(T) Roll No. .....

PAPER ID—16148

B. Tech. EXAMINATION, 2024

(First Semester)

COMPUTER SCIENCE AND ENGINEERING

(Internet of Things)

Physics

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 (Unit I) is compulsory. All questions carry equal marks.

Unit I

1. (a) What is Heinsberg uncertainity principle ? 2

   (b) Write the probability distribution function of electrons ? 2

   (c) What will be the De-Broglie Wavelength of an electron having Kinetic energy of 500 eV ? 2

   (d) A n-type Ge crystal has a current density 100 A/m^2. The crystal has resistivity of 0.5 Ωm and electron mobility of 0.4 $m^2/V\text{-}S$. Calculate the drift velocity of electron in the crystal. Given $e = 1.6 \times 10^{-19}$ C. 2

   (e) What are excetons ? What are its types ? 2

   (f) What is the difference between metals, semiconductors and insulators ? 2

   (g) Find out the value of resistivity in Si chip having thickness $0.60 \pm 2\%$ cm and probe distance (S) 0.300 ± 2 cm. The mean value of V/I ratio is 38.22 experimentally. 2

Unit II

2. Explain the Kronig-Penney model for a linear lattice. How does it lead to the formation of energy bands in solids ? What happens to the width of allowed and forbidden bands with the change in the strength of the periodic potential ? 14

3. (a) What is an effective mass of an e^- in solids ? Derive an expression for the same. 7

   (b) Derive the expression of density of states in 3-dimensions using Quantum theory. 7

Unit III

4. (a) Distinguish between intrinsic and extrinsic semiconductors. Indicate in energy level diagrams, the conduction band, valence band, donor and acceptor states. What are the positions of Fermi levels for the intrinsic and extrinsic semiconductors. 7

(b) Discuss the variation of Fermi level with temperature for N-type semiconductor. 7

5. (a) What is diffusion and drift current ? Derive an expression for total current density in a semiconductor. 7

(b) Hall voltage of 0.1 mV is found to be developed when a sample carrying a current of 10.0 mA is placed in a transverse magnetic field of 3 KG. Calculate the charge carriers concentration of the sample. Given the thickness of the sample along the direction of magnetic field is 0.3 mm. 7

Unit IV

6. (a) What is P-N Junction ? How potential barrier is formed in P-N junction diode ? Explain what happens when P-N function is baised in forward and reverse direction. 9

(b) Discuss, how the process of Avalanche breakdown occurs via PN junction diode. How is it different from zener breakdown ? 5

7. (a) What is density of states ? Derive an expression for joint density of states of a semiconductor substance. 7

(b) On the account of optical transition, defined induced absorption, spontaneous emission and stimulated emission. Derive the relation between Eienstein coefficients. 7

Unit V

8. Discuss the following methods of measurements of semiconductor parameters :

(a) Hot Point Probe Measurements 7

(b) Band Gap measurements using UV vis spectroscopy. 7

9. (a) Discuss the band diagram and working of P-N hetrojunction of both forward and reverse bias in detail. 7

(b) What are 3D, 2D, 1D and 0D system in solids ? Give plots between density of state and energy of each system. 7