TB145650A **Reg. No: .....**

Name: .....

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2016
SEMESTER V - PHYSICS
PHY5CQM - CLASSICAL AND QUANTUM MECHANICS

Time: Three Hours **Maximum Marks: 60**

PART A

I . Answer all questions. Each question carries 1 mark.

1. Give the Hamilton's principle for a conservative system.
2. What is meant by degrees of freedom of a system?
3. Distinguish between conservative and non-conservative systems.
4. What is meant by group velocity?
5. What is zero point energy?
6. State de Broglie hypothesis.
7. What is the expression for the Hamiltonian operator?
8. Write Einstein's photoelectric equation.

(8x1=8)

PART B

II . Answer any six questions. Each question carries 2 marks.

9. What is the principle of least action?
10. Show that the generalised momentum conjugate to a cyclic coordinate is conserved during motion.
11. Distinguish between holonomic and non-holonomic constraints.
12. Prove $x, p_y] = 0$
13. Find the de Broglie wavelength of a particle in thermal equilibrium at temperature T.
14. Obtain Wien's law from Planck's radiation law.
15. Find the eigen value for the equation $i\frac{d}{dt}e^{-i\omega t}$
16. What are the conditions for the Hamiltonian to be the total energy of the system.
17. What is meant by expectation value?
18. What is the physical interpretation of probability density?

(6x2=12)

PART C

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

19. Find the expectation value $\langle p_x \rangle$ of the particle trapped in a one dimensional box.
20. Write the equation of motion by setting up the Lagrangian for a compound pendulum. Also obtain the period of the pendulum.
21. If the position of a 5 keV electron is located within $2A^0$, what is the percentage uncertainty in its momentum?
22. A 100KeV photon collides with and electron at rest. It is scattered through an angle 90^0.

Determine the energy after collision.

23. Normalise the one-dimensional harmonic oscillator wave function $\psi(x) = e^{-m\omega x^2/2\hbar}$
24. Write Hamilton's equations for planetary motion.

(4x4=16)

PART D

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

25. Obtain Lagrange's equation from D'Alembert's principle.
26. What are matter waves? Describe the Davisson- Germer experiment to confirm the existence of matter waves.
27. Deduce the time- dependent Schrödinger equation for a particle moving in a potential.
28. Discuss the importance of a wave function in the quantum world. Explain the probability interpretation and conditions on the wave function.

(2x12=24)