ASSIGNMENT-

MODULE: QUANTUM MECHANICS

Descriptive Answers:

1. Write a note on Heisenberg uncertainty principle and its significance.
2. Write a note on probability density and normalization of wave function.
3. Prove that a free electron cannot exist inside a nucleus using the Heisenberg uncertainty principle.
4. Derive Schrödinger wave equation.
5. What is Eigen value and Eigen function? Derive the expression for Eigen function and Eigen energy values for a particle in a infinite potential well of finite width.
6. Derive an expression for the energy Eigen values of a free particle.
7. Discuss the wave functions and probability density for particle in an infinite potential well for first three allowed states.

Numerical:

1. *Electrons moving with a velocity of 3.32×10^5 m/s if this velocity is measured with an inaccuracy of 0.53% then estimate the uncertainty in the position of an electron.*

   Given that: Velocity of the electron is $v = 3.32 \times 10^5 m/s$
   Inaccuracy in the measurement of velocity = 0.53 %

2. *In an experimental determination of displacement of an electron in 10^{-6} second is 3.6m. Calculate the uncertainty involved in the determination of position if the inherent error involved in the measurement of displacement of the electron in given time is 0.23%.*

   Given that: The displacement of an electron in 10^{-6} second = 3.6 m
   The error in the displacement measurement = 0.23%

3. *The velocity of an electron confined in an infinite potential well is found to be 3×10^4 m/s for the ground state. Calculate the velocity of the electron in first and second excited state.*

   Given that: Velocity of the electron in ground state $v_a = 3 \times 10^4 m/s$

4. *An electron is bound in one dimensional potential well of width 0.18nm. Find the energy value in eV of the second excited state.* Given that: Width of the potential well a = 0.18 nm = 0.18×10^{-9} m