

UNIVERSITY OF HYDERABAD
School of Physics

Jul 2010 - Dec 2010
M.Sc. III-Semester

Quantum Mechanics-II

Time : 1hr
MM : 20

Session VII::Solved Examples Variation Method

- [1] Using a trial wave function of the form

$$\psi(x) = C \exp(-\alpha^2 x^2 / 2)$$

estimate the ground state energy of a particle in the δ - function potential

$$V(x) = -\gamma \delta(x), \quad \gamma > 0.$$

- [2] (a) Assuming the n-p forces to be given by spherically symmetric potential

$$V(r) = -V_0 \exp(-r/r_0)$$

compute the averages of kinetic energy and potential energy in the state given by a trial wave function

$$\psi(r) = \exp(-\alpha r / 2r_0)$$

where α is a parameter.

- (b) Show that the best estimate for the ground state energy of deuteron is obtained when α satisfies the equation

$$(\alpha + 1)^2 - \lambda \alpha = 0$$

where M_p is the proton mass and

$$\lambda = 6M_p r_0^2 V_0 / \hbar^2$$

- (c) Assume $r_0 = 2.4 fm$, $V_0 = 28 MeV$, solve this equation **numerically** for α and compare theoretical value of the binding energy of deuteron with the experimental value of 2.225 MeV.