VIT

Vellore Institute of Technology

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

REG.NO.:

SCHOOL OF ELECTRICAL ENGINEERING

CONTINUOUS ASSESSMENT TEST - I

WINTER SEMESTER 2024-2025

SLOT: C2+TC2

Programme Name & Branch : BTech EEE/EIE

Course Code and Course Name : BEEE201L Electronic Materials

Faculty Name(s) : Prof. P. Uma Sathyakam, Prof. Mallikarjuna Golla

Class Number(s) : VL2024250500978, VL2024250500980

Date of Examination : 29-01-2025

Exam Duration : 90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- Consider Plank's constant = 6.63×10^{-34} Js, Boltzmann Constant = 1.38×10^{-23} J/K, mass of electron = 9.1×10^{-31} Kg, Avogadro Number = 6.022×10^{23} mol^{-1}, 1J=6.242×10^{18} eV
- M-Marks, CO-Course outcomes, BL-Bloom's taxonomy level
  a. CO1: Understand the fundamental physics of electronic materials
  b. CO2: Classify and interpret various types of current carrying mechanisms in semiconductor materials

Q. No	Question	M	CO	BL
1.	(a) Consider an electron in an infinite potential well of size 0.2 nm. What is the ground energy of the electron? **[4]** (b) What is the energy required to put the electron at the second and third energy levels? **[4]** (c) How can this energy be provided? **[2]** Assume velocity of electron as 2.5×10^{8} m/s.	10	1	3
2.	Given that the density of states related effective masses of electrons and holes in Si are approximately 1.08*me* and 0.60*me*, respectively, and the electron and hole drift mobilities at room temperature are 1400 and 450 cm^2 /Vs, respectively, (a) Calculate the intrinsic concentration **[5]** (b) Intrinsic resistivity of Si. **[5]**	10	2	3
3.	(a) Discuss any three types of bonding in materials with diagrams and examples. Explain their characteristics with example applications. **[6]** (b) Calculate the Miller indices for **x, y, z** intercepts of -3, 4, ∞ respectively. Draw the crystal unit cell plane for the obtained Miller indices. **[4]**	10	1	2
4.	Given that the atomic concentration in silicon is 5×10^{22} cm^{-3}, $n_i = 1.0\times10^{10}$ cm^{-3}, μ_e = 1400 cm^2 /Vs, and μ_h = 450 cm^2 /Vs. (a) Find the resistance of a 1cm^3 pure silicon crystal. **[5]** (b) Also find the resistance of a doped silicon crystal, when it is doped with arsenic if the doping is 1 in 10^9. **[5]**	10	2	3
5.	What are different types of semiconductors? Discuss all types of them with diagrams and examples.	10	2	2