

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 :  $2.5 \times 6 = 15$
- (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)

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- (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)

(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,  $E_g = 1.42$  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.

#### UNIT – IV

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)