

**January 2017**  
**M. Sc. Ist Semester Examination**

**PHYSICS**  
**Paper III : Quantum Mechanics**

Time 3 Hours)

[Max. Marks : Regular 85 / Private 100

**Note : This question paper is meant for all Regular and Private students. Answer all five questions. All questions carry equal marks. The blind candidates will be given 60 minutes extra time.**

1. Discuss normality, orthogonality and closure properties of eigen functions.  
OR  
State and prove Ehrenfest theorems.
2. What do you mean by unitary transformations ? Explain the important properties of unitary transformation.  
OR  
Describe Heisenberg uncertainty relation through operators.
3. Solve Schrodinger equation for linear harmonic oscillator and discuss vibrational spectra.  
OR  
Solve the Schrodinger equation for a particle in one dimensional square well potential. Derive expression for transmission co-efficient and explain its significance.
4. Find the eigen values and eigen functions for  $L^2$  and  $L_z$ .  
OR  
Discuss CG coefficient, computation of CG co-efficient and their properties.
5. Write short notes on any two of the following :
  - (a) Equation of Continuity.
  - (b) Concept of Hilbert Space.
  - (c) Creation and Annihilation Operators.
  - (d) Angular Momentum in Quantum Mechanics.

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