1. Answer any **five** from the following :— **15**

(a) Why does the fringe width decrease as order increases in Newton's Rings but remain constant in a wedge shaped film ?

(b) What is Rayleigh's Criterion of resolution for diffraction ? Write the expression for Resolving Power of grating.

(c) Explain the role of Heluim in the He-Ne Laser.

(d) Why are soft magnetic materials used in transformer Cores ?

(e) What are the functions of the Optical Resonator in a Laser ?

(f) Using Heisenberg's Uncertainty Principle, show that electrons cannot exist within the nucleus.

(g) How is the phenomenon of interference used to test for optical flatness ?

2. (a) Obtain the conditions for maxima and minima due to interference in a wedge-shaped film observed in reflected light. Derive the expression for fringe width. **8**

(b) State the two types of diffraction and differentiate between them. Reduce the missing orders for a double slit Fraunhoffer diffraction pattern if the slit widths are 0·16mm and they are 0·8mm apart. **7**

3. (a) Explain phase velocity of a wave and group velocity of matter waves. Derive the one-dimensional time dependent Schrodinger wave equation for matter waves. **8**

(b) Explain the refractive-index profiles of step index and graded index fibres. An optical fibre has a Numerical Aperture of 0·20 and a cladding refractive index of 1·59. Determine the acceptance angle for the fibre in water which has a refractive index of 1·33. **7**

4. (a) Explain how the wave length of a spectral line can be determined in the laboratory using a plane trasmission grating. White light falls normally on a soap film of refractive index 1·33 and of thickness 5000 Au. What wavelength within the visible spectrum will be strongly reflected ? **8**

(b) With neat diagrams explain the construction and working of a Nd : YAG Laser. Discuss the pumping scheme. **7**

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5. (a) What is the role of Laser in the field of communication ? Explain Numerical Aperture and derive the same for step index fibres. 8

(b) Draw a graph to show the variation of magnetic induction 'B' with applied magnetic field 'H' in case of ferromagnetic materials. Calculate the members of ampere turns required to produce a flux of 10^{-3} weber round an iron ring of $5cm^2$ cross section and 20mm mean diameter having an air gap 2mm wide across it. The relative permeability of iron is 1000. Neglect the leackage flux. 7

6. (a) Explain the atomic origin of ferromagnetism. Differentiate between diamagnetic and paramagnetic materials. 8

(b) What is the physical significance of the wave function Ψ of a matter wave ? An electron is bound in a one-dimensional potential well of width 2Au, but of infinite height. Find its energy values in the ground state and first two excited states. 7

7. Write short notes on any three of the following :— 15

(a) Rotary Pump

(b) SEM

(c) Penning gauge

(d) AFM

(e) Application of Vacuum Technology.

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