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**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
MID TERM EXAMINATION - OCT 2023**

Semester : Semester III - 2022

Course Code : PHY1002

Course Name : Sem III - PHY1002 - Optoelectronics and Device Physics

Program : B. TECH

Date : 2-NOV-2023

Time : 9:30AM - 11:00AM

Max Marks : 50

Weightage : 25%

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE FIVE QUESTIONS

5 X 2=10M

1. Which band determines the electrical conductivity of a solid?
(CO1) [Knowledge]
2. The ----- is the lower-energy band, and it is typically filled with electrons
(CO1) [Knowledge]
3. Define superconductivity?
(CO1) [Knowledge]
4. What type of impurity is added to obtain n type semiconductor?
(CO1) [Knowledge]
5. Which are the three important energy bands in solids?
(CO1) [Knowledge]

PART B

ANSWER ALL THE FOUR QUESTIONS

4 X 5 = 20M

6. We know that, it is possible to destroy the superconductivity in the material by applying a certain magnetic field. This field is called critical field H_c . Classify superconductors based on this magnetic behavior.
(CO1) [Comprehension]
7. Are superconductors diamagnetic materials? Justify with proof.
(CO1) [Comprehension]

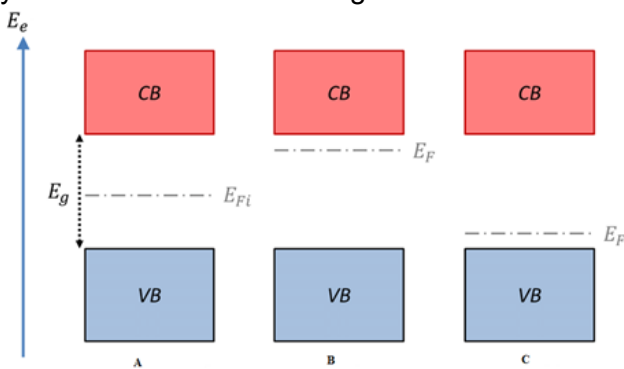
8. Calculate the Hall voltage when a conductor carrying a current of 100 A, is placed in a magnetic field of 2.5 T. The conductor has a thickness of 2 cm, and the density of charge carriers inside the conductor is $6.8 \times 10^{28} m^{-3}$.
(CO1) [Comprehension]
9. Estimate the fraction of electrons in the conduction band at 303K in Ge with $E_g=0.72$ eV.
(CO1) [Comprehension]

PART C

ANSWER ALL THE TWO QUESTIONS

2 X 10 = 20M

10. Find the intrinsic charge carrier concentration in a silicon crystal at 100 K. Given, $E_g = 1.1$ eV, $m_e = m_h = 9.1 \times 10^{-31} Kg$, $k = 1.38 \times 10^{-23} JK^{-1}$ and $h = 6.626 \times 10^{-34} Js$.
(CO1) [Application]
11. The energy band diagram of certain samples are represented in the figure. Identify A, B and C. Justify your answer. What is the significance of E_F ?



(CO1) [Application]