

<b>SC/CHEM 4031</b>	<b>3.0</b>	<b>Advanced Inorganic Chemistry</b>
<b>SC/CHEM 5031</b>	<b>3.0</b>	<b>Advanced Transition Metal Chemistry</b>

**Term** Winter 2019

**Location and Time** Lectures TR 10:00 – 11:30 (SLH 107)

**Prerequisite** SC/CHEM 3030 Transition Metal Chemistry

#### **Course Director and Instructor**

Prof. Christopher Caputo

Email: [caputo@yorku.ca](mailto:caputo@yorku.ca)

Phone: ext. 22964

Office: CB 354

Office Hour: T 11:30-12:30

#### **Course Description**

This course is a continuation and builds upon concepts learned in previous level inorganic courses (SC/CHEM 1000-3000). The course emphasizes the use of this knowledge to address issues and solve problems related to synthetic organometallic chemistry. Major approaches and reaction types encountered in organometallic chemistry will be presented. Special focus related to the use of organometallic complexes in industrially relevant topics, such as catalysis, will also be presented.

#### **Purpose and Objectives of this Course**

The purpose of the course is to further expand the knowledge gained in previous introductory inorganic chemistry courses. Particular attention will be paid to the synthetic aspects of organometallic chemistry and mechanistic understanding of reaction chemistry, and how those are being applied in current state-of-the-art chemistry research.

The following topics will be covered over the semester:

- Crystal field and molecular orbital theories
- Classes of ligands and electron counting ( $\sigma$ - and  $\pi$ -ligands)
- Reactivity of metal alkyl complexes
- Metal hydrides
- Characterization of metal complexes
- Metal carbene chemistry
- Catalysis

At the end of the course, the students should be able to:

- 1) Communicate effectively with chemists in the field using proper nomenclature
- 2) Propose reaction procedures to prepare organometallic complexes of interest
- 3) Determine and rationalize the product(s) formed by a reaction on an organometallic complex using sound reaction mechanisms
- 4) Explain which analytical tools can be used to elucidate the chemical structure of complexes and how
- 5) Read, understand and summarize important points from the chemical literature
- 6) Identify important areas of research in the field of inorganic and organometallic chemistry.

### **Organization of the Course**

A number of pedagogical approaches will be used to deliver the course and achieve the objectives. The lectures will be delivered by the Course Director via a combination of written notes and powerpoint support slides. Active participation of the students is required in various ways, including presentations, group problem solving, etc.

Problem sets will be assigned on a regular basis to facilitate learning of the concepts presented in class. The problem sets will be posted on the course Moodle website. Those problem sets will be graded and will be a component of the final grade.

### **Evaluation**

The level of proficiency in the material will be assessed differently whether the student is enrolled in undergraduate level CHEM4031 or in graduate level CHEM5031. The final grade for the course will be based on the following items weighted as indicated.

	CHEM4031	CHEM5031
Problem Sets	10%	5%
Class Participation	10%	10%
Midterm Exam (80 minutes)	20%	15%
Presentation Abstract	5%	5%
Oral Presentation (7 min + 3min Q&A) <sup>1,2</sup>	20%	30%
Evaluation of Presentations	5%	5%
Final Exam (3 hours)	30%	30%

<sup>1</sup>Thirty percent of the grade received for the paper presentation will be assigned by peer undergraduate students.

<sup>2</sup>All chemical structures in the presentation must be drawn using Chemdraw software. This is the industry standard for chemical representation and is available free as a York Student at the following link:

<https://sitesubscription.cambridgesoft.com/#Y>

If you have questions about the installation, please feel free to ask.

No make-up midterm will be available. The corresponding value of the midterm exam will be added to the final exam.

### **Important Dates**

Classes Start – January 3, 2019

Midterm Exam (Tentative) – February 14, 2019

Winter Reading Week (No Classes) – February 16 – 22, 2019

Presentation Abstract (Tentative) – February 28, 2019

Presentations (Tentative) – March 19 – 28, 2019

Last Date to Submit Winter Term Work – April 3, 2019

Classes End – April 3, 2019

Winter Examinations – April 5 – 20, 2019 (Exact final date TBD)

### **Textbooks** (All books have been put on reserve at the Steacie Library)

Much of the course will be based on the following book and is recommended:

Crabtree, R.H. (2014). *The Organometallic Chemistry of the Transition Metals*. 6<sup>th</sup> Ed. Wiley-Interscience Publication. ISBN 978-1-118-13807-6

In addition to this book, reading peer-reviewed papers from chemistry journals will be required from time to time. Links to the electronic copy will be provided. Access to the electronic paper is free, but requires affiliation with the library network of York University. It is the student's responsibility to ensure rights to

use this service. In addition to the book authored by R.H Crabtree, the following textbook also contain some valuable information:

Housecroft, C.E. and Sharpe, A.G. (2012). *Inorganic Chemistry*. 4<sup>th</sup> Ed., Pearson Prentice Hall. ISBN: 9780273742753

### **Supplementary Activities**

Students are **strongly** encouraged to attend all organometallic/inorganic presentations given by internal and invited speakers. Notice is posted throughout the Chemistry Building. The Course Director will bring such seminars to the attention of the class. Students are also strongly encouraged to participate (i.e. ask questions) during the seminars.

### **Email Communications**

Email messages must have CHEM4031/5031 as a subject line. Most course related questions and issues will however be addressed during class. Any administrative questions and issues should be directed to the Undergraduate and Graduate Program Assistants in the Chemistry Building (CB124).

### **Grading Scheme, Assignment Submissions, Lateness Penalties, Academic Integrity**

The grading scheme for the course conforms to the point system used in other undergraduate programs at York. The final grade for the course will be calculated using the grading scheme listed above under "Evaluation".

Proper academic performance depends on students doing their work not only well, but on time. Accordingly, the assignments must be received on the due date specified for the assignment. Assignments are to be handed at class on the due date. Late assignments should be dropped off in my office (CB354). Note that assignments should not be deposited in the Course Director's mailbox.

Assignments received later than 11:30 AM on the due date will be penalized by taking 20% off the maximum allowable grade per 24-hour period of lateness (including Saturdays and Sundays). For example, an assignment is due on Monday at 11:30 AM, but the student turned it in Monday night. The student will automatically lose 20% of the mark. If this assignment was turned in late Saturday afternoon, the result would be no credit (0%) at all. Exceptions to the lateness penalty for valid reasons such as illness, etc. Will be entertained by the Course Director only when supported by written documentation (i.e. a doctor's note).

In addition, students are expected to abide by rules set forth by York University. Any cases of academic misconduct or dishonesty will be treated accordingly. Ignorance of the Policies is not an acceptable excuse and students are strongly encouraged to become familiar with such Policies. The link to the Academic Integrity for Students website is [www.yorku.ca/academicintegrity/students/index.htm](http://www.yorku.ca/academicintegrity/students/index.htm). Students MUST also complete the Academic Integrity Tutorial, if they haven't already done so ([www.yorku.ca/tutorial/academicintegrity/](http://www.yorku.ca/tutorial/academicintegrity/))

Furthermore, students are expected to familiarize themselves with the following information, available on the Senate Committee on Academic Standards, Curriculum & Pedagogy webpage (see Reports, Initiatives, Documents) – <http://secretariat-policies.info.yorku.ca>

- Senate Policy on Academic Honesty and the Academic Integrity Website
- Ethics Review Process for research involving human participants
- Course requirement accommodation for students with disabilities, including physical, medical, systemic, learning and psychiatric disabilities
- Student Conduct Standards
- Religious Observance Accommodation