B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2015

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 Admissions]

Time : Three Hours   Maximum : 60 Marks

Part A

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

1. The conditions which restricts the ————— of the system are called constraints.

2. The number of degrees of freedom of the system is the ————— possible number of co-ordinates required to describe the system.

3. The product of any generalized momentum and the associate co-ordinate must always have the dimension of ————— momentum.

4. Photoelectric emission is an ————— process.

5. A moving particle has a ————— nature.

6. The characteristic value of energy of a system is known as energy ————— value of the system.

7. The one dimensional motion of a ————— mass about a fixed point under a force is called a LHO.

8. The ————— value of energy that an oscillator can have is called the zero point energy.

$(8 \times 1 = 8)$

Part B

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

9. What are constraints ?

10. State the principle of virtual work.

11. Give the Hamilton's principle for a conservation system.

12. What is Photoelectric effect ?

13. State de Broglie hypothesis.

14. What is a commutation relation ?

15. What is meant by eigen function ?

Turn over

16. What is group velocity ?

17. Write down Schrödinger equation in steady state form.

18. What is zero point energy ?

$(6 \times 2 = 12)$

Part C

Answer any four questions.
Each question carries 4 marks.

19. Deduce Hamilton's principle from D'Alembert's principle.

20. Obtain Lagrange's equation of motion for a simple pendulum.

21. The threshold wavelength of photoelectric emission in tungsten is 230 nm, what wavelength of light must be used in order for electrons with a maximum energy of 1.5 eV to be ejected?

22. A typical atomic nucleus is about 5×10^{-5} m in radius. Use the uncertainty principle to place a lower limit on the energy of an electron must have if it is to be part of a nucleus.

23. Find the probability that a particle trapped in a box L wide can be found between 0.45 L and 0.55L for the ground and first excited states.

24. Find the zero point energy in electron volts of a pendulum whose period is one second.

$(4 \times 4 = 16)$

Part D

Answer any two questions.
Each question carries 12 marks.

25. What are generalized co-ordinates and velocities ? Set up the Lagrangian for a spherical pendulum.

26. Discuss the Kepler problem of planetary motion.

27. Give an account on Heisenberg's uncertainty principle. Illustrate the principle.

28. Show that zero point energy of one dimensional harmonic oscillator can be the consequence of uncertainty principle.

$(2 \times 12 = 24)$