New Course

Proposal Reference Number : 2642
PRN Alias : 10-11#681
Version No : 6
Submitted By : Dr Audrey Moores-François
Edited By : Ms Josie D'Amico

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	New Data
Program Affected?	N
Program Change Form Submitted?	
Subject/Course/Term	CHEM 512 • one term
Credit Weight or CEU's	3 credits
Course Activities	Schedule Type: A - Lecture; Hours per week: 3 Total Hours per Week : 3 Total Number of Weeks : 13
Course Title	Official Course Title : Catalysis, concepts and app Course Title in Calendar : Catalysis, concepts and applications
Rationale	More than 95% of all manufactured products involve catalysis in at least one step of the fabrication process. At a time when Green Chemistry is emerging as a key frontier for chemistry, catalysis, one of its central tools, is an essential field of chemistry for McGill graduates. Little however is taught in the existing curriculum about the major processes that are involved in the production of industrial chemicals. This involves processes from petrochemical refining all the way to biorefining and fine chemicals. This course will thus fill a pressing need for our students, especially for the many graduate students engaged in research projects involving catalysis. Organic, inorganic and biological chemistry research groups in the Chemistry department will be obvious clientele. In general, this course will expose senior undergraduate and graduate students to important aspects of industrial chemistry, including commodity and pharmaceutical materials. Students will therefore acquire skills that are applicable for future careers in both academic and industrial chemistry.
Responsible Instructor	Audrey Moores
Course Description	General concepts governing catalysis, practical aspects of its implementation and some of its most important applications. A global perspective on industrial catalysis. A general introduction about catalysis will describe this

	concept in a unified fashion. Subsequent lectures will be divided into four sections: homogeneous catalysis, heterogeneous catalysis, organocatalysis, and biocatalysis. Because of the large scope of the course, a limited number of reactions will be selected and described thoroughly. The course will be based on the most recent research efforts made in the field of catalysis.
Teaching Dept.	0287 : Chemistry
Administering Faculty/Unit	SC : Faculty of Science
Prerequisites	CHEM 381 CHEM 302 CHEM 243 Web Registration Blocked? : N
Corequisites	
Restrictions	Course open to U3 undergraduate students and graduate students.
Supplementary Calendar Info	
Additional Course Charges	
Campus	Downtown
Projected Enrollment	30
Requires Resources Not Currently Available	N
Explanation for Required Resources	
Required Text/Resources Sent To Library?	
Library Consulted About Availability of Resources?	
Consultation Reports Attached?	
Effective Term of Implementation	201209
File Attachments	• Chem 512-Proposal-final final version.pdf View
To be completed by the Faculty	
For Continuing Studies Use	

Approvals Summary

CONSULTATION REPORT FORM
RE COURSE PROPOSALS

DATE: November 15, 2011

TO: Professor Dimitrios Berk, Chair
Professor Sasha Omanovic
Department of Chemical Engineering

FROM: Susie Vodopivec on behalf of Prof. Subhasis Ghoshal, Associate Dean - Undergraduate Education, Faculty of Engineering

The attached proposal has been submitted to the Curriculum/Academic Committee, and it has been decided that your department should be consulted.

Course # and Title: CHEM 512 Catalysis, concepts and applications

Please review this proposal and let me know as soon as possible, on this form, whether or not your department has any objections to, or comments regarding, the proposal.

X **NO OBJECTIONS** _____ **SOME OBJECTIONS**

COMMENTS:

Signature: 

Date: 16-Nov-2011

Proposal for a new Undergraduate/Graduate class entitled: "Catalysis, concepts and applications"

Audrey H. Moores – C. J. Li

Facts about the proposed course:

Proposed course number: CHEM 512
Number of credits: 3
Lecture frequency: 1.5 hour twice a week for 13 weeks
Undergraduate Prerequisites: CHEM 381 - CHEM 302 - CHEM 243
Expected enrollment: 30-40 students
Transcript abbreviation: Catalysis, concepts and app

Course description:

General concepts governing catalysis, practical aspects of its implementation and some of its most important applications. A global perspective on industrial catalysis. A general introduction about catalysis will describe this concept in a unified fashion. Subsequent lectures will be divided into four sections: homogeneous catalysis, heterogeneous catalysis, organocatalysis, and biocatalysis. Because of the large scope of the course, a limited number of reactions will be selected and described thoroughly. The course will be based on the most recent research efforts made in the field of catalysis.

Rationale:

More than 95% of all manufactured products involve catalysis in at least one step of the fabrication process. At a time when Green Chemistry is emerging as a key frontier for chemistry, catalysis, one of its central tools, is an essential field of chemistry for McGill graduates. Little however is taught in the existing curriculum about the major processes that are involved in the production of industrial chemicals. This involves processes from petrochemical refining all the way to biorefining and fine chemicals. This course will thus fill a pressing need for our students, especially for the many graduate students engaged in research projects involving catalysis. Organic, inorganic and biological chemistry research groups in the Chemistry department will be obvious clientele. In general, this course will expose senior undergraduate and graduate students to important aspects of industrial chemistry, including commodity and pharmaceutical materials. Students will therefore acquire skills that are applicable for future careers in both academic and industrial chemistry.

Relationship to existing courses

While catalyzed reactions are taught in several undergraduate and graduate courses (such as CHEM 462 and CHEM 612) this course will be designed to focus on the catalyst itself and understand the way it works. The course will also focus on the context of the use and application of catalysts. It will also describe catalysis as a unified concept transcending organic, inorganic and biochemistry, a concept quite unique to this course. Introductory classes will present kinetic and thermodynamic aspects of catalysis. Fundamental kinetic principles are covered in CHEM 575. In the framework of this course we will not focus on

the derivation of the equations, but rather on the implications of these results on fundamental aspects of catalysis.

Course outline

- Introduction (1 week)

-Kinetic and thermodynamic aspects of catalysis

- Homogeneous catalysis (4 weeks)

- Principles of homogeneous catalysis
- Description of important homogeneous processes

- Heterogeneous catalysis (4 weeks)

- Principles of heterogeneous catalysis
- Description of important processes, such as Haber-Bosch, Fisher-Tropsch or asymmetric heterogeneous catalysis and aspects of their economical importance.
- Description of some important catalysts, such as zeolites, nanoparticles and mesoporous inorganic oxides.

- Organocatalysis (1 weeks)

- Principles of organocatalysis
- Description of important processes

- Biocatalysis (1 week)

- Principles of biocatalysis and enzymology
- Description of biocatalytic processes

- Students presentation (2 weeks)

Course outline and potential instructors

Ideally this class should be taught by one or two instructors among Audrey Moores, CJ Li, JP Lumb and Tomislav Friscic. A small number of guest lectures are also envisaged: Karine Auclair, Nicolas Moitessier, Bruce Lennox and Peter Lau.

Marking Scheme:

- In-class quizzes (3-4, 25 min each) **30%**
- Project: students will be asked to do a mini review of the literature on a catalytic reaction. Topics will be proposed
    - Oral presentation **15%**
    - Essay/paper (~5 pages) **15%**
- Final exam for **35%**
- Participation **5%**

References:

There will not be a recommended textbook for this class as none exist which can match the scope of the course. However, the course material will be inspired by some of the following references as well as by recent research literature.

- **Catalysis: Concepts and Green Applications**

Author: Gadi Rothenberg
Publisher: Wiley-VCH; 1st edition (April 22, 2008)

- **Green Chemistry and Catalysis**

Author: Roger Arthur Sheldon, Isabel Arends, Ulf Hanefeld
Publisher: Wiley-VCH (April 24, 2007)

- **Nanoparticles and Catalysis**

Author: Didier Astruc
Publisher: Wiley-VCH (December 18, 2007)
Wiley-VCH (April 24, 2007)

- **Biochemistry**

Author: Donald Voet, Judith G. Voet
Publisher: Wiley-VCH (March 2004)-3rd edition

- **Industrial Organic Chemistry, 5th Edition**

Author: Hans-Jorgen Arpe, translated by Stephen Hawkins
Publisher: Wiley-VCH (November 9, 2010)