

Con. 2649-10.

AN-9805

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(2 Hours)

[Total Marks : 75

N.B. (1) Question No. 1 is compulsory.

(2) Attempt any four questions from Q. Nos. 2 to 7.

(3) Figures to the right indicate full marks.

(4) Use suitable data wherever necessary.

1. Solve any five from the following :-

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(a) What is stimulated emission? What role does it play in the operation of a laser?

(b) What is diffraction grating. What is the advantage of increasing the number of lines in a grating?

(c) Differentiate between diffusion and rotary pump.

(d) In Newton's ring experiment the fringes are circular with dark ring at centre. Why?

(e) What is the difference between critical angle and angle of acceptance?

(f) A magnetic material has magnetizing force 198 A/m and magnetization of 2300 A/m.

Find (i) Corresponding flux density

(ii) Relative permeability.

(g) What is Rayleigh's criterion of resolution? Write expression for the resolving power of a grating.

2. (a) Obtain the expression for nth dark ring in case of Newton's rings experiment. Hence explain the suitable way to calculate refractive index of a liquid using same set up. 8

(b) Explain with diagram, the construction and working of semiconductor diode laser. What serves the resonance cavity in semiconductor diode lasers? 7

3. (a) What is the fundamental principle of a hologram? How is it produced and how is the image constructed from it? 8

(b) What do you understand by antireflection coating? Derive the condition with proper diagram. 7

4. (a) What is monomode and multimode fibre? Explain the term V-number. 5

(b) Show that the energy of an electron in the box varied as the square of natural numbers. 5

(c) A magnetizing field of 1600 A/m produces a magnetic flux of 2.4×10^{-5} weber in an iron bar of cross-sectional area 0.2 cm^2 . Calculate permeability and susceptibility of the bar. 5

5. (a) Explain the principle of Pirani Gauge ? How does it work. 5
- (b) Arrive at Heisenberg uncertainty principle with the help of single slit diffraction experiment. 5
- (c) A diffraction grating used at normal incidence gives a line 5400 \AA in certain order superimposed on another line 4050 \AA of the next higher order if the angle of diffraction is 30° , how many lines/cm are there on the grating ? 6
6. (a) Explain Ohm's law for magnetic circuit and hence derive a relation between magnetomotive force and magnetic field strength for magnetic circuit due to solenoid. 5
- (b) A wedge shaped air film having angle of 40 second is illuminated by monochromatic light. Fringes are observed vertically through a microscope. The distance between 10 consecutive dark fringes is 0.12 cm . Find the wavelength of monochromatic light. 5
- (c) An optical fibre has a numerical aperture of 0.20 and a refractive index of cladding is 1.59 . Determine the acceptance angle for the fibre in water which has a refractive index of 1.33 . 5
7. (a) What are hard and soft magnetic materials ? Give their characteristics properties and applications. 5
- (b) Explain the construction of scanning Electron Microscope with proper diagram. Also explain the principle on which it works. 5
- (c) Find the thickness of the soap film which appear yellow (5896 \AA) in reflection when it is exposed by white light at an angle of 45° ($\mu = 1.35$). 5