PHYS 4390 Quantum Mechanics II

Homework Assignment 01

Due date: January 31, 2019

Instructor: Dr. Daniel Erenso Name: _____

Mandatory problems: *any two problems is required but I want you to try all!*

Student signature:_____

Student Comment:_____
_____
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P #	1	2	3	4	5	Score
Score	/	/	/	/	/	/100

Prob 1 Following a similar procedure to the one we used in the first order nondegenerate perturbation theory, show that in the second order nondegenerate perturbation theory the second order corrections are given by

$$E_n^{(2)} = \sum_{k \neq n}^{\infty} \frac{\left| \langle \phi_n | \hat{H}_1 | \phi_k \rangle \right|^2}{E_n^0 - E_k^0}$$

and

$$C_{nm}^{(2)} = \frac{C_{nm}^{(1)} E_n^{(1)} - \sum_{k \neq n}^{\infty} C_{nk}^{(1)} \langle \phi_m | \hat{H}_1 | \phi_k \rangle}{E_m^0 - E_n^0}.$$

Prob 2 Townsend 11.1

Prob 3 Townsend 11.4

Prob 4 Consider a symmetric rotator with

$$\hat{H}_0 = \frac{\hat{L}^2}{2I},$$

where $\hat{L}$ is the angular momentum operator and I is the moment of inertia of the rotator. Suppose this system is subject to a perturbation given by

$$\hat{H}_1 = E_1 \cos(\theta)$$

what are the energy shifts for the states with $l = 1$

Prob 5 (a) Townsend 11.6

(b) Determine the second order energy shift for the ground state of a Hydrogenic atom.