

B.Tech. (Main & COP)
First Semester Examination, 2015-16
Engg. Physics-I

Time: 2 Hours**Total Marks: 50****Note: Attempt all questions. Assume missing data suitably.****1. Attempt any four parts of the following: (3.5x4=14)**

✓ (a) Explain the physical significance of negative result in Michelson Morley experiment. If the length of the paths of the two beams is 11m each. The wavelength of light is used is 6000\AA . If the expected fringe shift is 0.4 fringes, calculate the velocity of earth relative to other.

✓ (b) Derive Lorentz transformation equations and use them to find out the expression for length contraction. What is proper length?

✓ (c) Derive an expression for time dilation? What is proper interval of time? The mean life of a meson is 2×10^{-8} sec. Calculate the mean life of a meson moving with a velocity $0.8c$.

✗ (d) Show that the mass of a body depends on its velocity? Deduce an expression for the variation of mass with velocity.

(e) An electron is moving with speed $0.99c$. What is its total energy? Find the ratio of Newtonian kinetic energy to the relativistic energy.

✗ (f) Prove the following relations:

✗ (i) $E^2 = m_0^2 c^4 + p^2 c^2$

(ii) $u = \frac{u' + v}{1 + \frac{u'v}{c^2}}$

2. Attempt any two parts from the following: (6x2=12)

✓ (a) What do you understand by phase and group velocities? Establish a relation between them. Also show that for a wave packet $v_p \cdot v_g = c^2$

✓ (b) Describe Davisson and Germer experiment to prove that electrons possess wave nature. What are the important conclusions that could be drawn from it?

- (c) Find an expression for the energy state of a particle in one dimensional potential box. Solve Schrodinger wave equation for a particle in one dimensional rigid box of length L and having potential energy (V) as follows:

$$V(x) = \infty \text{ for } x \leq 0 \text{ and } x \geq L$$

$$V(x) = 0 \text{ for } 0 < x < L$$

3. Attempt any two parts from the following:

(6x2=12)

- (a) Using Maxwell-Boltzmann law of distribution of speeds, derive the expressions for average speed, root mean square speed and the most probable speed of the molecules of an ideal gas.
- (b) Write the basic postulates of Bose-Einstein Statistics and then derive an expression for Bose-Einstein Energy Distribution Law.
- (c) Discuss the Fermi energy of conduction electrons. Calculate the value of Fermi energy.

4. Attempt any four parts from the following:

(3x4=12)

- (a) What is pumping? How can it help in achieving population inversion?
- (b) Explain the construction and working of Ruby Laser. Describe its important applications.
- (c) What are Einstein's coefficients? Obtain a relation between them. Also discuss the essential conditions for laser action?
- (d) What is an optical fiber? Explain the function of each section.
- (e) Explain acceptance angle, acceptance cone and numerical aperture of an optical fiber. Derive expressions for them.
- (f) What is holography? Explain with diagram the basic principle of holography. Discuss some applications of holography.