

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2023

B.Tech.-V Semester (ECE)

COURSE CODE(CREDITS):18B1WPH531(03)

MAX. MARKS: 25

COURSE NAME: Science and Technology of Materials

COURSE INSTRUCTORS: Dr. Ragini Raj Singh

MAX. TIME: 1 Hour 30

Minute

*Note: (a) All questions are compulsory.*

*(b) Marks are indicated against each question in square brackets.*

*(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems*

**Q.1.** Discuss intrinsic, p-type and n-type semiconductors? Give detailed description on how to prepare p-type and n-type semiconductors? [CO:1; Marks:4]

**Q.2.** Discuss the functioning of the p-n junction [CO:2; Marks:3]  
(i) Without external applied voltage  
(ii) With external applied voltage

**Q.3.** What do you know about emerging technology in electronics that is based on spin of electrons? If this technology succeeded in future what will be its advantages. [CO:2; Marks:2]

**Q.4.** Discuss direct and indirect band gap semiconductors? How and why they are being used in the field of optoelectronics devices. [CO:3; Marks:3]

**Q.5.** Discuss the characteristics of LED material and device with appropriate graphs and their respective explanation. [CO:3; Marks:3]

**Q.6.** Consider an intrinsic semiconductor in which the effective density of states is  $N_c$  in the conduction band and  $N_v$  in the valence band. Calculate the intrinsic density and the Fermi level position for the following temperatures: 37 degree Celsius, 137 degree Celsius and 237 degree Celsius. [CO:3; Marks:2]

**Q.7.** The Hall coefficient of certain silicon specimen was found to be  $-6.55 \times 10^{-5} \text{ m}^3 \text{c}^{-1}$  from 100 to 400 K. determine the nature of the semiconductor. If the conductivity was found to be  $200 \text{ m}^{-1}$ . Calculate the density and mobility of the charge carriers. [CO:4; Marks:3]

**Q.8.** In a p-type germanium  $n_i = 2.1 \times 10^{19} \text{ m}^{-3}$  density of boron  $4.5 \times 10^{23} \text{ atom /m}^3$ . The electron and hole mobility are  $0.4$  and  $0.2 \text{ m}^2 \text{v}^{-1} \text{ s}^{-1}$  respectively. What is its conductivity before and after addition of boron atoms. [CO:4; Marks:3]

**Q.9.** Find the resistance of an intrinsic Ge rod 1 mm long, 1 mm wide and 1 mm thick at 300 K. The intrinsic carrier density  $2.5 \times 10^{19} \text{ m}^{-3}$  is at 300 K and the mobility of electron and hole are  $0.39$  and  $0.19 \text{ m}^2 \text{v}^{-1} \text{ s}^{-1}$ . [CO:4; Marks:2]