

B.Sc. Semester - 5 (NEP-2020) Examination

Oct/Nov - 2025

PHY: Mathematical Physics, Classical Mechanics & Quantum Mechanics (Major-11)

Time: 2:00 Hours

Marks: 50

Instructions:

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

- Que.1 Answer the following questions (any two) (10)
- 1) Explain fundamental theorem of gradient.
 - 2) Define the Fourier series and evaluate its co-efficient.
 - 3) Find a series of sine and cosine of function (x) in the interval $-\pi < x < \pi$, Also deduce that $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \dots$
 $f(x) = 0$, when $-\pi < x < 0$
 $f(x) = \frac{\pi x}{4}$, when $0 < x < \pi$
- Que.2 Answer the following questions (any two) (10)
- 1) Derive Hamilton's principle from Newton's equation.
 - 2) Obtain equation of motion for Simple pendulum, using Lagrange's equation of motion.
 - 3) Obtain the Lagrange's equation of motion.
- Que.3 Answer the following questions (any two) (10)
- 1) Obtain the solution of a particle in a square well potential when $E < 0$.
 - 2) Prove probability of the particle is conserved.
 - 3) Prove one of the Ehrenfest's theorem equations.
- Que.4 Answer the following questions (any two) (10)
- 1) Prove that momentum operator is self-adjoint. Show that eigen values of self-adjoint operator are real.
 - 2) Describe any three fundamental Postulates of wave mechanics.
 - 3) Explain Dirac delta function in detail.
- Que.5 Answer the following questions (any five) (10)
- 1) Write-down any two product rules of differential calculus.
 - 2) Draw graph for even and odd function in interval $(-\pi, \pi)$
 - 3) Prove that: $[x, P_x] = i\hbar$
 - 4) Prove that: 1. $(A + B)^\dagger = A^\dagger + B^\dagger$ 2. $(CA)^\dagger = C^* A^\dagger$
 - 5) Explain Admissibility Conditions on the wave function.
 - 6) Explain Box normalization with example.
 - 7) Explain cyclic or ignorable coordinates.
 - 8) Explain Constraints and its types.
