

B.Sc. Semester - 5 (CBCS) Examination

Oct/Nov.- 2024 (Old Course)

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.

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- Que.1(A) Answer the following questions. (any one) (07)
1. Write Fourier Series and evaluate their Co-efficients.
 2. Obtain Fourier Series for Square Wave.
- Que.1(B) Answer the following questions. (any one) (04)
1. Explain Cosine Series.
 2. Explain properties of Fourier Series.
- Que.1(C) Answer the following questions. (any three) (03)
1. What is Fourier Co-efficient a_0 ?
 2. Is the full wave rectifier function even or odd?
 3. Cosine Series is also known as _____.
 4. If the $f(x)$ is even function, then $f(-x) = \text{-----}$.
 5. Write the formula of Fourier Series.
- Que.2(A) Answer the following questions. (any one) (07)
1. Explain Generalized Co-ordinates. Give some illustrations to choose the set of Generalized Co-ordinators.
 2. Explain D'Alembert's Principle.
- Que.2(B) Answer the following questions. (any one) (04)
1. Explain Virtual Work.
 2. Explain types of Constraints in detail.
- Que.2(C) Answer the following questions. (any three) (03)
1. Mention the name of Constraints which are classified on the base on time.
 2. Write the set of Lagrange's Equation of Motion.
 3. On which base the Constraints Holonomic and Non-holonomic are classified?
 4. How many degrees of freedom of a simple Pendulum?
 5. Write the expression of Generalized Displacement.
- Que.3(A) Answer the following questions. (any one) (07)
1. Deduce Hamilton's Canonical Equations of Motion.
 2. Explain Lagrange's method of Undetermined Multipliers.
- Que.3(B) Answer the following questions. (any one) (04)
1. Obtain Hamilton's equation of Compound Pendulum.
 2. Describe Phase Space.
- Que.3(C) Answer the following questions. (any three) (03)
1. $\frac{\partial L}{\partial q_j} = 0$, then q_j is referred to as _____.
 2. What is the Hamiltonian Equation of Simple Pendulum?
 3. Lagrange's Equation of Motion is invariant in form with respect to ----- transformation.
 4. In the Conservative System, the potential energy is only _____ dependent.
 5. Write Hamilton's Variational Principle.

- Que.4(A) Answer the following questions. (any one) (07)
1. Derive three-dimensional Schrodinger Equation for free particle.
 2. Describe one dimensional time Independent Schrodinger Equation.
- Que.4(B) Answer the following questions. (any one) (04)
1. Explain Expectation Value.
 2. Describe Compton Effect.
- Que.4(C) Answer the following questions. (any three) (03)
1. What is the total energy E of a free particle?
 2. $[y, p_y] = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} = i\hbar$, fill up the blanks.
 3. The minimum frequency that causes the emission of a photoelectron with zero kinetic energy is called -----.
 4. $[L_z, L_z] = \underline{\hspace{1cm}}?$
 5. Write Continuity Equation.
- Que.5(A) Answer the following questions. (any two) (07)
1. Derive solution of the time dependent Schrodinger Equation.
 2. Obtain solution of Hermite's differential Equation.
- Que.5(B) Answer the following questions. (any one) (04)
1. Explain Bra and Ket Notation.
 2. Derive eigen values and eigenfunctions of L^2 .
- Que.5(C) Answer the following questions. (any three) (03)
1. Fill up the blank: $L_x = -i\hbar \underline{\hspace{1cm}}$.
 2. Which way a Bra Vector Symbolized?
 3. When $\langle A|A \rangle$ becomes greater than Zero?
 4. What is the Hamiltonian for a simple Pendulum?
 5. What is the ground state energy of a Harmonic Oscillator?
