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

3. (a) Describe the construction of diffraction grating. What is grating element ? How   **10** do you determine the wavelength of spectral line in the laboratory using plane transmission grating ?
 (b) A step index fibre has a core diameter of 29×10^{-6} m. The refractive indices of   **5** core and cladding are $1 \cdot 52$ and $1 \cdot 5189$ respectively. If the light of wavelength $1 \cdot 3$ μm is transmitted through the fibre, determine :
  (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   **10** Schrodinger equation for matter waves.
 (b) In Fraunhofer diffraction due to a single slit of width $0 \cdot 2$ mm, a screen is placed   **5** 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. (a) With neat energy level diagram describe the construction and working of He-Ne   **10** Laser. What are its merits and demerits ?
 (b) The magnetic susceptibility of silicon is $-0 \cdot 5 \times 10^{-5}$. What is the intensity   **5** of magnetisation and magnetic flux density in a magnetic field of intensity $9 \cdot 9 \times 10^4$ amp/m ?

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

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