ and $n_e = 1.478$.

- (4)
- (c) Explain how Maxwell's equations predict that magnetic monopoles do not exist.
- (2)
3. (a) Deduce the Maxwell's equations for the propagation of electromagnetic wave in non-conducting media to obtain an expression for velocity and impedance.
- (14)
- (b) Describe the process of production of plane polarized light by reflection.
- (6)
4. (a) write simple notes on drawbacks of classical theory and need of quantum theory through any one example.
- (12)
- (b) In a Hall-effect experiment, a current of 3.0 A sent length wise through a conductor 1.0 cm wide, 4.0 cm long, and 10 mm thick produces a transverse (across the width) Hall potential difference of $10\ \mu\text{V}$ when a magnetic field of 1.5 T is passed perpendicularly through the thickness of the conductor. From these data, find (a) the drift velocity of the charge carriers and (b) the number density of charge carriers. (c) Show on a diagram the polarity of the Hall potential difference with assumed current and magnetic field directions, assuming also that the charge carriers are electrons
- (8)
5. (a) Explain how matter waves are explained by using de Broglie hypothesis.
- (6)
- (b) Explain the types of crystals with lattice parameters and also Bravais lattices with clear diagram
- (10)
- (c) Explain different types of pumping systems that helps to get population inversion in laser system
- (4)

6. (a) Describe the working principle, advantages, disadvantages and applications of CO₂ laser with neat diagram (12)
- (b) Describe heat engine and obtain an expression for its efficiency (8)

PART - B

Answer the following

1 x 20 = 20 Marks

7. (a) If the displacement of a moving particle at any time is given by $x = a \cos \omega t + b \sin \omega t$, show that the motion is simple harmonic. If $a = 3$, $b=4$, $\omega=2$, find the period, maximum velocity and maximum acceleration (6)
- (b) Calculate the index of glass medium when the red colour light is refracted to an angle 30° at polarized angle. Assume the light is passed from water. (4)
- (c) A bullet of mass 0.03 kg is moving with a velocity of 500 m/s. The speed is measured up in an accuracy of 0.02 %. Calculate the uncertainty in x . (5)
- (d) Find the number of modes supported by a 35 μm diameter of step index fiber is made with a core refractive index of 1.75 and cladding refractive index 1.65 while the light operated at wavelength of 1.05 μm . Also, calculate the maximum allowed radius of the core to support only one mode in the given parameters. (5)
