QP CODE: 21100037

Reg No : .....

Name : .....

BSc DEGREE (CBCS) EXAMINATION, FEBRUARY 2021

Fifth Semester

Core Course - PH5CRT06 - CLASSICAL AND QUANTUM MECHANICS

B.Sc Physics Model I ,B.Sc Physics Model II Applied Electronics ,B.Sc Physics Model II Computer Applications,B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

51C18AFF

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Name the constraints that are independent of time.
2. Write down the mathematical expression for Hamilton's principle.
3. Write down the basic equation from which the Hamilton's canonical equations of motion can be obtained.
4. What is the Hamiltonian for a linear harmonic oscillator ?
5. What is Compton effect ?
6. What was the purpose of Davisson-Germer experiment ?
7. What is group velocity? Write down an expression for group velocity.
8. If operators A and B are Hermitian , show that i[A,B] is Hermitian.
9. Explain the physical meaning of expectation values.
10. What is the physical significance of wave function?
11. What do you meant by Stationary State?
12. What is meant by normalising a wave function?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. For a particle of mass m moving in space, using spherical polar (r,θ,ϕ) as the generalized coordinates, express the virtual displacements δx, δy and δz in terms of r,θ and ϕ.
14. Obtain the equation of motion of a planetary motion in Lagrangian formulation.
15. What is the advantage of using Hamiltonian mechanics over Newtonian?
16. Calculate the number of photons emitted per second by a 40 W source of monochromatic light of wavelength 600 nm.
17. Why the electrons shows wave nature but the moon does not?
18. Find the eigen function of operator (x+d/dx) with eigen value 2.
19. A proton is confined to a nucleus of radius 5 fm. Estimate the minimum uncertainty in its momentum.
20. Discuss the Ehrenfest theorem.
21. A particle constrained to move along x-axis in the domain $0 \leq X \leq L$ has a wave function $\Psi(x) = \text{Sin}(n\pi x/L)$, where n is an integer.Normalize the wave function and evaluate the expectation value of its momentum.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Define generalized coordinates. How are they different from the ordinary coordinates. Discuss the transformation of Cartesian coordinates to polar coordinates and spherical polar coordinates and vice versa.
23. Derive Planck's radiation law. Discuss its high and low frequency limits.
24. What do you meant by normalization?
25. Develop the time dependent Schrodinger equation.

(2×10=20)