SLOT: A2+TA2

REG. NO.:

VIT
Vellore Institute of Technology

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

Programme Name & Branch	: B.Tech Electronics Engineering (VLSI Design and Technology)
Course Code	: BEVD201L
Course Name	: PHYSICS OF SEMICONDUCTOR DEVICES
Faculty Name(s)	: Dr. Prachi Sharma
Class Number(s)	: VL2025260102593
Date of Examination	: 17.08.25
Exam Duration	: 90 minutes **Maximum Marks:** 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcome Statements:

  CO 1: Give the student in-depth knowledge of the physics of solid state devices
  CO 2: Impart the fundamentals of semiconductor devices, their structures and operation
  CO 3: Teach the modelling of PN Junction, MOS capacitors, and MOSFETs

Q. No	Question	M	CO	BL
1.	Explain the temperature dependence of carrier concentrations, mobility degradation, and velocity saturation	10	1	2
2.	Under equilibrium conditions, what is the probability of an electron state being occupied if it is located at the Fermi level for intrinsic semiconductors? (a) If E_F is positioned at E_C, determine the probability of finding electrons in states at $E_C + kT$. (b) The probability of a state being filled at $E_C + kT$ is equal to the probability of a state being empty at $E_C + 3\ kT$. Where is the Fermi level located?	10	1	3
3.	Find the resistance of a 1 cm^3 silicon crystal. What is the resistance if the crystal is doped with arsenic and the doping is 1 in 10^9 i.e., 1 ppb (parts per billion)? Given data: Atomic concentration in silicon is $5 \times 10^{22}\ cm^{-3}$, $n_i = 1.45 \times 10^{10}\ cm^{-3}$, $\mu_e = 1350\ cm^2/Vs$, and $\mu_h = 450\ cm^2/Vs$.	10	2	3
4.	Briefly discuss how effective mass influences the carrier mobility and density of states in a semiconductor, and hence the performance of semiconductor devices.	10	2	2
5.	An ideal one-sided silicon n^+p junction has uniform doping on both sides of the abrupt junction. The doping relation is $N_d = 50N_a$. The built-in potential barrier is 752mV. A reverse-bias voltage of 10 V is applied at T = 300 K. Determine (a) N_a, N_d (b) W_{dep}, and (c) C_j for $V_R = 10V$.	10	3	3

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