REG.NO.:

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

SCHOOL OF ADVANCED SCIENCES
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

SLOT: B1

Programme Name & Branch :**B. Tech Chemical Engineering**
Course Code and Course Name : **BAPHY104 Physics of Materials**
Faculty Name(s) : **Dr. Anusha P T**
Class Number(s) : **3650**
Date of Examination :**16.03.2026**
Exam Duration : **90 minutes** **Maximum Marks: 50**

General instruction(s):

- Answer All Questions
- Students are permitted to bring any number of textbooks, printouts of e-books (complete / chapters) and handwritten notebooks (class notes).
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
  Course Outcomes
  CO2- Explain the origin of energy bands
  CO3- Explain the basics of quantum mechanics

Q. No	Question	M	CO	BL
1.	Starting from Planck's quantization of energy and the de Broglie hypothesis, explain how these ideas logically lead to the formulation of the time-dependent Schrödinger equation for a free particle. Key: Plank's quantisation (2.5 marks) Debroblie Hypothesis (2.5 marks) Wave function in terms of E and p (1 mark) Conservation of energy (1 mark) Differentiations (2 marks) Final expression (1 mark)	10	3	2
2.	a) Estimate the consequence for the electron's momentum inside nucleus and discuss why this contradicts experimental observations. Key: size of nucleus (1 mark) HUP(1 mark) Substitution and final momentum (2 marks) Conclusion (1 mark) b) A student claims that since ψrepresents a wave, the value of the wave function itself should directly represent the probability of finding a particle at a point. Using the interpretation introduced by Max Born, explain why this statement is incorrect and discuss the physical meaning and conditions that a valid wave function must satisfy. Key: The wave function can be complex number and probability density will be a positive number (1 mark) Conditions of wave functions (4 marks)	5+5	3	3
3.	a) During an experiment on Compton Scattering discovered by Arthur H. Compton, visible light is used instead of X-rays to scatter from electrons. Predict whether a measurable Compton shift will be observed. Discuss what this implies about the choice of radiation used in the experiment. Key: C shift will not be observed due to low energy of photons. Momentum is less. (1 mark) P=E/c for photon. Compare E of visible and Xray photons (4 marks)	5	3	3

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	b)A particle is described by the wave function $\psi(x)=A\sin(\pi x)$, where A=0.2 and x is in meters. Calculate the probability of finding particle at x=0.5. Key: 0.02	5		
4.	a) Suppose electrons in a metal followed classical statistics instead of Fermi–Dirac Statistics. Predict how the heat capacity of metals would differ from experimental observations. Key: U due to free electons=3/2 N_akT according to classical theory.(2 marks) Finding C (1 marks) Conclusion Therefore C=3/2R+3R which is huge than the experimental value(2 marks)	5	2	3
	b) Calculate the probability of an electron occupying a state with energy kT above fermi level. Key: 1/(1+e)= 0.27	5		
5.	Using the assumptions of the Drude model, explain electrical conductivity of a metal. Key : Assumptions (4 marks) Observations under applied E (3 marks) Finding ohms law (3 marks)	10	2	2

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