

# CHEM 224: SPECTROSCOPIC TECHNIQUES FOR THE CHARACTERIZATION OF INORGANIC AND ORGANOMETALLIC COMPLEXES – Spring 2012

Instructor: Bill Trogler, email: wtrogler@ucsd.edu  
Office Hours: Wed 3pm to 4 pm, Pac Hall 4100C, Phone-x46175  
Class Hours: 4:45 to 6:05PM, Pacific Hall 4501

**COURSE DESCRIPTION:** Application of physical techniques to the elucidation of the structure of inorganic complex ions and organometallic compounds. Topics covered include group theory, and its application to MO theory as well as electronic, vibrational, and Raman spectroscopy. Magnetism and EPR spectroscopy will also be covered.

**Website:** <http://chem-faculty.ucsd.edu/trogler/GroupTheory224/Grouptheory.html>

## COURSE OUTLINE:

- I) Group Theory
  - A) symmetry groups of molecules
  - B) character tables
  - C) direct product representations and spectroscopic selection rules
  - D) symmetry adapted linear combinations and molecular orbital theory
- II) Applications of MO Theory
  - A) Organic  $\pi$  systems – Hückel MO theory, SALCs, and secular determinants
  - B) MO theory of metal complexes
- III) Electronic, Infrared, and Raman Spectroscopies
  - A) Small Molecule Inorganics
  - B) Coordination Compounds
  - C) Vibrational Normal Coordinates, Vibronic Coupling, and the Jahn-Teller Effect
- IV) Magnetism and EPR Spectroscopy
  - A) The Zeeman effect, Van Vleck equation and bulk magnetic properties
  - B) Crystal field theory and spin-orbit coupling
  - C) EPR spectroscopy and the effective spin Hamiltonian

## READINGS:

*Symmetry and Spectroscopy: An Introduction to Vibrational and Electronic Spectroscopy* (Dover Books on Chemistry) [required - Paperback] Available for \$11.89 on Amazon.com (also on reserve)

*Magnetism and Transition Metal Complexes* [required – Paperback] Avail for \$11.66 on amazon.com (also on reserve)

*Chemical Applications of Group Theory* (3rd ed) by F. A. Cotton (reserve text)

*Physical Methods in Chemistry* by R. S. Drago (reserve text)

<http://roger.ucsd.edu:80/record=b1617746~S9>

<http://roger.ucsd.edu:80/record=b2960591~S9>

<http://roger.ucsd.edu:80/record=b3197416~S9>

Original Research Articles – Class handouts

**Grading:**

Exam: Monday, May 7<sup>th</sup> in class exam + takehome part - 30% of grade

Two Graded Homework Assignments – 20% of grade

Final Exam: Take Home Exam - Due in my office by noon, Wednesday, June 6 - 50% of grade