

UNIVERSITY OF HYDERABAD
School of Physics

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

Quantum Mechanics-II

Time : 1hr
MM : 20

Session VIII::Solved Examples Perturbation Theory
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- [1] QM23005 Use the first order degenerate perturbation theory to compute the correction to the $l = 1$ level of (use units such that $\hbar = 1$)

$$H = L^2 + \alpha L_x + \beta L_y$$

taking

$$H_0 = L^2, \quad \text{and} \quad H' = \alpha L_x + \beta L_y$$

Find the corrections to the $l = 1$ level using first order perturbation theory. Compare your answer with the exact answers.

- [2] QM23002 Use the first order non-degenerate perturbation theory to compute the correction to the $\ell = 1$ level of (use units so that $\hbar = 1$)

$$H = L^2 + \alpha L_z + \beta L_x$$

Use the splitting of H as

$$H_0 = L^2 + \alpha L_z, \quad \text{and} \quad H' = \beta L_x$$

in terms of unperturbed hamiltonian and perturbation hamiltonian H' .

- (a) Find the corrections to the $\ell = 1$ energy level using perturbation theory to the lowest non-vanishing order in H' . Compare your answer with the exact answers.
- (b) Obtain the eigenvectors of H upto lowest order in β .
- [3] QM23003 A particle, having charge q , moves in harmonic oscillator potential $V(x) = \frac{1}{2}m\omega^2 x^2$. Find the shift in the energy level of the n^{th} excited state when uniform electric field E is applied. Compute the corrections upto lowest order giving a nonzero value.

Date : Aug 16,2010