Reg. No ..... Name **22U523**

B. Sc. DEGREE END SEMESTER EXAMINATION : OCTOBER 2022

SEMESTER 5 : PHYSICS

COURSE : **19U5CRPHY06 : CLASSICAL AND QUANTUM MECHANICS**

(For Regular - 2020 Admission and Supplementary - 2019 Admission)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. Discuss Ehrenfest theorem.
2. Determine the degrees of freedom in the following cases i) a particle moving on a space curve ii) two particles moving on a space curve and having constant distance between them.
3. Show that Planck's radiation law modifies to Wien's law at high frequencies
4. State the important conclusions of Einstein's Photo Electric experiment
5. Distinguish between holonomic and non holonomic constraints.
6. Define the expectation value of an operator. Give the expression for the same, if the wave function is normalized.
7. State and explain D'Alembert's principle
8. Express time independent Schrodinger equation for a particle of mass m moving in a potential V.
9. Differntiate, commuting and non commuting operators
10. What is the physical significance of a wave packet.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. For an electron in a one dimensional infinte potential well of width 1Å , calculate the seperation between the two lowest energy levels.
12. An X-ray beam of wavelength 1 pm suffers Compton scattering from a target. Estimate maximum and minimum wavelength of the scattered X-rays.
13. Deduce the relation between group and phase velocity. Explain.
14. State and explain Hamilton's Principle.
15. A typical atomic nucleus is about 50 micro meter in radius.Apply uncertainty principle to place the lower limit on the energy of electron must have it to be part of a nucleus.
16. Prove that the eigen values of the momentum of particle in a box is discrete.
17. Briefly explain degrees of freedom. Determine the number of degrees of freedom in the following cases i) A particle moving on a space curve ii) 3 particles moving freely in space.
18. Discuss the terms (1) Probability current density (2) Orthogonality of wave function.

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Explain Davisson Germer experiment and elicit its conclusions
20. Deduce the general expression for stationary states of matter waves.

21. Set up the Lagrangian and obtain the Lagrange's equation for a linear harmonic oscillator. Also obtain its Hamilton's equations of motion.

22. What is linear vector space? Explain the general properties of a linear vetor space.

(10 x 2 = 20)