E 5271 (Pages : 2) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2018

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

1. The principle of virtual works states that in ———— the virtual work of the forces applied to a system is zero.
2. A line segment joining planet and the sun sweeps out equal ———— during equal intervals of time.
3. The ability of a body to radiate is closely related to its ability to ———— radiation.
4. Ultra violet ———— is a discrepancy with Rayleigh - Jeans formula.
5. Photoelectric emission is an ————process.
6. The idea of ———— waves was introduced by de Broglie.
7. The functions that satisfy Schrödinger equation for the discrete energy states are called ———— functions.
8. The lowest value of energy that an oscillator can have is called the zero ———— energy.

(8 × 1 = 8)

Part B

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

9. What are constraints ? Give examples.
10. Explain D'Alembert's principle.
11. State and explain Planck's law.
12. Bring out the conclusions of Davison - Germer experiment.
13. What is meant by uncertainties in measurements ? Explain.

Turn over

14. Differentiate between commutators and operators.

15. What is probability current density ?

16. What is meant by expectation value of a function ?

17. How group velocity is different from phase velocity ?

18. Explain orbital angular momentum.

(6 × 2 = 12)

Part C

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

19. Briefly explain the principle of least action. Illustrate your answer.

20. Spend Hamilton's principle to obtain Lagrange's equation.

21. Determine the phase and group velocities of an electron whose de Broglie wavelength is 0.1nm.

22. Calculate the de Broglie wavelength of an electron with KE 100 MeV.

23. A particle limited to the x-axis has the wave function $\psi = ax$ between $x = 1$ and $x = 0$; $\psi = 0$ elsewhere. Find the probability that the particle can be found between $x = 0.45$ and $x = 0.55$.

24. Find the expectation value of the position $< x >$ of a particle in a box L wide.

(4 × 4 =16)

Part D

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

25. Describe the planetary motion with the support of kepler's laws.

26. State and explain uncertainty principle. Derive the equations for uncertainties in position, momentum, time and energy according to Heisenberg.

27. Obtain Schrödinger time dependent wave equation in three dimensions. Show that the energy levels of a harmonic oscillator are equally spaced.

28. Express the components of orbital angular momentum in terms of the spherical polar coordinates.

(2 × 12 = 24)