

B.Sc. Semester - 5 (CBCS) Examination

Oct/Nov. - 2023(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 coefficients.
 2. Obtain Fourier sine and cosine series.
- Que.1(B) Answer the following questions (any one) (04)
1. Explain extension of interval.
 2. Explain properties of Fourier series.
- Que.1(C) Answer the following questions (any three) (03)
1. What is Fourier coefficient a_n ?
 2. Is the full wave rectifier function even or odd?
 3. Sine 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 Lagrange's equation from D'Alembert's principle.
 2. Explain constraints and its types in detail.
- Que.2(B) Answer the following questions (any one) (04)
1. Explain Hamilton's variational principle.
 2. Obtain Lagrange's equation of linear harmonic oscillator.
- Que.2(C) Answer the following questions (any three) (03)
1. Mention the name of constraints which are classified on the basis of time.
 2. Write the set of Lagrange's equation of motion.
 3. On which basis the constraints holonomic and non-holonomic are classified?
 4. How many degrees of freedom of a spherical 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 one of the applications of Hamiltonian equation of motion.
- Que.3(B) Answer the following questions (any one) (04)
1. Explain Lagrangian method of undetermined multiplier.
 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 Hamilton's 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 one-dimensional time dependent Schrodinger equation for free particle.
 2. Describe Compton effect.
- Que.4(B) Answer the following questions (any one) (04)
1. Explain expectation value.
 2. Describe group velocity.
- Que.4(C) Answer the following questions (any three) (03)
1. What is the total energy E of a free particle?
 2. $[P_x, x] = \underline{\hspace{2cm}}$. Fill up the blanks.
 3. The minimum frequency that causes the emission of a photoelectron with zero kinetic energy is called-----.
 4. What is energy operator?
 5. Write continuity equation.
- Que.5(A) Answer the following questions (any one) (07)
1. Deduce eigen value and eigen function of L^2 .
 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. Explain coherent states.
- Que.5(C) Answer the following questions (any three) (03)
1. Fill up the blank: $L_z = i\hbar \underline{\hspace{2cm}}$.
 2. Which way a ket vector symbolized?
 3. When $\langle A|A \rangle$ becomes greater than zero?
 4. What is the Hamiltonian for a linear harmonic oscillator?
 5. What is the ground state energy of a harmonic oscillator?
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