CBEN409 Petroleum Refining Processes
Fall Semester 2017

Instructor: John Jechura
Class Hours: T Th 11:00 am – 12:15 pm (AH 140)
Office Hours: T Th 10:00 – 11:00 am & by appointment
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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 Özüm
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. Alshahaf, A. Elkilan
Elsevier, 2010

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

Robert A. Meyers, ed.
McGraw-Hill, 2004

W.L. Leffler
PennWell, 2008

Refining Overview — Petroleum, Processes, & Products
Freeman Self, Ed Ekhom, & 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

<table>
<thead>
<tr>
<th>Safety Topic</th>
<th>(-10% to 0%)</th>
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<tbody>
<tr>
<td>Homework</td>
<td>30%</td>
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<tr>
<td>Short Quizzes</td>
<td>30%</td>
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<tr>
<td>Mid-Term Exams</td>
<td>0%</td>
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<tr>
<td>Final Exam</td>
<td>25%</td>
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<tr>
<td>Simulation Project</td>
<td>15%</td>
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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 also 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 a set 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 [online](#).

**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](http://disabilities.mines.edu) for more information.