PH204 : Quantum Mechanics II

Assignment 4 Due : 21/04/2012

Full marks :30 (total marks for the assignment 200).

1. Consider a two-level system with energies E_1 and E_2, $E_1 < E_2$. Consider action of a time-dependent potential such that $W_{11} = W_{22} = 0$ and $W_{12} = W_{21}^* = \gamma e^{i\omega t}$, γ real. At t=0, only the lowest energy level is populated i.e. without making any assumption on the size of γ.
   a) Solve the problem exactly and calculate $b_1(t)$ and $b_2(t)$ by solving the equations

$$i\hbar \frac{d}{dt} b_n(t) = \sum_{k=1}^{2} e^{i\omega_{nk}t} W_{nk}(t) b_n(t)$$

   where $n = 1, 2$.
   b)Solve now this using time-dependent perturbation theory and calculate the same to lowest non-vanishing order.Compare the results for small γ for $\omega \approx \omega_{21}$ and ω very far from ω_{21} .

(30)