Birzeit University
Faculty of Science-Department of Physics
Quantum Mechanics II
Spring 2021
Second Exam, Due June. 7^{th} 2021

Instructions:

1. You are allowed to use one books, namely: Griffiths, David J, Introduction to Quantum Mechanics, 3^{rd} edition
2. You are not allowed to communicate with each others.
3. you are not allowed to communicate with anybody regarding the exam.
4. You can communicate with me through Ritaj

1. Suppose that a hydrogen atom is exposed to a uniform electric field, ε, that has two components in the x and y directions and a parallel, uniform magnetic field, B. Consider the second excited energy level, corresponding to n = 3. Neglect spin of the electron. The degeneracy of this state will depend on the choice of the values of E and B. Find the values of E and B that causes all possible degeneracies.

2. A two level non-degenerate quantum system, ψ_a with Energy E_a and ψ_b with Energy E_b. They are orthogonal, normalized. When a perturbation $H^{'}$ is introduced, with the following matrix elements:

$$< \psi_a|H^{'}|\psi_a >=< \psi_b|H^{'}|\psi_b >= 0$$
$$< \psi_b|H^{'}|\psi_a >=< \psi_a|H^{'}|\psi_b >= h$$

   h is a real constant.

   (a) Find the exact eigenvalues of the total Hamiltonian system.

   (b) Estimate the energies of the perturbed system using variational principle with a trial wavefunction of the form:

$$\psi = (cos\phi)\psi_a + (sin\phi)\psi_b$$

3. Find the energy levels of a particle in well, using WKB approximation

$$V(x) = A|x| \qquad A > 0$$

Question:	1	2	3	Total
Points:	0	0	0	0
Score:				

Good Luck