Your Roll No. ....

5160   **B**

B.Sc. Prog./III

MP-302 : Optics, Electronics and Modern Physics

(Admissions of 2005 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) Explain the formation of spectral lines in a plane diffraction grating for normal incident of light. 9

    (b) Discuss how plane diffraction grating is used to determine the wavelength of light? 6

2. (a) Explain the working principle of LASER. 3

    (b) In a laser if the medium is in thermal equilibrium; the population of higher energy level can not exceed the population of lower energy level. Explain. 5

    (c) Discuss the construction and working of He-Ne LASER. 7

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3. (a) Explain critical angle of propagation and numerical aperture in an optical fibre. 6

   (b) In a step Index fibre core index (n_1) 1.45 and of cladding (n_2) 1.41. Find :

   (i) Numerical Aperture

   (ii) Fractional refractive index change

   (iii) Full acceptance angle. 9

4. (a) Discuss the construction and working of Field Effect Transistor (FET). 7

   (b) Discuss UJT relaxation oscillator with the help of circuit diagram. 5

   (c) Explain the need of modulation in radio communication. 3

5. (a) What are the main conditions to be satisfied by an acceptable wave function? 3

   (b) The wave function of a particle confined in a box of length L is

$$\psi(x) = \sqrt{\frac{2}{L}} \sin \frac{\pi x}{L}$$

in the region $0 < x < L$ and zero elsewhere. Calculate the probability of finding the particle in the region

$0 < x < \dfrac{L}{2}$.   5

(c) Derive the Schroedinger time independent and time dependent wave equations for a non-relativistic material particle.   7

6. (a) Define the critical frequency of an ionosphere layer. Show that critical frequency f_c is related to the peak electron concentration N_p of the reflecting layer by

$$f_c = 9 \sqrt{N_p} \ (\text{SI units}). \qquad 4+6=10$$

(b) Discuss the skip distance.   5

7. (a) Discuss n- and p-type extrinsic semiconductors. 5

(b) What do you understand by penetration depth in super conductors? How it varies with temperature? Explain.   5

(c) Discuss in brief Hall Effect.   5

8.　(*a*)　Distinguish between nuclear fission and nuclear fusion. Explain the principle on which atomic reactor is constructed. Mention some of its uses.　3+5+2=10

　　(*b*)　Calculate the minimum energy in MeV, necessary to disintegrate a deutron into a proton and neutron.

　　　(*Given* : mass of proton = 1.008142 amu, mass of neutron = 1.008962 amu, mass of deutron = 2.014735 amu, 1 amu = 1.6 × 10^{-27} kg)　　　　5