

[This question paper contains 4 printed pages.]

1965

Your Roll No. ....

**B.Sc. Prog. / III**

**E**

MP-302 : Optics, Electronics and Modern Physics

(Admissions of 2008 and onwards)

*Time : 3 Hours*

*Maximum Marks : 75*

*(Write your Roll No. on the top immediately  
on receipt of this question paper.)*

*Attempt any five questions.*

*All questions carry equal marks.*

1. (a) Discuss the Fraunhofer diffraction pattern due to a single slit. Find an expression for the width of the central maximum. (7,3)
  
- (b) In an arrangement for Fraunhofer diffraction a slit of width 0.3 mm is used and the first minima is found to be at 5 mm on either side of the central maximum. If the distance between the lens and the screen is 2 m, calculate the wavelength of light. (5)

P.T.O.

2. (a) What does the abbreviation LASER stand for? Explain the terms spontaneous emission and stimulated emission of radiation. (4)
- (b) Define the Einstein's A & B coefficients and write the relation between these coefficients. (6)
- (c) What is meant by population inversion? How it is achieved in a laser? (5)
3. (a) Name the parameter that governs the light gathering power of an optical fibre. Obtain an expression for the acceptance angle. (1,6)
- (b) Mention various types of fibres. Sketch the variation of refractive index with distance for these fibres. (2,2)
- (c) Calculate the numerical aperture of a step-index optical fibre having a core of refractive index 1.49 and cladding of refractive index of 1.48. (4)
4. (a) What are class A, B, and C amplifiers? (6)
- (b) What do you understand by ionosphere? How it is formed? (2,2)
- (c) What is modulation? Discuss in brief various types of modulation? (2,3)

5. (a) What are operators? Write the expressions for momentum and energy operators. (1,2)

- (b) A particle of mass 'm' and energy 'E' is approaching a one-dimensional step potential barrier given by:

$$V(x) = 0 \text{ for } x < 0; \quad V(x) = V_0 \text{ for } x \geq 0.$$

Obtain expressions for the reflection and transmission coefficients for the case when  $E < V_0$  and explain the results in terms of quantum tunneling. (10,2)

6. (a) What are amorphous and crystalline solids? Give examples.

Draw the energy band diagrams of a conductor, an insulator and a semi-conductor. (4,6)

- (b) Explain with examples what are intrinsic and extrinsic semiconductors. (5)

7. (a) What are superconductors? Distinguish between type I and type II superconductors. (4)

- (b) Using London equation, obtain an expression for magnetic field inside a superconductor. Hence deduce an expression for the penetration depth.

(7)

- (c) Explain in brief the Meissner effect in superconductors. (4)
8. Write short notes on any **two** of the following :
- (a) Half period zones
  - (b) Lawson criterion
  - (c) Nuclear fission and fusion
  - (d) UJT relaxation oscillator (7.5,7.5)