VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test – I

Programme Name & Branch: B.Tech Course

Name & Code: Engineering Physics & PHY 1701

Slot: E1+TE1 **Exam Duration: 1hr 30 mins** **Maximum Marks: 50**

Standard physical constants

Plank constant (h) = 6.626×10^{-34}Js, Velocity of light (c) =3×10^{8}m/s, Mass of electron (m_e) = 9.1×10^{-31}kg

Answer All Questions

S.No	Question
1.	Estimate the wavelength and the intensity of radiation emitted by a glowing tungsten filament whose surface temperature is 3300K. (Given $k = 1.3807\times10^{-23}JK^{-1}$ and Stefan constant $\sigma = 5.67\times10^{-8}\ Wm^{-2}K^{-4}$) [3+2]
2	X-ray of wavelength 1.4Å are scattered from a block of carbon. What will be the wave length of scattered X-rays at (i) 180° (ii) 90° (iii) 0°. At what scattering angle the maximum Compton shift is observed? [2+3]
3.	What is uncertainty principle? Calculate the minimum uncertainty in the speed of an electron Δv in an H atom if the uncertainty in its position Δx is the diameter of atom (10^{-10}m) (Given that $h= 6.626\times10^{-34}\ m^2kg/s$) [2+3]
4.	Explain de Broglie's hypothesis of matter waves. Briefly explain the Davisson-Germer experiment [5]
5	Calculate the de Broglie wavelength of (a) an electron having a kinetic energy 1000eV (b) a bullet of mass 100g moving with a velocity 900m/sec [3+2]
6	Starting from time-independent Schrodinger equation, obtain the Eigen function and energy Eigen values of a free particle confined in 1D box of length L with condition V(x) = 0 for $0 \le x \le L$, V(x) = ∞ for $x \ge L$, $x \le 0$ $E = \frac{\hbar^2k^2}{2m}$ $\psi(x) = A\sin(kx) + B\cos(kx)$ [5]
7	Sketch the wave function, probability and energy level diagram for n=1,2, and 3 of a free particle confined in 1D box of length L with boundaries at, x = 0 and x = L. $\psi_n(x) = \sqrt{\frac{2}{L}}\sin\left(\frac{n\pi x}{L}\right)$ [5]
8	Write down the working principle, components, applications and limitations of scanning tunneling microscopy (STM). [5]
9	A cube of side 5cm is cut into 1cm cubes. Calculate the surface area, volume and surface to volume ratio of original and cut cubes. As compare to bulk, how the surface area and surface to volume ratio of nanomaterials varies? [4+1]
10	Explain the classifications of nanomaterials based on the quantum confinement with examples and clear figures?. [5]