E 7122 (Pages : 2) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2017

Fifth Semester

Core Course—CLASSICAL AND QUANTUM MECHANICS

(Common for Model I and Model II B.Sc. Physics, B.Sc. Physics EEM and B.Sc. Physics Instrumentation)

[2013 Admission onwards]

Time : Three Hours Maximum Marks : 60

Part A

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

1. For a system consisting of N particles with k constraints, the degree of freedom is ———.
2. Transformation equation relates ordinary co-ordinates and ———.
3. Lagrange's function L = T – ———.
4. The norm of any non-zero vector corresponds to ——— of the vector.
5. If the unit vectors are in mutually perpendicular directions, they form an ——— basis.
6. Heisenberg represented operators in the form of arrays of numbers called ———.
7. The ——— will change one vector into another vector.
8. Eigen value of a self adjoint operator are ———.

(8 × 1 = 8)

Part B

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

9. What are cyclic co-ordinates ?
10. Write a note on black body radiation.
11. Give examples for Holonomic constraints.
12. Explain photoelectric effect.
13. What is a commutation relation ?
14. Write a short note on Hilbert space.
15. Get the expression for "Zero point energy" using uncertainty principle.
16. Show that the eigen values of a self adjoint operator are real.

17. State de Broglie hypothesis.
18. What is phase velocity ?

(6 × 2 = 12)

Part C

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

19. Describe the importance of Lagrangian formulation.
20. Obtain the eigen values of L_z.
21. Give general properties of operators.
22. Explain what do you mean by Hamiltonian of a system ? When is it equal to the total energy of the system ?
23. Obtain general solution of one dimensional Schrödinger equation for a free particle.
24. Calculate the energy carried by one photon of radiation produced in a diagnostic X-ray generator at a wavelength of 10 pm.

(4 × 4 = 16)

Part D

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

25. Find the expectation value <X> of the position of particle trapped in a box L wide.
26. Explain the fundamental postulates of quantum mechanics.
27. Starting from D'Alembert's principle arrive at the Lagrange's equation.
28. Obtain the Lagrange's equations for a particle moving in a plane and show that angular momentum is conserved.

(2 × 12 = 24)