**CHEM 3370 Symmetry, Spectroscopy and Structure (3)L** Applications of symmetry in chemistry; molecular spectroscopy; structure of solids.

*Prerequisite: CHEM 2280*

**Text recommended: “**Molecular Symmetry and Group theory”, by Robert L. Carter (John Wiley and Sons, 1998) *paperback, useful to bring to class, purchase not required*

“Modern Spectroscopy”, by J. Michael Hollas 4th edition (John Wiley and Sons, 2004) *No purchase necessary, copies available in laboratory; on reserve*

**Lab text:** “Experiments in Physical Chemistry”, by Shoemaker, Garland and Seinfeld.

*No purchase necessary, copies available in laboratory*

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**Course outline in brief:**

*3 lecture hours per week*

*3 laboratory hours per week*

**Overview:** This course introduces a combined theoretical and experimental approach to understanding structure and the various means we have for exciting atoms and molecules with light to learn more about these systems. The theoretical models used to describe energy states and the transitions between them will be studied more formally than in CHEM2280. Where symmetry exists, certain well-defined relationships must also exist. This course is traditionally the place where students are taught the basics of Group Theory and its applications in many situations, including the determination of symmetry adapted orbitals and the rules that necessarily apply in each of the spectroscopies. It is equally important to recognize that most molecules lack any significant degree of symmetry, and that removing symmetry can be an important goal. Both labs and lectures will address this reality. Current applications of spectroscopy to real-world problems will be integrated with lectures as appropriate.

In CHEM 2280, you saw various ways of describing the chemical bond, including both valence bond theory and molecular orbital theory and their validity and usefulness. Molecular electronic properties, such as energy, dipole moments and bond lengths were discussed. The quantum mechanical model of the harmonic oscillator was introduced, as well as an overview of the various ways of storing energy in a molecule: rotation, vibration, electronic, translation. Some of you will have also seen intermediate level material in quantum chemistry (CHEM 3360) or seen some aspects of group theory as applied to inorganic structures in other courses, or covered in Physics courses. All of you will have seen some applications of atomic, IR, Vis and UV spectroscopies in other courses. The material presented in CHEM3370 goes beyond these introductions and into details not considered in any other course. The goals are to extend and enrich your understanding of the fundamentals, and to enable you to apply these tools more knowledgably in a broad range of situations.