

B.Sc. Semester - 5 (Remedial) (CBCS) Examination**March/April-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 coefficients.
 - 2) Obtain Fourier series for full wave rectifier.
- Que-1(B) Answer the following questions (any one) (04)
- 1) Explain three-dimensional Dirac delta function.
 - 2) Explain properties of Fourier series.
- Que-1(C) Answer the following questions (any three) (03)
- 1) What is Fourier coefficient a_0 ?
 - 2) Is the half wave rectifier function even or odd?
 - 3) cosine series is also known as _____.
 - 4) If the $f(x)$ is odd 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 coordinates. Give some illustrations to choose the set of generalized coordinators.
 - 2) Explain D'Alembert's principle.
- Que-2(B) Answer the following questions (any one) (04)
- 1) Explain virtual work.
 - 2) Explain 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 compound pendulum?
 - 5) Write the expression of generalized displacement.
- Que-3(A) Answer the following questions (any one) (07)
- 1) Explain charge particle in electromagnetic field.
 - 2) Obtain the Hamilton's equation of motion.
- Que-3(B) Answer the following questions (any one) (04)
- 1) Obtain Hamilton's equation of simple 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 equation of spherical 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 Group velocity.
 - 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) $[L_y, L_z] = \underline{\hspace{1cm}}?$
 - 5) Write continuity equation.
- Que-5(A) Answer the following questions (any two) (07)
- 1) Deduce the simplified form for the oscillator.
 - 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: $L_x = -i\hbar \underline{\hspace{1cm}}$
 - 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?
