

Roll No.

Total No. of Pages : 02

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B.Tech. (Computer Science & Engineering/Electrical Engg.)

B.Tech. (ECE) (PIT) (Sem.-1,2)

SEMI-CONDUCTOR AND OPTOELECTRONICS PHYSICS

Subject Code : BTPH-105-18

M.Code : 75363

Date of Examination : 08-07-22

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

Write briefly :

1. Define Bloch's theorem.
2. Distinguish between direct and indirect band gap semiconductor materials.
3. At what temperature we can expect a 10% probability that electrons in silver have an energy which is 1% above the Fermi energy? The Fermi energy of silver is 5.5 eV.
4. Write a note on Ohmic junctions.
5. Highlight the importance of extrinsic semiconductors.
6. What is population inversion?
7. Discuss radiative recombination mechanism.
8. A 10 m W laser has a beam diameter of 3.2 mm. What is the intensity of the light assuming that it is uniform across the beam?
9. What are the advantages of four probe method over two probe method?
10. Draw and label V-I characteristics of PN junction.

SECTION-B

11. What are the special features of classical free electron theory of metals? Derive an expression for the electrical conductivity of a metal. Write any two drawbacks of the classical free electron theory of metals.
12. What is band theory of solids? Explain energy band diagram and distinguish metal, semiconductor and insulator on the basis of above theory.
13. Distinguish between extrinsic and intrinsic semiconductors. Discuss the effect of increasing amounts of dopants on the Fermi level in extrinsic semiconductors.
14. Obtain the expression for carrier concentration in n-type semiconductor.

SECTION-C

15. What is photo-detector? Explain the principle, construction and working of pin photodiode. Discuss its advantages over Photodiode.
16. What is Stimulated absorption, Spontaneous emission and Stimulated emission? Obtain the relation between different Einstein's coefficients and discuss the result.
17.
 - a) How to determine the type of the semiconductor using Hot point probe method?
 - b) What is Capacitance-Voltage (CV) measurement? Explain the method to determine depletion width using CV measurement.
18.
 - a) What is Van der Pauw method? Explain the measurement of resistivity using Van der Pauw method.
 - 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.