

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 60055

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Second Semester

Electronics and Communication Engineering

PH3254 – PHYSICS FOR ELECTRONICS ENGINEERING

(Common to: Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. For a cubic system, sketch the planes with Miller Indices (110) and (011).
2. Define the terms linear and planar densities.
3. List out the three main theories developed for understating the properties of metals.
4. On the basis of spin how are the materials classified?
5. State the properties of a semiconductor.
6. Give any two differences between Schottky diode and Ohmic contacts.
7. What are the main requirements for a suitable LED material?
8. Define the term plasmonics.
9. What is a quantum structure?
10. What is spintronics? Give its applications.

PART B — (5 × 16 = 80 marks)

11. (a) Describe the seven systems of crystals with suitable diagrams and give the relation of lengths of axes and the relation between the axes of a unit cell in each type.

Or

- (b) Classify and explain the various types of crystal defects with neat diagram.

12. (a) Write a short note on Tight Binding Approximation for energy band in solids. Derive the expression for effective mass of an electron and give the concept of hole.

Or

- (b) Discuss about the origin of ferromagnetism and exchange interaction in ferromagnetic materials.
13. (a) (i) Derive an expression for concentration of electrons in an n-type semiconductor. (12)
(ii) Briefly describe the variation of carrier concentration with temperature. (4)

Or

- (b) What is Hall Effect? Derive an expression of Hall Coefficient R_H for n-type semiconductor. Give the experimental determination of Hall Effect. Write its applications and importance.
14. (a) Discuss about the optical processes in semiconductors and in quantum well.

Or

- (b) Explain the construction and working of optoelectronic device made up of many layers with organic molecules of different conductivity levels.
15. (a) Explain the density of states in quantum well, quantum wire and quantum dot structure.

Or

- (b) Describe the CNT structures in detail with illustrations. Mention the physical properties and applications of CNT.

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 70183

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

Electronics and Communication Engineering

PH 3254 — PHYSICS FOR ELECTRONICS ENGINEERING

(Common to Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define unit cell.
2. Find the maximum radius of the interstitial sphere that can fit into the void at $(1/2, 1/2, 1/2)$ between the atoms in the BCC structure.
3. Calculate Lorentz number for copper at 293 K, if the electrical conductivity and thermal conductivity are $1.72 \times 10^{-8} \Omega m$ and 386 W/mK respectively.
4. Define Fermi surface or Fermi sphere.
5. How are holes generated in p- type semiconductors?
6. The intrinsic carrier density at room temperature in Ge is $2.37 \times 10^{19}/m^3$. If the electron and hole mobilities are 0.38 and 0.18 m^2/Vs respectively, calculate the resistivity.
7. Differentiate the optical absorption process that occur between direct and indirect bandgap semiconductors.
8. Give any two points that differentiate laser diode and LED.
9. Draw the density of states for bulk and quantum well structures.
10. Is energy band gap of nanomaterial greater than its bulk counterpart? If so give reason.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Calculate the packing factors of SC and FCC with neat diagram. (4+6=10)
- (ii) Mention any five crystal systems, their unit vectors and angles in tabular form. (6)

Or

- (b) (i) Discuss briefly the point and line imperfections in crystal with neat diagram. (10)
- (ii) Calculate the equilibrium concentrations of point imperfections at 300 K in the case of copper. The enthalpy of formation of point imperfections is 120KJ/mol. Gas Constant = 8.314 kJ/molK. (6)
12. (a) (i) Derive the expression for density of energy states for solids and find the carrier concentration at any temperature. (10)
- (ii) Using the expression of Fermi-Dirac distribution function, find the probability of finding the electron at
- (i) $T = 0K$ and $E < E_f$
- (ii) $T = 0K$ and $E = E_f$ (6)

Or

- (b) (i) Briefly discuss paramagnetism and ferromagnetism, in magnetic materials and their properties. (10)
- (ii) A paramagnetic material has a magnetic field intensity of 10^4 A/m. If the susceptibility of the material at room temperature is 3.7×10^{-3} , calculate magnetization and flux density in the material. (6)
13. (a) (i) Derive the expression for carrier concentration in intrinsic semiconductors. (10)
- (ii) For an intrinsic semiconductor with gap width $E_g = 0.7eV$, calculate the concentration of intrinsic charge carriers at 300 K assuming that $m^* e = m^* h = m_0$ (rest mass of electron). (6)

Or

- (b) (i) Describe the variation of carrier concentration with temperature in n-type semiconductor with diagram. (10)
- (ii) Suppose that the effective mass of holes in a material is 4 times that of electrons. At what temperature would Fermi level be shifted by 10% from the middle of the forbidden energy gap? Given $E_g = 1eV$. (6)

14. (a) Explain briefly with expression for optical absorption and emission processes in the direct and indirect band gap semiconductor. (16)

Or

- (b) Describe briefly the working principle, energy bands and spectral characteristic of double heterojunction laser diode with neat diagram. (16)

15. (a) Explain briefly the density of states for quantum well and quantum wire. In which way is it superior to bulk materials? (16)

Or

- (b) Explain briefly the operation of single electron transistor using single electron phenomenon with neat diagram. (16)

STUCOR APP