

Roll No.

3003

**B. Tech. 2nd Semester (CSE)
Examination – July, 2021**

SEMICONDUCTOR PHYSICS

Paper : BSC-PHY-103-G

Time : Three hours] [Maximum Marks : 75

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

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. **1** is *compulsory*. All questions carry equal marks.

1. Attempt any *six* parts : 2.5 × 6 = 15
- (a) When does an intrinsic semiconductor behaves as an insulator ? Explain.
 - (b) Explain the variation of conductivity of semiconductor with temperature.
 - (c) What is the phonon scattering ? Explain.

3003-125(P-4)(Q-9)(21)

P. T. O.

- (d) What is the value of surface potential under flat band condition ?
- (e) What is the difference between Ohmic and Rectifying junction ?
- (f) What do you mean by effective mass of an electron ?
- (g) What are heterojunctions ?

UNIT – I

- 2. Discuss the Kronig-Penny model for the motion of an e^- in a periodic potential. What is meant by the density of energy states ? Derive an expression. 15
- 3. (a) What is phonon scattering ? Explain how this scattering mechanism affects mobility of carrier. 5
- (b) Explain direct and indirect band gaps and also give examples of materials related with these band gaps. 10

UNIT – II

- 4. (a) Obtain an expression for carrier density of an intrinsic semiconductors. Explain how the resistivity of an intrinsic semiconductor varies with temperature. 10

3003- (P-4)(Q-9)(21) (2)

https://www.mdustudy.com

https://www.mdustudy.com

https://www.mdustudy.com

https://www.mdustudy.com

UNIT – IV

- (b) Calculate the intrinsic carrier concentration in GaAs at T = 450 K. Given that $N_C = 4.7 \times 10^{17} \text{ cm}^{-3}$; $N_V = 7 \times 10^{18} \text{ cm}^{-3}$ at T = 300 K, $E_g = 1.42 \text{ eV}$. 5
- 5. (a) Explain Schottky effect. Show that actual Schottky barrier height proportionately related to position of maximum barrier height due to Schottky effect. 10
- (b) Design an Ohmic contact for n-type GaAs using InAs with an intervening graded InGaAs region. 5

UNIT – III

- 6. (a) Explain the concept of density of states for photons. <https://www.mdustudy.com> 7
- (b) Define spontaneous, stimulated emission and absorption. 4
- (c) How optical transitions takes place in bulk s/c? 4
- 7. (a) State and explain Fermi's Golden Rule. 9
- (b) What is photovoltaic effect? 6

3003- (P-4)(Q-9)(21) (3) P. T. O.

- 8. (a) What are Vander Paw measurements for carrier density, resistivity and hall mobility? 9
- (b) Write parameter extraction from diode I-V characteristics. 6
- 9. Write and explain design fabrication and characterization techniques for quantum wells, wires and dots. 15

3003- (P-4)(Q-9)(21) (4)