

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (ECE/CSE) (Sem.-1,2)
SEMI-CONDUCTOR AND OPTOELECTRONICS PHYSICS

Subject Code : BTPH/105/18

M.Code : 75363

Date of Examination : 08-05-2024

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION-B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

1. Write briefly :

- a) Define Occupation probability.
- b) What are the basic assumptions of classical free electron theory of metals?
- c) At what temperature we can expect a 5% probability that electrons in silver have an energy which is 2% above the Fermi energy? The Fermi energy of silver is 5.0 eV.
- d) Write a note on diffusion current.
- e) What is the need of extrinsic semiconductors?
- f) What is the importance of population inversion?
- g) Distinguish between Radiative and non-radiative recombination mechanisms.
- h) When a laser has 2V applied to it, it draws 10 mA and produce 2 mW of optical power. What is the efficiency of laser?
- i) What information can be obtained from capacitance-voltage measurement?
- j) What is hall mobility?

SECTION-B

2. What are the special features of quantum free electron theory of metals? Derive an expression for the electrical conductivity of a metal.
3. Solve Schrodinger wave equation for periodic potential and show that it results in the band structure in solids.
4. Obtain the expression for electron density in an intrinsic semiconductor. Estimate the fraction of electrons in conduction band at room temperature in Ge with band gap 0.75 eV.
5. Distinguish between extrinsic and intrinsic semiconductors. Discuss the effect of impurity concentration on the Fermi level in extrinsic semiconductors.

SECTION-C

6. What is photo-detector? Explain the principle, construction and working of an Avalanche photodiode. Discuss its advantages.
7. What kind of semiconductor materials are used for optoelectronics devices? Discuss the construction and working of Light Emitting Diode (LED)?
8. a) What is divergence of laser? Write down the procedure for the measurement laser divergence.
b) A laser has a beam spot of 2 mm and 5 mm at distance of 1 m and 5 m from laser, respectively. Calculate divergence of laser.
9. a) What is Four-point probe method? Explain the measurement of resistivity using it.
b) The resistivity of an intrinsic semiconductor is $5.5 \Omega \text{ m}$ at 30°C and $3.0 \Omega \text{ m}$ at 42°C . Find the band gap.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.