N.B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **four** questions from Q. Nos. **2** to **7**.
(3) Use **suitable** data wherever **necessary**.

1. Solve any **five** from the following :– **15**
   (a) What do you mean by thin film ? Comment on the colours in thin film in sunlight.
   (b) Define diffraction of light. Why is it not evident in daily experience ?
   (c) On the basis of magnetic dipoles of atoms explain the terms-ferromagnetism, antiferromagnetism and ferrimagnetism.
   (d) Discuss the conditions required for a thin film to act as antireflection coating.
   (e) Establish Bohr's condition of quantization on the basis of de Broglie conception of matter waves.
   (f) Calculate the de Broglie wavelength of a proton with a velocity equal to $\frac{1}{20}$th velocity of light. (mass of proton = $1{\cdot}6 \times 10^{-27}$ kg).
   (g) What does LASER stand for ? In what respects it differ from an ordinary source of light ?
   (h) Would you recommend optical fibres to be widely used in communication system ? Why ?

2. (a) How can Newton's rings be obtained in the laboratory ? Why do we get circular rings ? Show that the radii of Newton's n^{th} dark rings is proportional to square root of Natural Number. **10**
   (b) White light is incident at an angle of 45° on a soap film 4×10^{-5} cm thick. Find the wavelength of light in the visible spectrum which will be absent in the reflected light ($\mu = 1{\cdot}2$). **5**

3. (a) Describe the construction of diffraction grating. What is grating element ? How do you determine the wavelength of spectral line in the laboratory using plane transmission grating ? **10**
   (b) A step index fibre has a core diameter of 29×10^{-6} m. The refractive indices of core and cladding are 1·52 and 1·5189 respectively. If the light of wavelength 1·3 μm is transmitted through the fibre, determine : **5**
      (i) normalised frequency of the fibre
      (ii) the number of modes the fibre will support.

4. (a) What is de Broglie concept of matter maves ? Derive one-dimensional time dependent Schrodinger equation for matter waves. **10**
   (b) In Fraunhofer diffraction due to a single slit of width 0·2 mm, a screen is placed 2 m away from the lens, to obtain the pattern. The first minima lie 5 mm on either side of the central maximum. Compute the wavelength of light. **5**

5. (a) With neat energy level diagram describe the construction and working of He-Ne Laser. What are its merits and demerits ? **10**
   (b) The magnetic susceptibility of silicon is $-0{\cdot}5 \times 10^{-5}$. What is the intensity of magnetisation and magnetic flux density in a magnetic field of intensity $9{\cdot}9 \times 10^{4}$ amp/m ? **5**

6. (a) Sketch the Hysteresis loop and explain the terms retentivity, coercivity, hysteresis and hysteresis loop. Give the characteristic properties and applications of Hard and Soft magnetic materials. **10**
   (b) An electron has a speed of 900 m/s with an accuracy of 0·001%. Calculate the uncertainty with which the position of the electron can be located. **5**

7. (a) Explain what do you mean by biophysics ? Discuss its importance. Mention the instruments involved in this branch. **8**
   (b) Describe the role of vacuum in nanotechnology. List out the general applications of vacuum. **7**
