Continuous Assessment Test I – Oct/Nov 2022

Programme	: Integrated M. Tech (BA)	Semester	:	Fall 22-23
Course	: Engineering Physics	Code	:	PHY1701
Faculty	: Dr. N. Manikandan & Dr. M.G. Shalini	Slot	:	A1 + TA1
		Class Numbers	:	CH2022231700950 CH2022231700886
Time	: 1½ Hours	Max. Marks	:	50

Answer any FIVE Questions (5 x 10 = 50)

Useful constants

$m_e = 9.1 \times 10^{-31}$ kg; $m_p = 1.67 \times 10^{-27}$ kg; $h = 6.626 \times 10^{-34}$ Js

1. Derive the Compton shift in terms of scattering angle when an X-ray photon collides with a graphite target. **10**

2. (i) Arrive at the Time Independent Schrodinger equation. **10**

   (ii) Calculate the de Broglie wavelength of a 50 keV electron.

3. (i) Calculate the uncertainty in the velocity of a proton confined in a 20 nm box. **10**

   (ii) What is a wave function? Write down four properties of wavefunction.

4. (i) Briefly discuss the concept of ultraviolet catastrophe with a neat diagram. **10**

   (ii) Write down the energy Eigen values for an electron confined in a 1D box in states $n=3$ and $n=4$. What will be the energy difference for that electron between these 2 states?

5. (i) Consider a particle with energy 0.6 eV moving along the positive x-direction. It is obstructed in its path by a 0.2 nm wide barrier with energy 4 eV. If the particle is considered to be an electron, what will be the probability of it to be found on the other side of the barrier? **10**

   (ii) State and explain Heisenberg's uncertainty principle of space and time.

6. (i) Consider an object moving at a constant velocity on a flat surface from east to west. As it moves along, it sees a wall of finite height in its path over which it cannot jump. What will happen to the object as it hits the wall (a) if it is a classical object in macroscopic world and (b) if it is quantum object in microscopic world? **10**

   (ii) A nonrelativistic particle is moving three times as fast as an electron. The ratio of their de Broglie wavelength's, particle to electron is 1.813×10^{-4}. Identify the particle.