

Xerox



A Charutar Vidya Mandal's Institution
V.P. & R.P.T.P. SCIENCE COLLEGE (AUTONOMOUS)
(Grant-in-Aid)



Affiliated to Sardar Patel University
VALLABH VIDYANAGAR-388120
Bachelor of Science (Semester-6)
Internal Examination - 2026

Course Code:US06MAPHY01 Course Title: Quantum Mechanics

Date: 06/03/2026, Friday

Total Marks: 30

Time: 10:45 a.m. to 12:15 p.m.

Q-1 Multiple Choice Questions (Attempt All)

[06]

- (1) Any wave function having anti-symmetry property is said to be of _____ parity
 - (a) zero
 - (b) even
 - (c) odd
 - (d) infinite
- (2) The limit of a region-III for a square well potential is _____
 - (a) $-\alpha < x < 0$
 - (b) $a < x < \alpha$
 - (c) $-a < x < a$
 - (d) $-\alpha < x < -a$
- (3) For adjoint operator A, $(\phi, A\psi) =$ _____
 - (a) $(A^+\phi, \psi)$
 - (b) $(\phi^*, A\psi)$
 - (c) $(\phi, A\psi)$
 - (d) $(A\phi, \psi)$
- (4) The same state of all the components of _____ operator is impossible
 - (a) $\vec{P}$
 - (b) $\vec{L}$
 - (c) $\vec{K}$
 - (d) $\vec{V}$
- (5) The zero point energy for simple harmonic oscillator is $E =$ _____
 - (a) $\hbar\omega$
 - (b) $\frac{1}{2}\hbar\omega$
 - (c) $\frac{3}{2}\hbar\omega$
 - (d) $\frac{5}{2}\hbar\omega$
- (6) Energy of an isotropic oscillator is _____
 - (a) continues
 - (b) discrete
 - (c) 0
 - (d) $h\nu$



Q-3 Derive the expression of energy eigen values for a particle in a square well using the admissible solutions [06]

OR

Q-3 Derive the time independent Schrodinger equation and explain their physical significance [06]

Q-4 Discuss about the eigen values and eigen functions of self adjoint operator [06]

OR

Q-4 Derive eigen function in momentum space and normalized it by box normalization [06]

Q-5 State uncertainty principle and discuss it for quantum mechanical observables [06]

OR

Q-5 Derive the dimension less Schrodinger equation for simple harmonic oscillator [06]

Q-6 Derive the radial equation for a particle in central potential [06]

OR

Q-6 Set up the Hamiltonian of anisotropic oscillator and derive its energy eigen value [04]



A Charutar Vidya Mandal's Institution
V.P. & R.P.T.P. SCIENCE COLLEGE

(AUTONOMOUS) (Grant-in-Aid)

Affiliated to Sardar Patel University

VALLABH VIDYANAGAR-388120

BSC (Semester-6) Quiz - 2026

COURSE CODE: US06MAPHY01

COURSE TITLE: Quantum Mechanics



Date: 06/03/2026

Time: Maximum 20 minutes

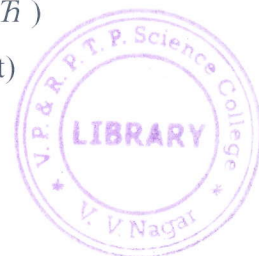
Day: Friday

Total marks :15

Q-1 Fill in the blanks with appropriate answer given in the bracket.

[08]

- (i) The operator operating on the wave function should always standing on _____ side (left/right)
- (ii) If the particle moving in a time _____ potential then the solution of the wave equation is described as a stationary state (dependent/independent)
- (iii) For the adjoint of the product of two operators A and B , $(AB)^\dagger = ______ (A^\dagger B^\dagger / B^\dagger A^\dagger)$
- (iv) Any two eigen functions belonging to unequal eigen values of a self-adjoint operator are _____ (orthogonal/non-orthogonal)
- (v) If A & B are a canonically conjugate pair of operators, then $[A, B] = ______ (\hbar/i\hbar)$
- (vi) Force acting on the pendulum is proportional to _____ (velocity/displacement)
- (vii) In a rigid rotator distance between two particles is _____ (constant/variable)
- (viii) Central potential is a function of _____ (r/r & θ)



Q-2 Whether the following statement is true or false. Write your answer in the box

[07]

- (i) $E < 0$ for non-localized states of the square well potential []
- (ii) There exists at least one bound state, however weak the potential may be []
- (iii) If $\delta_{m,n}$ is Kronecker delta function then $\delta_{m,n} = 0$ when $m = n$ []
- (iv) Eigen values of a self-adjoint operator are real []
- (v) Potential of harmonic oscillator is $V = mgh$ []
- (vi) The quantum mechanical energy for a particle in one-dimension square well potential is $E = \frac{(l+1)\hbar^2}{2I}$ []
- (vii) For a rigid rotator the differences of energy levels are govern by $\Delta E = n\hbar v$ []