QP CODE: 22101786

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Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) SPECIAL SUPPLEMENTARY EXAMINATIONS, MAY 2022

Fifth Semester

CORE COURSE - PH5CRT06 - CLASSICAL AND QUANTUM MECHANICS

Common for 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

2019 Admission Only

B0A5D746

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

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

1. Write down the equation connecting Lagrangian and Hamiltonian.
2. What is the Hamilton's canonical equation for the rate of change of generalized momentum?
3. Write down one difference between Hamiltonian formulism and Newtonian formulism.
4. Write down the transformation equation of generalized momentum for a simple pendulum in tranforming from Lagrangian to Hamiltonian.
5. Write down Einstein’s photoelectric equation and explain the terms involved.
6. Explain the dual nature of light.
7. At what condition the group velocity and phase velocity become the same?
8. Write down the general eigen value equation. What are the terms involved?
9. Explain the concept of probability density.
10. Write down the time dependent schordinger equation.
11. What is meant by normalising a wave function?
12. Write down the orthogonality condition for eigen functions.

(10×1=10)

Part B

*Answer any **six** questions.*

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

13. Determine the degrees of freedom for a) Five particle moving in a plane. b) Two particles moving in a plane connected by a rod. c) A freely moving rigid body in three dimensional space.
14. Write a short note on virtual work.
15. Obtain the equation of motion of a one-dimensional harmonic oscillator Lagrangian formulation.
16. Prove that Wien's law is the high frequency approximation of Planck's law.
17. Prove that eigen value of Hermitian Operator are real.
18. Calculate the expectation value of the momentum of a particle trapped in a one - dimensional box .
19. The position and momentum of a 1.00 keV electron are simultaneously determined. If its position is located to within 0.100 nm, what is the percentage of uncertainty in its momentum
20. A particle constrained to move along x-axis in the domain $0 \leq x \leq L$ has a wave function $\psi(x)=\sin(n\pi x/L)$, where n is an integer. Normalize the wave function and evaluate the expectation value of its momentum.
21. Discuss the Ehrenfest theorem.

(6×5=30)

Part C

*Answer any **two** questions.*

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

22. Define generalized coordinates. And obtain expressions for a) generalized acceleration b) generalized force, c) generalized potential energy and d) generalized kinetic energy in the case of simple pendulum.
23. Explain one experiment which demonstrates light particle interaction.
24. What is meant by matter waves ? Give experimental evidence in support of the concept of these waves .
25. Discuss the method of box normalization. Obtain the eigen values and normalized eigen functions of a particle confined to a one dimensional rectangular box

(2×10=20)