

Syllabus_Chem521/421_Fall2020

(Wed Sep 02, 2020 09:15 AM - Wed Dec 09, 2020 10:35 AM)

Instructor: Prof. Ed Castner Office: WL-184 ecastner@chem.rutgers.edu

**Time: Mondays and Wednesdays, 09:15-10:35 (MORNINGS!) Location: online (Zoom/Sakai)
Computer with webcam and microphone required.**

Text: *Elements of Quantum Mechanics*, by Michael D. Fayer. ISBN: 978-0195141955 Available online for used prices from \$71.06 today; likely price in Rutgers bookstore new is \$199.99.

This syllabus offers a rough guide to what material will be covered, and when. You are expected to read and prepare questions about the assigned reading from the book *Elements of Quantum Mechanics* **before** class. Please download and print the PDF file lecture notes from the Sakai site before class, so that you can annotate these notes.

There will be no exams during this course. Graded projects will be done (with help from Mathematica) and submitted on this Sakai site. Successful completion of these four projects will determine your course grade. Homework problems from the relevant chapter should be done expeditiously following class. Make sure to obtain and install Mathematica software to aid you in doing more complex problems. Any updates or changes to this schedule will be posted on Sakai. ***Instead of a final exam, there will be a take-home project due on Mon. 12/14/2020, 16:00.***

Course syllabus

Class 1 Wed., 9/2 Six postulates of QM; Chapter 1, *Elements, Mathematica*. Mathematica intro.
project due Fri. 9/4.

Class 2 Tues., 9/8 Chap. 2, *Elements*: wavefns., kets (bras), operators (note shifted class day because of the Labor Day holiday on Mon. 9/7)

Class 3 Wed., 9/9 Chap. 3, *Elements*: free particles, wavepackets

Class 4 Mon., 9/14 Chap. 4, *Elements*: Dirac's Quantum Condition; Uncertainty

Class 5 Wed., 9/16 Chap. 5, *Elements*: Schrödinger equation

Class 6 Mon., 9/21 Chap. 5, *Elements*: particles in potentials- tunneling; ionization

Class 7 Wed., 9/23 Chap. 6, *Elements*: harmonic oscillator- Schrödinger rep.

Class 8 Mon., 9/28 Chap. 6, *Elements*: harm. osc.- Dirac- raising/lowering operators

Class 9 Wed., 9/30 Chap. 6, *Elements*: harm. osc. and time-resolved spectroscopy

Class 10 Mon., 10/5 **Take home project due.** Review and discussion of material to date.

Class 11 Wed. 10/7 Chap. 7, *Elements*: H atom

Class 12 Mon., 10/12 Chap. 7, *Elements*: more on H atom

Class 13 Wed., 10/14 Chap. 8, *Elements*: time-dep. 2-state problems

Class 14 Mon., 10/19 Chap.9, *Elements*: perturbation theory. Non-degenerate, 1st order

Class 15 Wed., 10/21 Chap.9, *Elements*: perturbation theory. 2nd order, degenerate.

Class 16 Mon., 10/26 Chap. 10, *Elements*: He atom. perturbational, variational.

Class 17 Wed., 10/28 Chap. 11, *Elements*: time-dep. perturbation theory. Transitions.

Class 18 Mon., 11/2 Chap. 12, *Elements*: radiation: absorption, emission of photons.

Class 19 Wed., 11/4 Chap. 13, *Elements*: matrix representation

Class 20 Mon., 11/9 Chap. 13, *Elements*: more on the matrix representation

Class 21 Wed., 11/11 Chap. 14, *Elements*: density matrices- light/matter interactions

Fri. 11/13- Take home project due.

Class 22 Mon., 11/16 Chap. 14, *Elements*: more on density matrices.

Class 23 Wed., 11/18 Chap. 15, *Elements*: angular momentum- raising/lowering ops.

Class 24 Mon., 11/23 Chap. 15, *Elements*: more on angular momentum

no lecture Wed., 11/25 no class- RU Friday class schedule

Class 25, Mon. 11/30 Chap. 16, *Elements*: electron spin

Class 26 Wed., 12/2 Chap. 16, *Elements*: more on electron spin

Class 27 Mon., 12/7 Chap. 17, *Elements*: covalent bonds- H_2^+ and H_2

Class 28 Wed., 12/9 Chap. 17, *Elements*: more on covalent bonds

Mon. 12/14/2020, 16:00 Final project due.