

Roll No.

3003

**B. Tech. 1st Semester (CSE)
Examination – December, 2022**

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. (a) What do you mean by direct and indirect band gap semiconductor materials ?
- (b) Write a short note on the term effective mass.
- (c) What is DLTS ? Discuss.
- (d) What are excitons ? Briefly discuss *two* types of excitons.

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- (e) How does a semiconductor behave electrically at 0 K temperature ?
- (f) Discuss heterojunction devices. $6 \times 2.5 = 15$

UNIT - I

2. Explain the Kroning-Pemney model and discuss how it explains formation of energy bands ? 15
3. Discuss quantum free electron theory of electrons. Explain density of states, Fermi energy and probability of occupation. 15

UNIT - II

4. Derive an expression for the carrier concentration in intrinsic semiconductors and discuss the position of Fermi level. 15
5. (a) Draw and discuss the energy band diagram for p-n junction diode. 7
- (b) Explain Ohmic and schottky contacts. 8

UNIT - III

6. (a) Discuss the Drude Model to explain electrical conductivity in metals. 10
- (b) Explain the Photovoltaic process. 5

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7. Derive an expression for joint density of photons in semiconducting materials. 15

UNIT - IV

8. (a) Explain Vander Pauw method and how to determine the resistivity and Hall mobility of a semiconductor material by this method ? 11
- (b) What is hot-point probe measurement ? 4
9. (a) What are low dimensional systems ? Explain quantum well, quantum wire and quantum dot with suitable practical examples and applications. 11
- (b) Explain VLS growth method to grow nanowires. 4

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