

QP CODE: 23129056



Reg No : .....

Name : .....

**B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, OCTOBER  
2023**

**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

2017 Admission Onwards

1022209A

Time: 3 Hours

Max. Marks : 60

**Part A**

*Answer any **ten** questions.*

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

1. Describe the term configuration space.
2. What does a Hamiltonian signify?
3. Write down the Hamilton's canonical equations of motion.
4. Write down one advantage of using Hamiltonian formulism.
5. What are the features of a blackbody?
6. Explain the term matter wave.
7. What are eigen functions and eigen values?
8. Write down the Heisenberg's commutation rules.
9. If an operator A is Hermitian, show that the operator  $B=iA$  is anti Hermitian.
10. Write down the three-dimensional time dependent Schrödinger equation for a particle moving in a potential.
11. Brief the essential requirements on a wave function.
12. What do you meant by Stationary State?

(10×1=10)

**Part B**

*Answer any **six** questions.*

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



13. Discuss whether the constraints are holonomic or non-holonomic, also write down the force of constraint in each case.
  - a) A bead on a circular wire.
  - b) A pendulum with variable length
  - c) a particle placed on the surface of a sphere.
14. What do you understand by cyclic coordinates? Show that the generalized momentum corresponding to a cyclic coordinate is a constant of motion.
15. Obtain the Hamiltonian  $H$  and the Hamilton's equations of motion of a linear harmonic oscillator.
16. The photoelectric threshold for a certain metal is 300 nm. Estimate the maximum energy of the electrons emitted by a radiation of wavelength 200 nm.
17. We do not consider wave nature of particles in classical mechanics. Why?
18. Explain the importance of operators in quantum mechanics.
19. Distinguish between uncertainty in a quantum system and the error in classical observations.
20. Discuss the admissibility conditions on wave function.
21. Write down the orthogonality condition for eigen functions.

(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. What is Compton effect and derive the expression for Compton shift?
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)