Spring 2022

CHE 750-852: Environmental Catalysis

Xianqin Wang

Spring 2022 Academic Calendar

January	17	Monday	Martin Luther King, Jr. Day
January	18	Tuesday	First Day of Classes
January	22	Saturday	Saturday Classes Begin
January	24	Monday	Last Day to Add/Drop a Class
January	24	Monday	Last Day for 100% Refund, Full or Partial Withdrawal
January	25	Tuesday	W Grades Posted for Course Withdrawals
January	31	Monday	Last Day for 90% Refund, Full or Partial Withdrawal, No Refund for Partial Withdrawal after this date
February	14	Monday	Last Day for 50% Refund, Full Withdrawal
March	7	Monday	Last Day for 25% Refund, Full Withdrawal
March	14	Monday	Spring Recess Begins - No Classes Scheduled - University Open
March	19	Saturday	Spring Recess Ends
April	4	Monday	Last Day to Withdraw
April	15	Friday	Good Friday - No Classes Scheduled - University Closed
April	17	Sunday	Easter Sunday - No Classes Scheduled - University Closed
May	3	Tuesday	Friday Classes Meet
May	3	Tuesday	Last Day of Classes
May	4	Wednesday	Reading Day 1
May	5	Thursday	Reading Day 2
May	6	Friday	Final Exams Begin
May	12	Thursday	Final Exams End
May	14	Saturday	Final Grades Due
May		TBA	Commencement

CHE 750: Environmental Catalysis
On-line Course
Spring 2022

Course Time/Location:
Instructor: Xianqin Wang
Lecture Materials will be uploaded to Canvas: https://njit.instructure.com/courses/20795/files

Office Hours: You can ask questions by email (xianqin@njit.edu) or through Canvas anytime. I will try to answer all your questions by every Friday evening if I cannot respond you right away due to other activities. Although this is an online course, you can still meet me in person or through my webex room (https://njit.webex.com/meet/xianqin) by making appointment with me.

Prerequisite(s): Have basic knowledge on Kinetics and Reactor Design, and Transport Phenomena.

Required Materials: The materials covered are mainly from the following text books (you are not required to buy all the three books. But it is better to have one of them)

1. (**CAPC**) Ronald M. Heck, Robert J. Farrauto, Suresh T. Gulati, Catalytic Air Pollution Control, Third Edition, ISBN:9780470275030 |Online ISBN:9781118397749
2. (**ITFS**) Ulf Hanefeld (Editor), Leon Lefferts (Editor) Catalysis: An Integrated Textbook for Students, ISBN: 978-3-527-34159-7 February 2018 384 Pages
3. (**PPHC**) John Meurig Thomas, W. John Thomas; Principles and Practice of Heterogeneous Catalysis, 2nd Edition, ISBN: 978-3-527-31458-4, Feb 2015, 768 pages

Course Description: This course is to introduce students (including MS and PhDs) to the fundamentals of catalysis in abating pollutant emissions and developing future environmentally friendly energy technologies. A review of catalysis fundamentals, including catalyst preparation methods and characterization techniques, and the correlation between structural properties and catalyst activities, will be covered. Density functional theory (DFT) will also be briefly introduced. For Several popular environmental processes including mobile and stationary pollution abatement technologies will be discussed, including automobile catalytic converters, diesel truck emission control, and catalytic abatement of chemical plant emissions. In addition, the use of catalysis for "green" alternative energy processes will also be reviewed including fuel cell systems, bio-fuel production, bio-fuel refining, and CO2 sequestration. each technology, the discussion will cover both the chemistry occurring on the catalyst surface as well as the engineering involved in the overall process.

Course Outcomes (CO): By the end of the course students should be able to:

1. Explain catalysis chemistry and catalytic reactor engineering
2. Understand the modern catalytic pollution abatement and emerging "green" catalytic processes;
3. Know different kinds of catalytic materials and their structural properties
4. Know different kinds of catalyst characterization techniques and data analysis from each technique
5. Understand structural and activity correlations

Assignments:

Homework:

HW work assignments and exam problems will be posted in Canvas. Please submit your assignments to Canvas.

Group/ Individual Project:
You can work alone or form 2-3-person group for the project. Each group will design a creative system or unit using catalytic systems. The project should include a description of the design (draw pictures if necessary) **(written report)**, and be presented to the whole class via **Webex (presentation)**. **The files must to be sent to the instructor one day before the presentation.**

Written report: 15-20 page technical paper on approved topic with overview, presentation of present status and issues, analysis of sustainability options for the future, and references. All pages must be formatted to fit on 8-1/2 by 11 inch paper with no smaller than 12 point font and margins not less than one inch on every side.

Oral presentation: 25 minute formal oral presentation of the topic selected for the term paper plus 5 minutes of Q&A. **The files must be sent to the instructor one day before the presentation.**

Grading:
Homework: 20% (200 pts) (either individual assignment or open discussion)
Group design project: (group/individual effort)
Written report: 20% (200 pts)
Oral presentation: 20% (200 pts)
Midterm exam (take home) 20% (200 pts) (individual effort)
Final exam (take home): 20% (200 pts) (individual effort)

Letter grades will be awarded for the following totals:

A	900 - 000 pts
B+	825 - 899 "
B	750 - 824 "
C+	700 - 749 "
C	650 - 699 "
F less than	650 "

NJIT HONOR CODE: The NJIT honor code is being upheld on all issues related to the course. Students are expected to be familiar with the code and conduct themselves accordingly.

Group activities policy: Each student will be asked at the end of the semester to confidentially rate his/her performance/effort as well as that of all his/her groupmates. This rating will reflect the performance when the members were actually present. The completed evaluation form has to be submitted either as a hard copy in a sealed envelope or as a word-file attached to an e-mail to the instructor. Evaluation forms are due on **reading day. Submissions of forms after the due date but before the final exam will result in a 75% reduction of credit that the student would have received if the form was submitted timely.**

Date	week	Tentative topics	ITFS	CAPC	PPHC
1/18/2022	week1	Introduction	Ch1-4	Ch1.	Ch1. Ch2.
1/24/2022	week2	Catalyst Materials and Preparation	Ch8.	Ch2.	Ch4.
1/31/2022	week3	Catalyst Characterization and Deactivation	Ch6-7	Ch3. Ch5.	Ch3. Ch6.
2/7/2022	week4	Catalyst electronic structure and activity correlation	Ch6-7		Ch5.
2/14/2022	week5	Reactor Design for Environmental Catalysis	Ch5.	Ch4	Ch7.
2/21/2022	week6	Automotive Catalyst		Ch6. Ch7, Ch12	
2/28/2022	week7	Diesel Engine Emission Control		Ch8. Ch9. Ch12.	
3/7/2022	week8	Mid-term exam-take home			
3/14/2022	week9	Spring Break			
3/21/2022	week10	Volatile organic compounds (VOCs control)		Ch11.	
3/28/2022	week11	Gasoline, hydrotreating		notes	
4/4/2022	week12	Other pollution control		Ch13.	
4/11/2022	week13	Fuel Cells and Battery Technology			
4/18/2022	week14	Biofuels		Ch16	notes
4/25/2022	week15	Webex Presentation for the project,written report due		Ch16	notes
5/2/2022	week16	Final exam week-take home			
5/12/2022		final exam due			

ITFS: Catalysis: An Integrated Textbook for Students
CAPC: Catalytic air pollution control
PPHC: Principles and Practice of Heterogeneous Catalysis

HW assignments will be posted in Canvas!