

B.Sc. Semester - 5 (Remedial) (CBCS) Examination**March/April-2024 (NEW COURSE)****Mathematical Physics, Classical Mechanics & quantum Mechanics(Core)****Time: 2:30 Hours****Marks: 70****Instructions:**

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

- Que-1(A) Answer the following questions (any two) (10)
- 1) Explain fundamental theorem of gradient.
 - 2) Explain fundamental theorem for curl.
 - 3) Explain the relations between fundamental theorems.
- Que-1(B) Answer the following questions (any one) (04)
- 1) Explain Gauss's theorem in detail.
 - 2) Write six product rules for differential calculus.
- Que-2(A) Answer the following questions (any two) (10)
- 1) Represent $f(x) = \begin{cases} 0 & -\pi \leq x \leq 0 \\ 1 & 0 \leq x \leq \pi \end{cases}$
Evaluate the coefficient in above interval.
 - 2) Define the Fourier series and evaluate its co-efficient.
 - 3) Explain three-dimensional Dirac delta function and properties of Dirac delta function
- Que-2(B) Answer the following questions (any one) (04)
- 1) Explain Fourier sine series in detail.
 - 2) Obtain Fourier series for a full wave rectifier function.
- Que-3(A) Answer the following questions (any two) (10)
- 1) Explain the generalized coordinates. Give some illustrations to choose the set of generalized coordinates.
 - 2) Explain Atwood machine.
 - 3) Obtain the Hamilton's equation of motion.
- Que-3(B) Answer the following questions (any one) (04)
- 1) Explain constraints in detail.
 - 2) Obtain Lagrange's equation of motion for simple pendulum.
- Que-4(A) Answer the following questions (any two) (10)
- 1) Obtain the Schrodinger's equation for free particle in one dimension.
 - 2) Explain conservation of probability.
 - 3) Prove one of the Ehrenfest's theorem equation.
- Que-4(B) Answer the following questions (any one) (04)
- 1) Find the normalized wave function for $\varphi(\phi) = A \sin m\phi$ $0 < \phi < 2\pi$.
 - 2) Explain expectation values.
- Que-5(A) Answer the following questions (any two) (10)
- 1) Show that eigen values of self-adjoint operator are real.
 - 2) Derive Schrodinger's equation for simple harmonic oscillator and find its eigen values and eigen function.
 - 3) Explain fundamental postulates of wave mechanics.
- Que-5(B) Answer the following questions (any one) (04)
- 1) Prove that: $[L_y, L_z] = i\hbar L_x$.
 - 2) Prove that: 1. $(A + B)^+ = A^+ + B^+$ 2. $(CA)^+ = C^* A^+$
