

**VIT**

Vellore Institute of Technology

Continuous Assessment Test II – May 2023

Programme	: B.Tech.	Semester	: Win 22-23
Course	: Engineering Physics	Code	: BPHY101L
Faculty	: Dr.G Vinitha	Slot	: E1 + TE1
		Class Number	: CH2022232300020
Time	: 1½ Hours	Max. Marks	: 50

1. OPEN BOOK Examinations, 2. Answer ALL the Questions

1.	(i) An X-ray photon of wavelength 0.1 nm is scattered through 108° by an electron. What is the kinetic energy of the scattered electron? (ii) In Davisson-Germer experiment, why are the shapes of the incident beam different at different accelerating voltage? Explain with necessary diagram.	8
2.	(i) Electron beams are accelerated to potentials 45kV and 120V. Estimate the wavelengths of the electrons in the two beams. Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg, $h = 6.6 \times 10^{-34}$ Js. (ii) In Compton scattering experiment, why at zero degree angle, only one peak is observed while at 90 degrees, two peaks are observed. Explain with necessary diagram.	8
3.	(i) What will be the probability of finding a particle between 0.2L to 0.5L in one-dimension box of length L in the third excited state? $n=4$ (ii) Calculate the surface to volume (S/V) ratio of (a) a sphere shaped nanoparticle of radius 1nm (b) a nano cubic crystal of length 6 nm.	8
4.	(i) The wave function of a certain particle confined in a 1D box is $\psi = \sqrt{P} \cos(y)$ for $-\pi/4 < y < \pi/2$. Find the value of P. Find the probability that the particle be found between $y = 0$ and $y = \pi/4$.	10
5.	(i) A particle is in the ground state of a one-dimension infinite square well with length α . Calculate the probability that the particle will be found in between $x = \alpha/4$ and $x = 3\alpha/4$. (ii) The speed of the bullet ($m = 50$ g) and the speed of an electron ($m = 9.1 \times 10^{-31}$ kg) are measured to be the same, namely 300 m/s, with an uncertainty of 0.01%. With what fundamental accuracy could we have located the position of each, if the position is measured simultaneously with the speed in the same expt.?	8
6.	(i) Your friend who is interested in studying the morphology of a wood sample feels that the Scanning Tunnelling Microscope is a good choice to study the sample. What is your suggestion? Comment. (ii) A beam of electrons is incident on a potential barrier of height 10eV and width 0.8 nm. What should be the energy of electron so that half of them able to penetrate through the barrier?	8