

B.Sc. Semester - 5 (CBCS) Examination

Oct/Nov. - 2018

**MATHEMATICAL PHYSICS CLASSICAL MECHANICS AND QUANTUM MECHANIC
(CORE)**

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

- Q-1(A) Answer any One (07)
- (1) Obtain Fourier series for a full wave rectifier.
 - (2) Give definition of Fourier Series and derivation of the co-efficient of Fourier series.
- Q-1(B) Answer any One (04)
- (1) (a) Obtain the Fourier series of the function

$$f(x) = \begin{cases} 0, & - \\ 1, & \end{cases}$$
 (b) Verify the result by assuming the Fourier series in complex form.
 - (2) Give the advantages of Fourier series.
- Q-1(C) Answer any Three (03)
- (1) Write Parseval's Theorem.
 - (2) Integration of Fourier series yields more rapid convergence. (True/False)
 - (3) Write DIRICHLET'S condition.
 - (4) Define Dirac delta function.
 - (5) Write any one properties of Dirac delta function.
- Q-2(A) Answer any One (07)
- (1) State and prove Hamilton's principle.
 - (2) Derive Lagrange's equation of motion for simple pendulum.
- Q-2(B) Answer any One (04)
- (1) Derive Newton's second law of motion from Hamilton's principle.
 - (2) Explain the principle of virtual work.
- Q-2(C) Answer any Three (03)
- (1) Explain the principle of virtual work.
 - (2) Hamiltonian function $H = ______$
 - (3) What is the degree of freedom for a particle move in a plane?
 - (4) In Lagrangian approach we consider Vector quantities. (True/False)
 - (5) Define degree of freedom.
- Q-3(A) Answer any One (07)
- (1) Derive Hamilton's canonical equations of motion.
 - (2) Derive the equation of motion for linear harmonic oscillator using Hamiltonian.

- Q-3(B) Answer any One (04)
- (1) Write note on Physical significance of H.
 - (2) Give the advantages of Lagrangian approach.
- Q-3(C) Answer any Three (03)
- (1) Configuration space is a _____ dimensional space.
 - (2) According to Hamilton's principle, the path followed by a system is such that time integral of L is minimize. (True/False)
 - (3) Define phase space.
 - (4) Lagrange's undetermined multiplier is denoted by _____
 - (5) Define cyclic coordinate.
- Q-4(A) Answer any One (07)
- (1) Derive one-dimensional time independent Schrodinger equation.
 - (2) Explain Particle in a one dimensional potential well of finite depth.
- Q-4(B) Answer any One (04)
- (1) Explain uncertainty principle.
 - (2) Give Physical interpretation of Ψ
- Q-4(C) Answer any Three (03)
- (1) Give M.K.S. unit of h.
 - (2) Write Ehrenfest's theorem.
 - (3) Define stationary state.
 - (4) What is parity?
 - (5) Define Compton effect.
- Q-5(A) Answer any One (07)
- (1) Derive the Hermite equation.
 - (2) Derive the solution of the Schrodinger equation corresponding to the hydrogen atom.
- Q-5(B) Answer any One (04)
- (1) Explain ket vector.
 - (2) Explain Linear operator.
- Q-5(C) Answer any Three (03)
- (1) Give the symbol of bra vector.
 - (2) The scalar product of the ket $|A\rangle$ and bra $\langle B|$ is _____.
 - (3) Define angular momentum
 - (4) When operator called unit operator?
 - (5) Define commutator of two operators.
