

Total No. of Questions – 8 ]

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BE-II/6(A)  
216515

ENGINEERING PHYSICS

COURSE NO. PHY – 202

( New Course )

Time Allowed: 3 Hours

Maximum Marks – 100

Note: Attempt **five** questions in all selecting at least two questions from each Section. Each question carries 20 marks.

### Section – A

1. (a) Describe Michelson-Morley experiment. State clearly the purpose for which it was designed. Analyze the conclusions of the experiment. Explain what is meant by inertial and non-inertial frames of reference.  
(b) Find the apparent length of a meter stick measured by an observer at rest when the stick is moving along its length with a velocity equal to  $C$ ,  $C/\sqrt{2}$ ,  $\sqrt{3}C/2$ ,  $C/2$ . (12, 8)
2. (a) Derive the formula for the variation of mass with velocity. Deduce Einstein's mass-energy relation  $E=mc^2$  considering the variation of mass with velocity.

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- (b) The mean life of a particle is  $2.2 \times 10^{-8}$  secs. It is found to be  $1.1 \times 10^{-5}$  secs. When the particle is in motion, what is the speed of the particle? ( 12, 8 )
3. (a) Explain Planck's hypothesis of a quantum theory of radiation. Deduce an expression for average energy of a Planck's Oscillator and hence obtain Planck's radiation formula.
- (b) Gamma photons of  $1.2 \text{ \AA}^0$  suffer Compton scattering at  $\pi/3$  radian. Find percentage increase in wavelength. ( 12, 8 )
4. (a) Discuss Phase and Group velocities. Obtain a relation between them. Show that Group velocity of the waves associated with a particle is equivalent to the velocity of the particle.
- (b) Find the energy of photon whose De-broglie wavelength is  $1 \text{ \AA}^0$ . ( 12, 8 )

### Section – B

5. (a) Explain the physical significance of wavefunction. What is meant by the normalization of wavefunction? Derive Schrodinger's Time dependent wave equation for a particle subjected to force. Express the equation for a free particle also.

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(b) Calculate the lowest two energy levels for an electron trapped in a box of width  $3 \text{ \AA}$ . Express the energy difference in electron volts. ( 12, 8 )

6. (a) Consider a particle incident on a potential step of height  $V_0$  with energy  $E > V_0$ . Calculate the coefficients of reflection and transmission. Prove that  $R + T = 1$ .

(b) Explain what is meant by Eigen-function, Eigen value and Expectation value? ( 14 )

7. (a) Give a brief account of Band theory of solids. Discuss the classification of solids into conductor, semi-conductor and insulators on the basis of this theory. What do you understand by intrinsic and extrinsic semiconductors? Explain the concepts of hole in a semiconductor.

(b) Mobilities of electrons and holes in a sample of intrinsic germanium at room temperature are  $0.39$  and  $0.19 \text{ m}^2/\text{Vs}$  respectively. Given that the intrinsic density of carriers is  $2.5 \times 10^{19}/\text{m}^3$ , find the conductivity and resistivity of germanium. ( 12, 8 )

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8. (a) Explain what is Hall Effect? Derive the expression for the Hall-Coefficient and discuss its significance. ( 12 )

(b) Write notes on:

(a) Nano materials

(b) High  $T_c$  materials.

( 4, 4 )

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