Study Guide for Exam #3

1. Essay question (has to be completed in class without use of any reference materials). The answer for the essay question should contain a brief statement of the problem, discussion of the solution supported by the appropriate equations and brief discussion of the special cases (where appropriate).

The possible topics for the essay question are the following:

1) **Angular Momentum in Quantum Mechanics.** Angular momentum operator in rectangular coordinates. Commutation relations. Raising and lowering operators for angular momentum. Discussion of eigen values and simulations eigen states for $\vec{L}, L_z$ operators using Dirac’s notation. (You are not required to perform explicit consideration in spherical coordinates.)

2) **Hydrogen Atom.** Schrödinger equation for the central potential $V(r) = -\frac{Z\epsilon^2}{4\pi\epsilon_0 r}$ of Hydrogen-like atom. Separation of variables. The energy spectrum. (You are not required to memorize explicit form of eigen functions, such as Laguerre polynomials or spherical harmonics).

3) **Spin in Quantum Mechanics.** Commutation relations. Matrix representation, eigen states and eigen values of spin for spin $\frac{1}{2}$ particles.

Problems (any reference material can be used)


4. Spin. See our discussion of eigen vectors and eigen values of spin operators and problem 10.6 from HW10.