

Department of Chemistry

The University of Texas at El Paso

Structure of Matter/Advanced Inorganic Chemistry

**CHEM 4469**

**CHEM 5361/6361**

Fall Term, 2017

Instructor: Dino Villagrán, Ph. D.

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Lectures will be held on Tuesdays and Thursdays from 12:00 PM – 1:20 PM in Physical Science Building 314. Office hours will be held on Mondays from 5:00 PM – 6:00 PM or by appointment.

*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", 3<sup>rd</sup> Ed., Wiley & Sons, 1990.
- 2) Carter, R. L. Molecular Symmetry and Group Theory, 1<sup>st</sup> Ed. Wiley & Sons, 1998

*Additional reading:*

- 3) DeKock, R.L., Gray, H. B. Chemical Structure and Bonding, 2<sup>nd</sup> 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.**

If possible, exams will be administered at times (and location) other than class time to allow students longer time to finish the exam.

Random quizzes will 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 (9/13/2017) will be deleted from the student's semester record. After this date, the University permits any student to drop with an automatic "W" until **11/3/2017**. 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 turn your cell phones off and keep them away during lectures.