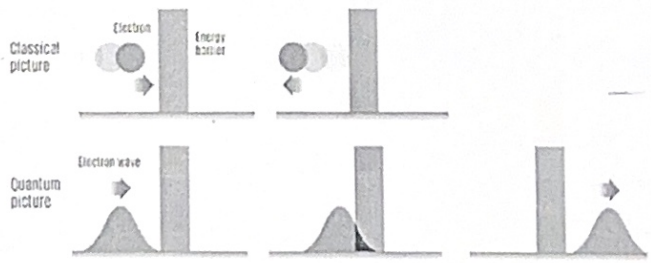
VIT
Vellore Institute of Technology

Continuous Assessment Test II – May 2023

Programme	:	B.Tech.	Semester	:	Win22-23
Course	:	Engineering Physics	Code	:	BPHY101L
Faculty	:	Caroline Ponraj, M. Gopinath, N. Manikandan, V. Rajasekarakumar	Slot/ Class Numbers	:	F1/CH2022232300023, CH2022232300029, CH2022232300030, CH2022232300036
Time	:	1½ Hours	Max. Marks	:	50

Answer any FIVE Questions (5 x 10 = 50)

1.	(a) You have been asked a question about the wave-particle duality of EM radiation. To justify your answer, you have been asked to use an allotrope of carbon as a target element. What will be your answer to that? How will you justify your answer (Without any derivation)? (b) Compare the uncertainties in the velocities of an electron and a proton confined in a 3 nm box.	10
2.	(a) If an amorphous material is used instead of a crystal, will it be possible to prove wave nature of electron? Justify your answer with suitable reasoning. (b) If you are given 2 particles each with corresponding masses and velocities (m_1 = 1.67 x10^{-27} kg; v_1 = 2 x 10^6m/s and m_2 = 10 mg and v_2 = 15 m/s), then calculate and compare their de Broglie wavelengths.	10
3.	(a) A small object of mass 2 mg is confined to move between two rigid walls separated by 3 cm. (i) Calculate the minimum speed of the object. (ii) If the speed of the object is 5 cm/s, find the corresponding value of 'n' (b) You are given a particle which is moving with kinetic energy equal to its rest mass energy and its de Broglie wavelength is 1.4 x10^{-6} Å. If the kinetic energy reduces to half, what will be its new de Broglie wavelength?	10
4.	(a) Consider that you accidentally stumble upon a sample piece which is conducting and you are inclined to understand the surface of that sample. How will you do that? Explain the principle and the possible modes. (b) Calculate the width of a 1-D box in which a ground state electron of 10 keV is confined.	10
5.	(a) If you are given the following image, what will be your explanation to the science enthusiasts? How will you convince them about the scientific phenomenon related to this?  (b) An electron is confined to a 1D box of length L. When the electron makes a transition from its first excited state to the ground state, it emits a photon of energy 0.75 eV.(i) What is the ground state energy in eV of the electron in the box? (ii) Sketch the wave function of the electron in the second excited state.	10
6.	(a) Consider the following statement: "Emission wavelength from a sample remains the same even when the particle dimensions are reduced". Do you agree or disagree? Justify. (b) What will happen to tunnelling probability if the width of the barrier is doubled? Find the ratio of tunnelling probabilities between barriers of thickness L and 2L.	10