

# School of Computing Science and Engineering

B.Tech CSE  
ETE - Jun 2023

Time : 3 Hours

Marks : 100

## Sem II - C1UD121B / BBS01T1002

### Semiconductor Physics

*Your answer should be specific to the question asked*

*Draw neat labeled diagrams wherever necessary*

1. Define intrinsic and extrinsic semiconductors which types of dopant is used in p-type and n-type semiconductors. K2 CO1 (5)
2. Write the Fermi-Dirac distribution function and interpret it graphically at the temperatures  $T_1$  and  $T_2$  where  $T_1 > T_2$ . K1 CO1 (5)
3. Interpret the types of quantum confinement with examples K3 CO1 (5)
4. Discuss the working principle of light emitting diode (LED) and how is different from the laser diode. Calculate energy band gap of semiconductor with the radiation of wavelength 550 nm. K2 CO2 (10)
5. Design a forward and a reversed biased circuit by connecting the voltmeter and ammeter using p-n junction diode. Analyze the I-V characteristics of the p-n junction diode Interpret the static and dynamic resistance of the diode K4 CO3 (10)

### OR

- The potential barrier across a p-n junction is 0.7V. A resistance of  $4.3k \Omega$  is connected in series with diode . If a source is connected of 5.0 V across the diode. Find the current through the resistance and also sketch the suitable circuit diagram K4 CO3 (10)
6. Obtain the expression of conductivity of intrinsic semiconductors. Deduce the conductivity of a semiconductor if pentavalent atoms are doped with intrinsic semiconductor K1 CO2 (10)
  7. Explain the concept of holes using E-k curve. If the relation between energy and wave vector is given by  $E = Pk^2 - Qk^4$ , where P and Q are constants. Determine the maximum energy ( $E_{max}$ ) in term of P and Q. K4 CO2 (10)
  8. Give an explanation of the differences between spontaneous and stimulated emission while also mentioning the characteristics of coherent and incoherent waves K3 CO3 (15)
  9. Investigate an electron's behavior in a periodic potential. Establish the inverse relationship between the effective mass of an electron and the second derivative of the E-k curve K3 CO3 (15)
  10. Describe the working principle of a semiconductor laser diode. Explain how the laser is differ from ordinary light. Write three important application diode laser K4 CO3 (15)

### OR

Analyze the statement "Energy of a particle in a one-dimensional box is quantized". Discuss the comparison between classical and quantum ideas. A particle is moving in one dimensional box and its wave function is given by  $\psi = A \sin (n\pi/a)x$ . Find the normalize the wave function. K4 CO4 (15)