647510 **BSCmcmCC5010** **Seat No :_____**

B.Sc. Semester - 5 (*CBCS*) Examination

Oct/Nov. - 2021(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.

Q.1(A) **Answer the following questions in details. (Any One Out of Two)** (07)

1. Write Fourier series and evaluate their coefficients.
2. Obtain Fourier series for a full wave rectifier function.

Q.1(B) **Answer the following questions in Brief. (Any One Out of Two)** (04)

1. Obtain Fourier cosine series.
2. Obtain Fourier sine series.

Q.1(C) **Answer the following question shortly. (Any Three Out of Five)** (03)

1. What is fourier coefficient a_0 ?
2. What is fourier coefficient b_n ?
3. Cosine series is also known as_____.
4. Sine series is also known as_____.
5. Write the formula of Fourier series.

Q.2(A) **Answer the following questions in details. (Any One Out of Two)** (07)

1. Describe the classification of constraints.
2. Define Hamilton's variational principle and obtain Lagrange's equation of motion using L= T-V.

Q.2(B) **Answer the following questions in Brief. (Any One Out of Two)** (04)

1. Explain degree of freedom.
2. Obtain Lagrange's equation of simple pendulum.

Q.2(C) **Answer the following question shortly. (Any Three Out of Five)** (03)

1. What is the generalized coordinate of a simple pendulum?
2. Write the set of Lagrange's equation of motion.
3. Write the equation of D'Alembert's principle.
4. How many degree of freedom of a simple pendulum?
5. Give the expression of Hamilton's principle.

Q.3(A) **Answer the following questions in details. (Any One Out of Two)** (07)

1. Explain Lagrange's method of undetermined multipliers.
2. Obtain the Hamilton's equation of motion.

Q.3(B) **Answer the following questions in Brief. (Any One Out of Two)** (04)

1. Explain generalized momentum.
2. Describe phase space.

Q.3(C) **Answer the following question shortly. (Any Three Out of Five)** (03)

1. $\frac{\partial L}{\partial q_j} = 0$, then q_j is referred to as _____.
2. In the _____ formulation n coordinates q_j and n momenta pi are taken as independent variables.
3. What are the Hamilton's canonical equation of motion?
4. In the conservative system, the potential energy is only _____ dependent.
5. Write Hamilton's variational principle.

Q.4(A) **Answer the following questions in details. (Any One Out of Two)** (07)

1. Derive one-dimensional time dependent Scrodinger equation for free particle.
2. Explain density of states.

Q.4(B) **Answer the following questions in Brief. (Any One Out of Two)** (04)

1. Explain Compton effect.
2. Describe probability of particle.

Q.4(C) **Answer the following question shortly. (Any Three Out of Five)** (03)

1. What is the total energy E of a free particle?
2. $[x , p_x]$ = _____ = _____ = $i\hbar$, fill up the blanks.
3. $[p_x , x]$ = _____ = _____ = $-i\hbar$, fill up the blanks.
4. $[p_y , p_z]$ = _____?.
5. [x , y] = _____?.

Q.5(A) **Answer the following questions in details. (Any One Out of Two)** (07)

1. Deduce the simplified form for the oscillator.
2. Obtain solution of Hermite's differential equation.

Q.5(B) **Answer the following questions in Brief. (Any One Out of Two)** (04)

1. Obtain Schordinger wave equation for the oscillator.
2. Explain coherent states.

Q.5(C) **Answer the following question shortly. (Any Three Out of Five)** (03)

1. Fill up the blank: L_z = - $i\hbar$____
2. Which way a ket vector symbolized?
3. When <A|A> becomes greater than zero?
4. What is the Hamiltonian for a linear harmonic oscillator?
5. What is the ground state energy of a harmonic oscilattor?

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