

**B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2016****Fifth Semester**

Core Course—CLASSICAL AND QUANTUM MECHANICS

Common for Model I and Model II B.Sc. Physics

(B.Sc. Physics E.E.M. and B.Sc. Physics Instrumentation)

[2013 Admission onwards]

Time : Three Hours

Maximum : 60 Marks

**Part A***Answer all questions.**Each question carries 1 mark.*

1. In holonomic constraints, the conditions of constraints are expressible as equations connecting the \_\_\_\_\_ and time.
2. Hamilton's principle is a \_\_\_\_\_ formulation of the laws of motion in configuration space.
3. The wave nature and \_\_\_\_\_ nature complement each other.
4. The change in \_\_\_\_\_ of photon during scattering is called Compton effect.
5. A probability must be a \_\_\_\_\_ real quantity.
6. The functions that satisfy Schrodinger equations for the discrete energy \_\_\_\_\_ are called eigen functions.
7. The spacing of the energy levels is \_\_\_\_\_ for a harmonic oscillator.
8. The components of the angular momentum operator do not \_\_\_\_\_ among themselves.

(8 × 1 = 8)

**Part B***Answer any six questions.**Each question carries 2 marks.*

9. What are generalized co-ordinates ?
10. State the D'Alembert's principle.
11. State the principle of least action.
12. What is Compton Effect ?
13. What are operators ?
14. What is meant by expectation value ?
15. What is the significance of eigen values ?

Turn over

16. What is phase velocity ?
17. What is degeneracy ? Explain.
18. Why there exists zero point energy ?

(6 × 2 = 12)

### Part C

*Answer any four questions.  
Each question carries 4 marks.*

19. Obtain Lagrange's equation from Hamilton's principle.
20. Find the differential equations of motion of a spherical pendulum using Lagrangian method.
21. Calculate the de Broglie wave length of an electron with kinetic energy 1eV.
22. A hydrogen atom is  $5.3 \times 10^{-11}\text{m}$  in radius. Use the uncertainty principle to estimate the minimum energy an electron can have in this atom.
23. Find the expectation value  $\langle x \rangle$  of the position of a particle trapped in a box L wide.
24. Bring out the angular momentum operators and their basic commutation relations.

(4 × 4 = 16)

### Part D

*Answer any two questions.  
Each question carries 12 marks.*

25. What are constraints ? Derive Lagrangian equation for a non holonomic system.
26. Discuss the Davisson-Germer experiment and observe the conclusions.
27. Obtain the energy eigen values of a rigid rotator.
28. Obtain the energy spectrum of one dimensional harmonic oscillator.

(2 × 12 = 24)