Syllabus

CHEM-610 – ADVANCED INORG CHEM

CHEM 412 - INORG REACTNS & PROCSSES

Instructor: Prof. Yong Yan

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Meet time: Monday 6-9pm

Office hour: Tuesday 1-3pm, or by appointment

Course Description: This course is intended for Chemistry, Materials Science, Physics, and Geology majors, and is designed to prepare students for further research in Inorganic Chemistry, Materials Science, Nanotechnology, Renewable Energy or, more generally, employment in physical or materials sciences fields. The course content will include advanced concepts in structure, bonding, and chemical/physical properties of inorganic compounds, understanding of which is central to the study of all areas of chemistry. The course will rely both on the books and literatures. Not all material in the text book will be covered and not all material covered will be found in the textbooks. Additional reading from primary literatures and presenting will be an integral part of this course. This course cannot be exhaustive in its coverage of organometallic chemistry but it is hoped that it will serve as a rational foundation of self-development in further studies.

Major topics will include:

1) Introduction to Current Inorganic Related Topics: Inorganic Materials, Renewable Energy, Catalysis, Nanotechnology, Environmental Inorganics, Semiconductor and Functional Materials (length: 1 week)

2) Structure, Bonding and Properties of Inorganic Solid Materials/Semiconductors (solid state chemistry, semiconductor principles, including descriptive crystal chemistry and X-ray crystallography) (length: 1-3 week)

3) Coordination Molecular Compounds/Organometallics (including 18-electron rule, oxidation state, molecular orbital theory, symmetry, group theory, and vibrational/electronic spectroscopy.) (length: 5-7 week)

4) Current Advanced Topics in Inorganics/Organometallics (length: 2-3 week)

5) Bio-organometallic Chemistry (length: 1 week)

6) Physical Methods to Characterize Inorganics/Organometallics (length: 1-2 week)

Prerequisites: General Chemistry, Organic Chemistry are required; General Physics, Calculus, and Physical Chemistry is recommended.

Expected Outcomes:

Upon completion of Chemistry 610, graduate students should be able to:

• Apply knowledge obtained in this class to problem solving and critical thinking in the field of Inorganic Chemistry.

•Master Inorganic Chemistry concepts, knowledge, histories

• Understand the direction of future Inorganic Chemistry

• Utilize knowledge gained from this class to perform logic thinking and utilize concepts and theories to predict the properties of common/general Inorganics/Organometallics.

• Grasp the advanced knowledge to characterize inorganic materials and organometallic molecules by physical and spectroscopic means, including IR, Raman, NMR, XPS, XRD, TEM etc.

• Develop the skill set necessary to continue on to further Inorganic Chemistry graduate Research.

Upon completion of Chemistry 412, undergraduate students should be able to:

• Apply knowledge obtained in this class to problem solving and critical thinking in the field of Inorganic Chemistry.

• Master Inorganic Chemistry concepts, histories, knowledge and know the direction of future Inorganic Chemistry

• Utilize knowledge gained from this class to perform logic thinking and utilize concepts and theories to predict the properties of common Inorganics/Organometallics.

• Grasp the advanced knowledge to characterize inorganic materials and organometallic molecules by physical and spectroscopic means, including IR, Raman, NMR, XPS, XRD, TEM etc.

Examinations and Points:

Attendance and class performance: 100 points

In-class quiz/exam: 300 points

Homework: 300 points

Final Exam: 300 points

Total points: 1000points (100%)

Grading: A: 90-100%, B: 80-89%, C: 70-79%, D, 60-69%, F:

Suggested Text book: Robert Crabtree, Edition 6th The Organometallics of Transition Metals

Suggested Text book: Robert Jordan, Reaction Mechanisms of Inorganic and Organometallic systems

Suggested Text book: F. Albert Cotton, Chemical Applications of Group Theory

Other useful course materials: peer reviewed Journal papers in: Journal of American Chemical Society; Inorganic Chemistry; Nature Materials; Energy & Environmental Science

I will teach primarily from the required text, with occasional use of the suggested text, as well as other texts, literature works, internet videos, etc.