Assignment on Quantum Mechanics

Subject: Engineering Physics (Theory); Course Code: PHIC101

1. What are the drawbacks of classical mechanics? Explain in details.
2. What are de-Broglie matter waves? Write the expression of the de-Broglie wavelength of a particle.
3. What are the properties of matter waves?
4. What do you understand by wave packet?
5. What are phase velocity and group velocity?
6. Derive the relation between phase and group velocity. Also, show that phase velocity and group velocity are same in a non-dispersive medium.
7. Prove that the group velocity is less than phase velocity in a dispersive medium.
8. Prove that the phase velocity of associated wave is greater than velocity of light.
9. Prove that for non-relativistic free particle, the phase velocity is half of the group velocity.
10. Prove that group velocity $v_g = -\lambda^2 \frac{dv}{d\lambda}$, where the symbols have their usual meanings.
11. What is the energy of γ-photon having a wavelength of 0.1 nm.
12. An electron is moving with kinetic energy equal to 10 eV. What is the de-Broglie wavelength of this electron?
13. Calculate the de Broglie wavelength of an a-particle accelerated through a potential difference of 200 volts.
14. What is uncertainty principle? Explain it for (i) position-momentum uncertainty, (ii) energy-time uncertainty, and (iii) angle-angular momentum uncertainty.
15. Explain some applications of the uncertainty principle.
16. Write Schrodinger's time-dependent wave equation for a free particle.
17. What is the physical significance of wave function?
18. What are the properties of the wave function?
19. Write Schrodinger's time-independent wave equation.
20. What are the nodes and antinodes?