An-Najah National University
Faculty of Science-Department of Physics
Quantum mechanics 22453
Spring 2014
Second Exam, Nov 16^{th} 2014

Name: _____

Number: _____

1. (6 points) Consider the n=2 state in Hydrogen atom, draw a diagram, that show the effect of relativistic, spin orbit corrections and weak Zeeman effect on it.

2. (4 points) Show that If ψ_1 is orthogonal to the ground state wavefunction, then $< \psi_1|H|\psi_1 > \geq E_{fe}$

3. (6 points) Consider a one-dimensional simple harmonic oscillator whose classical angular frequency is ω_0. For t < 0 it is known to be in the ground state. For t > 0 there is also a time-dependent force $F(t) = F_0 x cos(wt)$, where F_0 is constant in both space and time. Obtain an expression for the expectation value $< x >$ as a function of time using time-dependent perturbation theory to the second non-vanishing order. [You may use $< m|x|n >= \sqrt{\frac{\hbar}{2m\omega_0}}(\sqrt{n+1}\delta_{m,n+l} + \sqrt{n}\delta_{m,n-l})$]

4. (4 points) If an electron at state n=5, l-0, m=0, show how it will decay to state n=1

Question:	1	2	3	4	Total
Points:	6	4	6	4	20
Score:					

Good Luck