



COLORADO SCHOOL OF MINES

CBEN409 Petroleum Refining Processes Fall Semester 2018

Instructor: John Jechura
Class Hours: T Th 11:00 am – 12:15 pm (AH 140)
Office Hours: To be posted outside of office & by appointment (AH 437)
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Course Description from Bulletin

Application of chemical engineering principles to petroleum refining. Thermodynamics and reaction engineering of complex hydro carbon systems. Relevant aspects of computer-aided process simulation for complex mixtures. Prerequisite: CHGN221, ChEN201, ChEN357, ChEN375, or consent of instructor. 3 hours lecture; 3 semester hours.

Text Book

Petroleum Refining, Technology & Economics, 5th ed.
James H. Gary, Glenn E. Handwerk, & Mark J. Kaiser
CRC Press, 2007

Supplemental Text & Materials

Petroleum Refinery Process Economics, 2nd ed.
Robert E. Maples
PennWell Corp., 2000

Refinery Process Modeling
Gerald Kaes
Kaes Enterprises, 2000

Refinery Engineering, Integrated Process Modeling & Optimization
Ai-Fu Chang, Kiran Pashikanti, & Y.A. Liu
Wiley-VCH, 2012

Petroleum Refining Processes
James G. Speight & Baki Özüim
Marcel Dekker, Inc., 2002

The Chemistry & Technology of Petroleum, 4th ed.
J.G. Speight
Marcel Dekker, Inc., 1991

Fundamentals of Petroleum Refining
M.A. Fahim, T.A. Alsahhaf, A. Elkilan
Elsevier, 2010

Petroleum Processing Handbook
John J. McKetta, ed.
Marcel Dekker, Inc., 1992

Handbook of Petroleum Refining Processes, 3rd ed.
Robert A. Meyers, ed.
McGraw-Hill, 2004

Petroleum Refining in Nontechnical Language, 4th ed.
W.L. Leffler
PennWell, 2008

Refining Overview — Petroleum, Processes, & Products
Freeman Self, Ed Ekholm, & Keith Bowers
CD, South Texas Section AIChE, 2000

Course Objective

The objective of this course is to acquaint the student with the engineering & business fundamentals associated with petroleum refining.

- Emphasis will be placed on developing a basic understanding of petroleum chemistry with applications to process design & analysis of typical refinery operations. Understanding how to use crude oil assays will play a key part in the class.
- Simulation software for crude oil characterization, fractionation, & refining unit operations will be utilized.
- The impact of government mandates and rules & emission legislation on refinery operations, process design, and products (reformulated gasolines, etc.) will be covered.

Topics

- Petroleum refining overview
- Refinery feedstocks & products
 - Crude oil assays
 - Product specifications
 - Petroleum specific properties & supporting calculations
- Overview of separation & conversion technologies
 - Crude distillation complex
 - Coking
 - Other “bottom of the barrel” technologies
 - Catalytic cracking
 - Hydrotreating & hydrocracking
 - Reforming, isomerization, & alkylation
- Overview & usage of HYSYS/Aspen Plus
- Supporting processes
 - Hydrogen production via methane reforming
 - Acid gas separation
 - H₂S to sulfur
- Blending & Optimization
- Future?
 - New feed stocks
 - Government mandates – Alternative & bio fuels
 - Clean Air Act & Renewable Fuel Standards impacts
 - Current biofuels

Grading Policies

Safety Topic	(-10% to 0%)
Homework	35%
Short Quizzes	30%
Mid-Term Exams	0%
Final Exam	20%
Simulation Project	15%

The only formal exam will be given during the Final Exam week. If the student is unable to take the exam during this scheduled period then he/she must make special arrangements with the instructor to take the exam prior to the scheduled time.

There will be 6 to 10 short quizzes given throughout the semester. The quizzes will be 10 minutes in length and given at the very beginning of the class. Quizzes will be unannounced. There will be no make-up quizzes. It will be up to the discretion of the instructor to excuse an absent student from a particular quiz. To be eligible for an excused absence the student must notify the instructor of the absence via email before the class period.

There will be about 8 to 12 homework assignments. Homework will be announced at least one week before it is due. Homework will be due by 9:00 pm on the due date and is to be emailed to the instructor. Late homework will not be accepted.

There will be one special project. A set of simulations (ASPEN Plus or HYSYS) will be used to answer engineering-type questions concerning crude oil distillation. Students may work in groups to do the simulation work, but each individual will be responsible for his/her own report.

Class will begin with a short safety topic. Each student will be responsible to provide at least one topic during the semester. Doing so will provide the credit toward this grade.

Policy on academic integrity/misconduct

The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining and fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every student's academic achievements, and giving credence to the university's educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times.

Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization, or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.

The complete policy is [online¹](#).

Disability support statement

The Colorado School of Mines is committed to ensuring the full participation of all students in its programs, including students with disabilities. If you are registered with Disability Support Services (DSS) and I have received your letter of accommodations, please contact me at your earliest convenience so we can discuss your needs in this course. For questions or other inquiries regarding disabilities, I encourage you to visit disabilities.mines.edu for more information.

Discrimination, Harassment and Title IX

All learning opportunities at Mines, including this course, require a safe environment for everyone to be productive and able to share and learn without fear of discrimination or harassment. Mines' core values of respect, diversity, compassion, and collaboration will be honored in this course and the standards in this class are the same as those expected in any professional work environment. Discrimination or harassment of any type will not be tolerated. As a participant in this course, we expect you to respect

¹ http://inside.mines.edu/UserFiles/File/PoGo/Policies/STU/STU_Academic_Integrity_August2016.pdf

your instructor and your classmates. As your instructor, it is my responsibility to foster a learning environment that supports diversity of thoughts, perspectives and experiences, and honors your identities. To help accomplish this:

- Course rosters are provided to the instructor with the student's legal name. I will honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.
- If something is said or done in this course (by anyone, including myself) that made you or others feel uncomfortable, or if your performance in the course is being impacted by your experiences outside of the course, please report it to:
 - Me (if you are comfortable doing so)
 - Wellness Center- Counseling (<https://www.mines.edu/counseling-center/>)
 - Speak Up (<https://www.mines.edu/speak-up/>)- Anonymous Option

In this course, we will cultivate a community that supports survivors, prevents interpersonal violence, and promotes a harassment free environment. Title IX and Colorado State law protects individuals from discrimination based on sex and gender in educational programs or activities. Mines takes this obligation seriously and is committed to providing a campus community free from gender and sex-based discrimination. Discrimination, including sexual harassment, sexual violence, stalking, and domestic violence, is prohibited and will not be tolerated within the Mines campus community. If these issues have affected you or someone you know, you can access the appropriate resources here: <http://www.mines.edu/title-ix/>. You can also contact the Mines Title IX Coordinator, Karin Ranta-Curran, at 303-384-2558 or krcurran@mines.edu for more information.

It's on us, all of the Mines community, to engineer a culture of respect.