Roll No. | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (AI&ML/(AI) and Data Science/CSE/Data Science/Robotics & Artificial Intelligence/IT/Internet of Things and Cyber Security including Block Chain Technology/) (Sem–1,2)

SEMI-CONDUCTOR PHYSICS

Subject Code : BTPH-104-18

M.Code : 75360

Date of Examination : 15-06-2023

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) Explain the terms : (i) Drift velocity and (ii) Carrier mobility.

b) What are the basic assumptions of classical free electron theory?

c) What do you understand by wave function?

d) Why are we not aware of quantization in the daily experience?

e) Explain it. What is the density of states? Discuss briefly.

f) Give the physical basis of effective mass and explain its physical significance.

g) Write a short note on the band theory of solids.

h) Define the following terms : (i) Population inversion (ii) Pumping.

i) What is Fermi level and Fermi energy?

j) What is exciton?

SECTION-B

2. Obtain an expression for the electrical conductivity of metal on the basis of the free-electron theory. Hence prove Ohm's law.

3. Discuss with suitable mathematical expressions, the motion of an electron in a periodic potential. Explain how the above theory leads to the concept of the band structure of solids.

4. Derive an expression for Fermi energy in an intrinsic semiconductor. What is the effect of temperature on Fermi level in an intrinsic semiconductor?

5. a) Differentiate the n-type and p-type semiconductors with their Fermi level diagram.

   b) For an intrinsic semiconductor having a band gap $E_g = 0.7$ eV, calculate the density of holes and electrons at room temperature (= 27°C).

SECTION-C

6. Explain the term 'spontaneous' and 'stimulated' emission of radiation. Obtain a relation between transition probabilities of spontaneous and stimulated emission.

7. Describe the construction and working of a semiconductor laser with necessary diagrams. Discuss its merits over other lasers.

8. Explain the concept of directionality and monochromaticity as applied to lasers.

9. a) What is the Hall effect? Give an experimental method of calculating concentration and type of charges in a given semiconductor.

   b) Assume that there are 5×10^{28} atoms/m^3 in Cu, find the Hall coefficient.

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.