

Physical Chemistry II: Quantum Chemistry

Chem 4120/6120 (3 Credits)

Fall Semester 2020

Course modality: **Online; Synchronous**

Instructor: Ivaylo Ivanov

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Teaching Assistant: Ms. Jina Yu

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Office Hours: By email/videoconferencing (please email to set up an appointment)

Lecture Time: TR from 3:45 pm-5:00 pm

Lectures will be hosted live on Webex at the above-listed class time. A link will be emailed to all students prior to each lecture that they can use to join the session. The online lectures will also be recorded and made available from the iCollege webpage.

Course Prerequisites: Chem 3410; Math 2212; Phys 2211K; and Phys 2212K.

Text: *Atkins' Physical Chemistry (11th Edition)* by Peter Atkins, de Paula, Julio, James Keeler
ISBN 9780198769866

Course Description: Physical Chemistry II is a 3-credit hour semester course that covers the subjects of atomic and molecular structure (quantum chemistry) and elements of statistical thermodynamics. The course introduces quantum mechanics and covers applications to spectroscopy, chemical bonding and electronic structure theory of atomic and molecular systems. The postulates and fundamental concepts of quantum mechanics are introduced and complemented by example applications. Special emphasis is placed on the connection to atomic and molecular spectroscopy. The course illustrates important concepts such as wave-particle duality, the Schrodinger equation, particle-in-a-box, harmonic oscillator, rotational and vibrational spectra of diatomic molecules, bound states in the hydrogen atom, atomic and molecular orbitals as well as key experiments in quantum mechanics. Knowledge of these fundamental concepts is expected of all chemistry graduates. The course also develops key analytical and quantitative skills and promotes critical thinking.

Help Sessions: Problem-solving tutorial sessions will be offered to assist with homework problems, preparation for the quizzes and the required mathematics. Any student having difficulty with homework or the required math background may participate. Ms. Jina Yu will administer the tutorial. The tutorial will start the second week of the semester. Exact time to be determined in during first week of classes.

Homework: Homework problems will be assigned to help you improve your understanding of the material. They will not be graded. However, periodically problems very similar to the homework will be included on the tests.

Quizzes, Exams, Grading: There will be **four quizzes** distributed through the iCollege webpage (see schedule at the end of the syllabus). **The lowest quiz score will be dropped. The 3 remaining quiz scores will count equally for 60% of your overall grade. A comprehensive final exam will count for 40% of the grade.** The grade for the final exam cannot be dropped or replaced.

Several brief, low stakes quizzes (multiple choice) will be administered through iCollege and you are encouraged, though not required to take them. They serve primarily as a diagnostic tool to monitor your understanding of the material as the semester progresses. Extra credit (up to 10% of the points awarded for quizzes) will be given on this basis.

Tentative Course Schedule Fall, 2020

<u>Approximate Dates</u>	<u>Topics covered</u>
8/25, 27, 9/1	Early Developments in Quantum Theory
9/3	Wave Phenomena
9/8, 10, 15, <u>17</u>	Postulates of Quantum Mechanics
9/22, 24	Particles-In-A-Box and Applications
9/29, 10/1	Vibration/Rotation of Diatomic Molecules
10/6	Spectroscopy of Diatomics
10/8, <u>13</u>	Hydrogen Atom
10/15, 20	Many Electron Atoms
10/22, 27	Introduction to Chemical Bonding
10/29, 11/3, 11/ <u>5</u>	Chemical Bonding in Diatomic/Polyatomic Molecules
11/10, 12	Probability, Boltzmann Distribution
11/17, 19	Statistical Thermodynamics, Partition Functions
11/24-26	Thanksgiving Break
12/1, 3	Monatomic & Diatomic Gase, Chemical Equilibrium
12/ <u>7</u>	
TBD	Final exam (week of Dec. 8-15 th)

Final exam schedule has not yet been finalized by the registrar's office. The schedule will eventually be posted: <https://registrar.gsu.edu/registration/semester-calendars-exam-schedules/>

*Quiz dates are underlined.

PDF files of scanned lecture notes, videos the Webex sessions, homework assignments etc. will be made available from the iCollege site.

Statements required by University Policies and Regulations

Please note, the course syllabus provides a general plan for the course; **additional deviations may be necessary.**

It is required that we refer to the Policy on Academic Honesty (Section 409). The university's policy on academic honesty is published in the Faculty Affairs Handbook and the On Campus: The Undergraduate Co-Curricular Affairs Handbook and is available to all members of the university community. The policy represents a core value of the university and all members of the university community are responsible for abiding by its tenets. Lack of knowledge of this policy is not an acceptable defense to any charge of academic dishonesty. All members of the academic community -- students, faculty, and staff -- are expected to report violations of these standards of academic conduct to the appropriate authorities. The procedures for such reporting are on file in the offices of the deans of each college, the office of the dean of students, and the office of the provost.