TB165395D

Reg. No.: .....

Name : .....

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2018
(2016 Admission Regular & 2015 Admission Supplementary)
SEMESTER V- CORE COURSE (PHYSICS)
PH5B05TB – CLASSICAL AND QUANTUM MECHANICS

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

PART A

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

1. Define virtual displacement.
2. What are generalized coordinates? What are the advantages of using them?
3. What are features of a black body?
4. Write down the time dependant Schrodinger equation for a free particle in one dimension.
5. Write down the normalisation condition of a wave function.

(5 x 1 = 5)

PART B

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

6. Prove that the generalized momentum conjugate to a cyclic coordinate is conserved.
7. What are constraints? Classify constraints.
8. State and explain Hamiltons principle.
9. Explain de Broglie concept.
10. Discuss energy time uncertainty relation.
11. Commuting operators have common set of eigen function. Prove.
12. Explain quantum mechanical tunnelling.
13. What is zero point energy of a particle confined in a box? Explain.

(5x 2= 10)

PART C

III. Answer any five questions. Each question carries 5 marks.

14. Derive the equations of motion for a particle moving under central force. What is the form of equations, when the particle is moving under an attractive inverse square law of force ($F = -k/r^2$).
15. What is Hamiltonian function H? Explain its physical significance. Prove that the Hamiltonian H of a conservative system is equal to the total energy of the system.
16. Obtain the equations of motion of a system of two masses connected by an inextensible string passing over a small smooth pulley.
17. Determine the ground state energy of a harmonic oscillator using uncertainty relation.
18. A metal of work function 3 eV is illuminated by a light of wavelength 3000 Å. Calculate (a) threshold frequency (b) the maximum energy of photoelectrons and (c) the stopping

potential.

19. Write a note on photoelectric effect.
20. Obtain the expectation value of momentum of a particle enclosed in a one dimensional box.
21. A particle moving along the x direction has the wave function $\psi = ax$ in the interval $x = 0$ and $x = 1$ and zero elsewhere. Determine the probability that the particle can be found between $x = 0.4$ and $x = 0.6$.

(5 x 5 = 25)

PART D

IV. Answer any two questions. Each question carries 10 marks.

22. Obtain Euler Lagrange differential equation by variational method and hence obtain Lagrange's equation of motion for a system of particles.
23. Explain uncertainty principle. Illustrate uncertainty principle using single slit experiment. How does it account for natural line width of spectral lines?
24. (i) Discuss the importance and admissibility conditions of a wave function in the quantum world.
    (ii) Derive equation of continuity for probability of wave function from Schrodinger equation.
25. Find the eigen function and eigen value of a particle of mass m moving inside a potential well

$$V(x) = \begin{cases} V_0 & x < -a \\ 0 & -a < x < a \\ V_0 & x > a \end{cases}$$

Where V_0 has a finite value.

(2 x 10 = 20)