# Assignment -1

**Date: 2079 - 08 - 29**                    **Date of submission: 2079 - 09 - 08**

1. What do you know about Heisenberg uncertainty principle?   Find an expression of time independent Schrodinger wave equation for free particle.

2. Write down the physical significance of wave function $\psi$. Derive with explanation, an expression that relates the wave and particle nature of matter.

3. What is De Broglie's wavelength and how it deals with the duality of Wave?

4. Solve the Schrodinger wave equation for a free electron whose energy is E. What is the uncertainty in the position of the electron and the uncertainty in the momentum of the electron?

5. What are matter waves? Assuming electron as traveling matter, Formulate its describing equation.

6. Derive the Fermi energy expression for free electron model at 0 K.

7. Define number of state and density of state in quantum mechanics.

8. X-rays of wavelength $0.91 \, A^0$ Fall on a metal plate having work function 2ev. Find the wavelength associated with emitted photo electrons.

9. Derive time independent Schrodinger's equation. Starting with Classical wave equations $Y = A \sin 2\pi \{ ft - (x / \lambda) \}$, where the notations have their usual meanings. What do you understand by wave function $\Psi$ in quantum mechanics?

10. Define density of states. Show that the relationship between density of states and energy is parabolic.

11. Define wave function, $\psi$. Starting with the general solution of Schrodinger's equation for 1-D case, as $\psi(x) = A \sin \beta x + \cos \beta x$. Where the notations have their usual meanings, derive the relation for total energy and normalized wave function.

12. Find the energy levels and wave function of an electron inside one dimensional potential well and sketch them.