

Department of Chemistry

The University of Texas at El Paso

Structure of Matter/Advanced Physical Chemistry

CHEM 4469

CHEM 5351/6351

Fall Term, 2020

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COVID-19 Considerations

Due to the current conditions from the COVID-19 pandemic several changes have been instituted to this course compared to other semesters.

This course is listed as HYBRID. This means we have permission to attend lectures on campus at least once per week. We will not do so. Lectures will be held online on Tuesdays and Thursdays from 10:30AM – 11:20 PM in the using Microsoft Teams, or ZOOM. Please find and install both programs in your computers. All lectures will be recorded, so while attendance to the lectures is NOT mandatory, I still expect you to make an effort to log in during the scheduled lecture times. Attending online lectures will help your understanding of the topics taught and will give you the opportunity to ask and answer questions in real time. Nonetheless, not being able to attend should not directly affect your grade.

Office hours will be held online and by appointment. I will try to group people to have online office hours as needed.

Depending on the current Emergency status in campus and in El Paso, we may have face-to-face examinations. If possible, you will come to campus for Exams 1, 2 and 3. If the Pandemic Status at the time of the examination does not permit it we will have exams online.

All homework will be turned in online.

Course Description

The objective of this course is to present the chemical applications of group theory with a focus on inorganic systems. We will emphasize its conceptual development without refraining from its mathematical origins. Background of matrix algebra will be helpful. We will focus our efforts into electronic structure of molecules, vibrational and electronic spectroscopy, magnetic measurements, and other topics relevant to inorganic chemistry.

Topics to be covered:

1. Introduction to Symmetry
2. Introduction to Group Theory
3. Molecular Orbital Theory (general principles)
4. LCAOs
5. Hückle Eigenfunctions
6. Angular Overlap Method
7. Projection Operators: SALCs
8. Inorganic Ligands (sigma donors, pi donors, pi acceptors)

9. Octahedral Complexes
10. The Spectrochemical Series
11. Vibrational Spectroscopy
12. Cluster Compounds
13. Metal-metal bonding
14. Sandwich Complexes
15. Metal-Ligand multiple bonds.
16. Symmetry in chemical reactions

Textbook:

- 1) Cotton, F. A. "Chemical Applications of Group Theory", 3rd Ed., Wiley & Sons, 1990.
- 2) Carter, R. L. Molecular Symmetry and Group Theory, 1st Ed. Wiley & Sons, 1998

Additional reading:

- 3) DeKock, R.L., Gray, H. B. Chemical Structure and Bonding, 2nd Ed. University Science Books, 1989

Other reading material may be available at either blackboard (accessed through my.utep.edu) or <http://utminers.utep.edu/dino/classes.html>

Grading:

The grade for this course for undergraduate students will be determined by three exams (30% each) and problem sets (10%).

Graduate students will additionally have the task of writing a research paper on a topic of contemporary interest in inorganic chemistry approved by the instructor and due at the end of the semester. The research paper grade will count towards the homework percentage. Exams will be different between graduate and undergraduate students. Graduate students should expect an exam of greater difficulty.

Random quizzes may be given throughout the semester, and the percentages will be applied to the homework percentage.

Course Withdrawal Policy Classes dropped prior to the official census date (9/9/2020) will be deleted from the student's semester record. After this date, the University permits any student to drop with an automatic "W" until **10/30/2020**. After this date, and per College of Science policy, students who withdraw must receive grades of "F".

Disability If you believe you may qualify for special accommodations due to disability contact the Center for Accommodations and Support Services: <http://sa.utep.edu/cass>; 915-747-5148.

Other considerations

Please understand that during these difficult times you **MUST** take greater responsibility in learning. This is a difficult course made even more difficult for our inability to meet face-to-face. Proper use of all current technological tools available will benefit your learning. Take advantage of that, and remember it is in your best interest to put as much effort in your studies as you can.