An-Najah National University
Faculty of Science-Department of Physics
Quantum Mechanics I
Summer 2014
$1^{st}$ Exam, Sep. $25^{th}$ 2014

Name: _____

Number: _____

1. Consider a spin-1/2 particle placed in a uniform magnetic field of strength $B_0$ and pointing into the z-direction. If the system was initially at spin sate pointing in the positive x direction
   (a) (2 points) What is the spin wavefunction at any later time t

   (b) (3 points) Describe the spin orientation of the particle as a function of time

   (c) (3 points) At what time t, the particle will be pointing in the negative z direction

2. (4 points) Si atom has 14 electron and its configuration is given by: $(Ne)(3s)^2(3p)^2$. Find its configuration according to Hunds's rules.

3. A simple harmonic oscillator is subjected to a perturbation :

$$H_1 = \lambda X^2$$

(a) (4 points) Find the first and second order correction on the ground state and first excited state energies

(b) (4 points) Find the first order correction on the ground state and first excited state wavefunction.

4. (5 points) Two partilces each with angular momentum 1, if $J = J_1 + J_2$. Construct the state $|J \quad M >= |2 \quad 1 >$

| Question | Points | Score |
|---|---|---|
| 1 | 8 | |
| 2 | 4 | |
| 3 | 8 | |
| 4 | 5 | |
| Total: | 25 | |

Good Luck