CH 354 - Physical Chemistry

Instructor: Prof. John F. Stanton (Welch 3.208A, 1-5903)

Office Hours: TTh 3:00-4:45 PM (or by appointment)

Teaching Assistant: Andrew Ritchie

Office Hours: TBA

Textbook: None

Course Schedule

Week	Dates	Material
		Fundamental Quantum Mechanics
I	Jan 17†,19	Boot Camp
II	Jan 24,26	Boot Camp and Historical Background
III	Jan 31†‡, Feb 2	Postulates of Quantum Mechanics
IV	Feb 9,11	Solvable Problems I
V	Feb 14†‡,16*	Solvable Problems II
VI	Feb 21,23	Solvable Problems III
VII	Feb 28†‡, Mar 1	Overview of Approximation Methods
VIII	Mar 6,8	Application of Approximation Methods to Model Problems
		Applications of Quantum Mechanics
IX	Mar 20†‡,22*	The Hydrogen and Helium Atoms
X	Mar 27,29	"Complex" Atoms and Hartree-Fock Theory
XI	Apr 3†‡,5	What is a Molecule? and the Born-Oppenheimer Picture
XII	Apr 10,12	Introduction to Spectroscopy
XIII	Apr 17†‡,19*	Spectroscopy of Diatomics I
XIV	Apr 24,26	Spectroscopy of Diatomics II
XV	May 1‡,3	Something Special

† - Homework assignments will be passed out.

‡ - Homework assignments will be collected.

∗ - Hour examination will be administered.

Scope of Material

CH 354 covers the subject of quantum mechanics from a chemist's point of view. The course will begin with a "review" of concepts from mathematics (trigonometry and calculus, primarily) that are seen again and again in this course, followed by a historical overview of the subject, covering physics from the time of Newton to the dawn of the new age at the beginning of the 20^{th} century. This is followed by an outline of the framework of quantum mechanics and its application to model systems for which the Schrödinger equation can be solved exactly. In chemistry, however, *all* systems of interest involve mathematically intractable Schrödinger equations and approximations are the name of the game. The rest of the course deals with the fundamental principles that underlie atoms and molecules: the existence of discrete energy levels, their qualitative interpretation, and the ability of electromagnetic radiation (photons) to induce transitions between these levelsi and the connection between quantum mechanics and thermodynamics. I will warn you now that this course (particularly the early part of it) involves some rather serious and involved mathematics. If you were overwhelmed with the math encountered in CH 353, you might seriously consider re-evaluating your decision to take this course. *Also, this course is not a requirement for any degree at UT, so anyone who is in this class is here by choice.* It's tough, but worth it for those who expend the effort.

Homework

Homework problems will be assigned every other Tuesday throughout the semester and are due *at the beginning of class* two weeks later. *Assignments turned in later than 5:00 PM on the specified Tuesday will not be accepted.* If you anticipate that it will not be possible to arrive by that time, there are two options: 1) get a friend to turn it in for you; 2) slide your homework under my office door sometime BEFORE 5:00 PM on Tuesday afternoon. Please show all work on the sheets provided in the homework packet. If there is not enough room underneath the problem statement to write down your calculations and/or reasoning along with the solution, you should attach extra pages to the assignment packet, order them properly and then restaple it before submission. For those of you who want challenging and sometimes algebraically brutal problems, I will not disappoint.

Examinations

There will be three open-book, open-note examinations administered during the usual class time, and the course will conclude with a comprehensive final examination. *I expect you to be responsible and avoid scheduling conflicts that interfere with exams.* Take note of the exam dates *now* and plan things such as medical school interviews accordingly. I rarely give make-up exams, and do so only for very good reasons (medical emergencies, death of a relative, religious holidays *etc.*).

The Dean Sez...

The Dean's office has requested that the following information be included in the syllabus:
• Please notify me of any modification/adaptation you may require to accommodate a disability-related need. You will be requested to provide documentation to the Dean of Students' Office, in order that the most appropriate accomodations can be determined. Specialized services are available on campus through Services for Students with Disabilities.
• Students unable to take examinations that are given on a religious holiday must notify the instructor (me) at least fourteen days in advance.

Grading Policy

The basis for grades in CH 354 will be performance on the hour exams, the final exam and the homework assignments. Only the five highest of seven homework scores will be counted. The distribution of points is given below. In general, the basis for grade assignment is the class median; those of you scoring above the median receive a grade of A or B; those scoring below receive a C, D or F. While I generally do not give a lot of A's, it works both ways: only the truly determined student can get an F in this class.

Homework	200
Hour Exam I	200
Hour Exam II	200
Hour Exam III	200
Final Exam	200
Total	1000