Reg. No:

H/E/TX

VIT
Vellore Institute of Technology

Final Assessment Test – May 2024

Course: PHY1701 - Engineering Physics

Class NBR(s): 1974

Slot: B1+TB1

Time: Three Hours

Max. Marks: 100

- KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. List out the properties of matter waves. Using diffraction from single crystal nickel, how can you demonstrate the wave nature of electrons? [4+6]

2. a) Obtain the steady state equation for a particle in quantum mechanics. [5]

   b) In a Compton scattering experiment, the incident X-rays have a wavelength of 0.312 nm and are scattered by "free" electrons in graphite. The scattering angle is $\theta=135°$ What is the (i) energy and (ii) momentum of the scattered photon. [5]

3. Show that the energy of the particle confined in the one dimensional box is discrete and quantized. Attain the expression for normalized wave function using a steady-state equation in quantum mechanics. [10]

4. a) Explain quantum tunnelling and write the expression for wave functions for the following three regions. [5]

   $((-\infty < x < 0), (0 > x > \infty), (L < x < \infty))$

   b) An electron is trapped in a one-dimensional box of length 0.1 nm. Calculate the energy required to excite the electron from its ground state to 5th excited state. [m-9.1×10^{-31} Kg, h-6.62×10^{-34} JS] [5]

5. Briefly describe about synthesis of nanomaterials. Discuss about carbon nanotube based on their geometry of atoms. [10]

6. a) Explain the process leading to lasing action in an active medium. [5]

   b) The wavelength of He-Ne laser is 632.8nm. Its output power is 3.147 mW. How many photons are emitted at each minute when it is in operation? [5]

7. Explain the construction and working of Nd-YAG with necessary diagrams. Give its applications. [10]

8. a) Explain the terms phase velocity. Group velocity and group index in questions mechanical consideration of particle. [5]

   b) A region is specified by the potential function $V= 2x^2+3y^3-5z^2$. Calculate the electric field intensity at a point (2, 4, 5) in this region. [5]

9. Deliberate the importance of Maxwell's contribution in reaching the conclusion, "Light is an EM wave", with appropriate mathematical arguments. [10]