

QP Code : **28544**

(2 Hours)

[Total Marks :75

- N.B. :** (1) Question no. 1 is compulsory.
 (2) Attempt any four questions from the remaining.
 (3) Assume suitable data and symbol-if required.
 (4) Figures to the right indicate full marks.
 (5) Illustrate your answer with sketches wherever necessary.

1. Solve any five from the following:-

- (a) What is Rayleigh's criterion for resolution? Write an expression for the resolving power of a grating? 15
- (b) Newton's rings are observed in reflected light of wavelength 5×10^{-5} cm. The diameter of 10th dark ring is 0.5 cm. Calculate the radius of curvature R and thickness of the film t at the ring.
- (c) Differentiate between stimulated and spontaneous emission.
- (d) Why electron microscope is considered better than optical microscope.
- (e) Calculate the numerical aperture and hence the acceptance angle for an optical fibre whose core R.I. 1.48 and a cladding R.I. of 1.39.
- (f) Calculate de Broglie wavelength of proton with a velocity equal to 1/20th velocity of light. Given: $m_p = 1.6 \times 10^{-27}$ kg and $h = 6.63 \times 10^{-34}$ J.sec
- (g) Write the relation between relative permeability and susceptibility.
2. (a) Show that in Newton's ring, diameter of the bright ring is proportional to the square root of the odd natural number. Find out similarities and dissimilarities between Newton's rings and Wedge shaped film. 8
- (b) Consider an air cored torroid with 500 turns with cross sectional area of 6 cm², mean radius of 15 cm and coil current of 4 Amp, Now calculate MMF(NI), Reluctance (R), Magnetic flux, Magnetic flux density, Magnetic flux intensity. 7
3. (a) What is de Broglie's concept of matter waves? Derive one dimensional time dependent Schrodinger wave equation for matter waves. 8
- (b) White light is incident on a soap film at an angle $\sin^{-1}(4/5)$ and the reflected light observed with a spectroscope. It is found that two consecutive dark bands correspond to wavelengths 6.1×10^{-5} and 6.0×10^{-5} cm. If the refractive index of the film be 4/3, calculate the thickness. 7
4. (a) What is monomode, multimode fibre? Differentiate between step index and graded index fibre. 5
- (b) Explain with the diagram, the construction and working of semiconductor diode laser. 5
- An electron is confined in a box of length 10^{-8} m. Calculate minimum uncertainty in its velocity. 5

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5. (a) In a plane transmission grating with 5000 lines/cm and for a wavelength of 6000 Å, if the width of opaque spaces are exactly twice that of transparent spaces, which order of spectra will be absent? 5
- (b) In Newton's ring experiment, if the n^{th} dark ring due to wavelength λ_1 coincides with $(n+2)^{\text{th}}$ dark ring due to wavelength λ_2 , prove that the radius of n^{th} dark ring due to λ_1 is $(2\lambda_1\lambda_2R/\lambda_1 - \lambda_2)^{1/2}$ 5
- (c) Derive the condition of fringes of equal width in a wedge shaped film and explain. 5
6. (a) A diffraction grating which has 4000 lines in 1cm is used at normal incidence. Calculate the dispersive power of the grating in the third order spectrum in the wavelength region 5000 Å. 5
- (b) Discuss the Weiss's theory of ferromagnetism and derive Curie-Weiss's law, 5
- (c) Explain the working of SEM with a neat diagram. 5
7. Write short notes on any three. 15
- (a) Holography as an application of laser.
- (b) Diffusion pump.
- (c) Antireflection coating.
- (d) Optical fibre communication system.