

M.Sc. 2nd Semester Examination, 2025

PHYSICS

(Semiconductor Physics)

PAPER—PHS-205

Full Marks : 25

Time : 1 hour

Answer all questions

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

GROUP — A

1. Answer any two questions : 2 × 2

- (a) Calculate the energy difference between the intrinsic level and Fermi energy in an intrinsic semiconductor.**

(Turn Over)

- (b) Find the expression of barrier potential for a $p-n$ junction under equilibrium condition.
- (c) Show with a band diagram the ohmic contact for a metal semiconductor junction.
- (d) Show the possible recombination of carriers when a semiconductor is illuminated with light.

GROUP – B

2. Answer any *two* questions : 4 × 2
- (a) What is meant by depletion temperature ?
Find an expression of depletion temperature for a n -type semiconductor. 1 + 3
 - (b) What is meant by diffusion length ? Find an expression for diffusion length of minority carriers for a $p-n$ junction under forward bias.

- (c) Derive Einstein relation assuming a $p-n$ junction under equilibrium condition.
- (d) Explain what is meant by quadratic recombination.

GROUP - C

3. Answer any *one* question : 8 × 1

(a) (i) Find the expression of carrier concentration in an n type non-degenerate semiconductor at extremely low temperature region.

(ii) Find an expression of capacitance in an abrupt $p-n$ junction. 4 + 4

(b) (i) What is meant by relaxation time of a carrier ?

(ii) Find the expression of growth of carrier of a non-degenerate semicon-

(4)

ductor under illumination. Also show the expression of decay of carrier when the light is made off.

- (iii) A $0.46 \mu\text{m}$ thick sample of GaAs is illuminated with monochromatic light of $h\nu = 2 \text{ eV}$. The absorption coefficient α is $5 \times 10^4 \text{ cm}^{-1}$. The power incident on the sample is 10 mW . Find the total energy absorbed by the sample. 1+5+2

[Internal Assessment – 5 Marks]
