QP Code : 28617

(2 Hours)   [Total Marks : 60

N.B. : (1) Question No. **1** is **compulsory**.
       (2) Attempt any **three** questions from the remaining questions.
       (3) Assume suitable **data** and **symbols** if **required**.
       (4) **Figures** to the **right** indicate **full** marks.

1. Attempt any **five**.   15
   (a) Why does an excessively thin film appear to be perfectly dark when illuminated by white light?
   (b) A grating has 620 rulings/mm & is 5.05 mm wide. What is the smallest wavelength-interval that can be resolved in the third order at $\lambda = 481$ nm?
   (c) Why would you recommend use of optical fibre in communication system?
   (d) An electron is bound in a one dimensional potential well of width 2 A^0 but of infinite height. Find its energy values in the ground state and first excited state?
   (e) Explain measurement of frequency of AC signal using Cathode Ray Oscilloscope?
   (f) Explain the term Stimulated emission & Population inversion?
   (g) Define superconductivity, critical temperature & critical magnetic field.

2. (a) How is Newton's ring experiment used to determine refractive index of liquid medium?   8
       The diameter of 5th dark ring in Newton's ring experiment was found to be 0.42 cm. Determine the diameter of 10th dark ring.
   (b) An optical fibre has core diameter of 6 μm and its core refractive index 1.45.   7
       The critical angle is 87^0. Calculate - (i) refractive index of Cladding (ii) acceptance angle (iii) the number of modes propagating through fibre when wavelength of light is 1 μm.

3. (a) With neat energy level diagram, explain principle, construction & working of Nd -YAG laser?   8
   (b) Two plane rectangular pieces of glass are in contact at one edge & are separated at the other end 10 cm away by a wire to form a wedge shaped film. When the film was illuminated by light of wavelength 6000 A^0, 10 fringes were observed per cm. Determine the diameter of the wire.   7

4. (a) Explain the experimental method to determine the wavelength of spectral line using diffraction grating ?   5
   (b) Show that electron cannot pre-exist in free state in a nucleus, using uncertainty principle.   5
   (c) Distinguish between type I & type II superconductor?   5

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5. (a) A diffraction grating used at normal incidence gives a yellow line   5
(λ = 6000 A°) in a certain spectral order superimposed on a blue line
(λ = 4800 A°) of next higher order if the angle of diffraction is $\sin^{-1}(3/4)$,
calculate the grating element?

   (b) Derive one dimensional time dependent Schrodinger's equation for matter   5
waves?

   (c) With neat diagram, explain construction & working of Atomic Force   5
Microscope.

6. (a) Find the de Broglie wavelength of (i) an electron accelerated through a   5
potential difference of 182 volts & (ii) 1 kg object moving with a speed of
1m/s. Comparing the results, explain why is the wave nature of matter not
apparent in daily observations?

   (b) Derive Bethe's law for electron refraction?   5

   (c) What are Carbon Nano tubes? Explain properties of Nano tubes?   5

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