Phys 402: Applications of Quantum Mechanics

Homework I (due 930am, Thursday, Jan 14, 2016)

1) Problem 6.2, page 254.

2) Problem 6.3. (Two identical Boson wave functions have to be symmetrized. See page 203-205.)

3) Problem 6.29, page 286.

4) Stark effect of a charged particle moving in a Harmonic potential. Now assume an electric field along X-direction is applied to the charged particle subject to a harmonic potential defined in Prob. 6.2. Find the second order correction to the ground state energy using the second order perturbation theory.

   Hint: A very pleasant approach to the harmonic potential problem is to use lowering/raising operators introduced in section 2.3. These operators are closely related to the creation-annihilation operators widely used in quantum optics and in quantum electrodynamics. Although for this particle problem this is not the only way to proceed.

5) Stark effect in a hydrogen atom. Calculate the second order correction to the ground state energy and polarizability. (You can keep the first 4 excited states in your estimate to simplify the calculation.)

    * If integrals and sum can not be done exactly, please reduce them to dimensionless ones and show that they are convergent. Alternatively evaluate them numerically.