TB245452B

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S.) EXAMINATION, FEBRUARY 2024

2021 ADMISSIONS SUPPLEMENTARY (SAY)

SEMESTER V - CORE COURSE (PHYSICS)

PH5B06B18 - Classical and Quantum Mechanics

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 marks **(10x1=10)**

1. Give two examples for nonholonomic constraint.
2. What are generalized coordinates?
3. Compare the features of Hamiltonian and Lagrangian dynamics.
4. Mention the physical significance of Hamiltonian function.
5. Briefly describe photoelectric effect.
6. Outline the Rutherford planetary model of atom.
7. State the de- Broglie hypothesis.
8. Represent a wave packet both graphically and analytically.
9. Briefly discuss the normalization condition for a wave function.
10. Outline the various admissibility conditions on the wave function of a system.
11. Define a linear operator.
12. Graphically represent the first two eigenfunctions of a one-dimensional harmonic oscillator

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. Show that for equilibrium of a system, the virtual work of applied forces is zero.
14. Derive the equation of motion of Atwood's machine using Lagrangian dynamics.
15. Show that the shortest distance between two points in a plane is a straight line.
16. Explain Bohr's postulates with regard to hydrogen.
17. Obtain the expression for the de Broglie wavelength for a relativistic particle of mass m moving with the velocity of light.
18. Obtain the relation between particle velocity and the group velocity for a non relativistic particle.
19. Evaluate the probability current density of a spherical wave given by $\Psi(r) = \frac{A}{r}\exp(ikr)$.
20. If two functions Ψ_1 and Ψ_2 are the eigen functions belonging to the same energy eigen value E_1, show that their linear combination is also an eigen state having the same energy E_1.
21. For an electron in a one dimensional potential well of width 1 Å, calculate (i) the separation between the two lowest energy levels (ii) the frequency and wavelength of the photon corresponds to a transition between these two levels.

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Derive Lagrange's equations using Hamilton's principle.
23. Give the Physical significance of Compton effect. Obtain an expression for Compton wavelength of a scattered photon.
24. Develop time dependent Schrodinger equation for a particle moving in a field.
25. Solve the Schrodinger equation for a particle in a one dimensional box and find out its energy eigen values.