Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT:
F1+TF1

Vellore – 632014, Tamil Nadu, India

SCHOOL OF ELECTRONICS ENGINEERING

FALL SEMESTER 2024-2025

CAT-1

Programme: B-TECH Electronics Engineering	**Branch: VLSI Design and Technology**	**Course code: BEVD201L**
Course Name: Physics of Semiconductor Devices		**Date: 30/08/2024**
Class Nbr: VL2024250104205	**Max Marks: 50**	**Duration: 90 mins**
Faculty name(s): Dr. Prachi Sharma		

General instruction(s): 1. Answer ALL Questions

Q. No	Question	Marks
1.	For a silicon crystal, the hole concentration is given by $p = 10^{16} \exp(-x/L_p)$ for $x \geq 0$ and the electron concentration is given by $n = 3 \times 10^{15} \exp(x/L_n)$ for $x \leq 0$. The values of L_p and L_n are 3×10^{-4} cm and 10^{-3} cm respectively. Find the total current density which is the sum of hole and electron diffusion current density at x=0.	10
2.	A semiconductor has $N_c = 3 \times 10^{19}$ cm^{-3}, $N_v = 6 \times 10^{18}$ cm^{-3} and $E_g = 1.6$ eV. If doped with 3×10^{17} cm^{-3} acceptors, calculate the electron, hole, and intrinsic carrier concentration at 327 °C. Show the Fermi level on a suitable band diagram.	10
3.	a) What are the root causes of carrier collisions or scattering in a crystal lattice?	5
	b) A sample of N-type silicon is at room temperature. When an electric field with a strength of 1000 V/cm is applied to the sample, the hole velocity is measured and found to be 2×10^5 cm/sec. The width and height of the sample are 10 μm and 1.5 μm, respectively, and the length of the sample is 20 μm. Calculate the resistance of the sample.	5
4.	Explain the qualitative description of current flow at p-n junction under equilibrium and biased conditions.	10
5.	Boron is implanted in an n-type Si ($N_d = 10^{16}$ cm^{-3}), forming an abrupt p–n junction with the square-cross sectional area 3×10^{-4} cm^2. Accepter concentration (N_a) on the p-side is 3×10^{18} cm^{-3}. Find out the width of the depletion zone (W_{dep}) at 300 K. Also find the capacitance.	10