5. Consider a particle on potential step of height V_0 with energy $E > V_0$. Calculate the coefficient of reflection and transmission.

6. Derive Schrodinger equation for a free particle in one dimension.

7. Derive an expression for the energy of a three dimensional harmonic oscillator.

8. Starting from radial equation R(r) of electron in hydrogen atom, calculate the value of energy.

B.A./B.Sc. 4ᵗʰ Semester

PHYSICS

Paper–A (Quantum Mechanics)

Time Allowed—2 Hours]   [Maximum Marks—35

Note :— There are **Eight** questions of equal marks. Candidates are required to attempt any **Four** questions.

1. Discuss Einstein's photoelectric equation. What is the effect of potential on photoelectric current ?

2. What is meant by Hesinberg's uncertainty principle ? Give an example of position momentum uncertainty principle.

3. State and prove Ehrenfest theorem.

4. (a) A particle is moving in a one dimensional box. Its wave function in given by :

$$\psi = \begin{bmatrix} A \sin \dfrac{n\pi x}{a} & \text{for } 0 < x < a \\ 0 & \text{outside} \end{bmatrix}$$

Normalize the wave function.

   (b) Derive an expression for the expectation value of position, momentum and energy operators.