VIT
Vellore Institute of Technology
CHENNAI

Reg. Number:

Continuous Assessment Test (CAT) – I - AUGUST 2025

Programme	:	B.Tech	Semester	:	Fall Semester 2025-2026
Course Code & Course Title	:	BAPHY107 & Physics of Semiconductor Devices	Class Number	:	CH2025260103607 CH2025260103611 CH2025260103613 CH2025260103621 CH2025260103624 CH2025260103658 CH2025260103746
Faculty	:	Prof. Jitendra Narayan Dash Prof. Rajasekarakumar Vadapoo Prof. Atanu Dutta Prof. Caroline Ponraj Prof. B. Ajitha Prof. N. Punithavelan Prof. B. Karthikeyan	Slot	:	A1
Duration	:	1½ Hours	Max. Marks		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information
- Only non-programmable calculator without storage is permitted

Useful Constants: $m_e = 9.11 \times 10^{-31}$ kg, $\hbar = 1.055 \times 10^{-34}$ J·s, 1 eV = 1.602×10^{-19} J; h = 6.626×10^{-34} J·s

Answer all the questions

Q. No	Sub Sec.	Section A (2 x 10 = 20 marks)	Marks
1	(i)	Using the de Broglie relation, calculate the wavelength of an electron accelerated through 100 eV and the wavelength of a cricket ball of mass 160 g moving at 30 m/s; then, using these results, explain concisely why quantum (wave) effects are prominent for electrons but negligible for a cricket ball.	5
	(ii)	Write down Planck's radiation formula and explain the basis on which Planck arrived at this hypothesis.	5
2	(i)	What is wave function? Explain its significant properties.	5
	(ii)	State and explain Heisenberg's uncertainty principle of space as well as for energy.	5
		Section B (2 x 15 = 30 marks)	
3	(i)	A particle of mass m is confined in a one-dimensional infinite potential well ($0 \leq x \leq L$). Starting from the time-independent Schrödinger equation, apply the boundary conditions to obtain the normalized eigen functions $\psi_n(x)$ and the corresponding energy eigenvalues E_n. Here $V(x) = 0$ for $0 < x < L$ and $V(x) = \infty$ elsewhere.	10
	(ii)	An electron with energy E = 0.30 eV is incident on a one-dimensional rectangular potential barrier of height U_0 = 0.80 eV and width a = 1.0 nm ($U_0 > E$). Estimate the tunnelling transmission probability T for the electron to appear on the other side of the barrier.	5
4	(i)	Explain the Kronig–Penney model for electrons in a one-dimensional periodic lattice with neat diagrams.	10
	(ii)	At T = 350 K, compute the occupancy probability for (a) an energy level 0.08 eV above the Fermi energy and (b) an energy level 0.02 eV below the Fermi energy.	5

**********All the best *************