

HL 249

Heavy Oil Upgrading & Process Optimization

3 Credits

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HL 249 Version: 4



Heavy Oil Upgrading & Process Optimization

Calendar Description

Upgrading oil sands and heavy oil is an essential part of oil sands development as it adds tremendous value to the raw resource. It allows it to be further processed into fuels and lubricants at existing refineries and used as feedstock in petrochemical plants. The process results in various hydrocarbon products that can be blended together or sold or used separately. The final product of upgrading, known as synthetic crude oil or upgraded crude oil, can be used by many refineries as a replacement for conventional light, sweet crude oil.

Rationale

This is a required course for the Heavy Oil Power Engineering program. This course provides the students a starting point to understanding the oil upgrading process in industry. Currently the most common unit operation for heavy oil upgrading is a refinery process, the coker. A coker operates on the principle of thermal “cracking,” which converts large hydrocarbon molecules into smaller, more useful molecules by removing carbon while rearranging the chemical bonds of the original molecules. Cokers and other petroleum processes employ carbon rejection, wherein carbon is removed from the hydrocarbon molecules as coke in order to produce smaller, more valuable liquid hydrocarbon molecules. The upgrading process converts heavy oil to high quality light oil that is low in sulphur and nitrogen and creates sellable by-products such as coke, sulphur and butane. The need for light oil produced from the upgrading process is in ever growing demand, Lakeland students, will come out with the knowledge base to play an important role in this fast growing industry.

Prerequisites

HL 119, HL 129, HL 139, and HL 149

Co-Requisites

None

Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. be familiar with the Upgrading Process.
2. construct a knowledge base in the byproducts of Coke and sulphur produced.
3. illustrate a base understanding of the Hydrogen use in upgrading.
4. implement a strong safety awareness of the dangers in upgrading.

Resource Materials

Required Text(s):

Course handout and course slides

Reference Text(s):

None

Conduct of Course

Course topics are covered in lecture form using the smartboard, whiteboard and PowerPoint presentations to enlarge upon each point of information. Whenever practical, hands on projects are used to make the learning as real as possible. Flow simulators allow students to see process and equipment use first hand. Students are encouraged to discuss each subject and to share prior field knowledge and understanding. Assignments and lecture quizzes extend learning and evaluate progress.

Evaluation Procedures

Learning is assessed in the following activity areas:

Quizzes and assignments	10%
Midterm exam	20%
Final Project	15%
Final Exam	45%
Lab	10%
Total	100%

The value of each assignment is set by the instructor prior to the evaluation. In setting the value, the instructor considers length, depth, and complexity of the assignment.

A penalty is normally applied to late assignment work.

Grade Equivalents and Course Pass Requirements

A minimum grade of C+ is required to pass this course.

Letter	F	C+	B-	B	B+	A-	A	A+
Percent Range	0-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Attendance

Students must attend classes on time and as scheduled. Attendance is recorded at each session. Students must maintain a 90% hourly attendance record in this course.

Course Units/Topics

1. Safety
 - List of hazards in each process unit
 - Implementing safety in the workplace
 - Upgrader Safety and Environmental Issues
2. Crude separation
 - Desalting
 - Distillation
3. Hydrocracking and H-Oil Fractionation
4. Coking:
 - Delayed Coking
 - Coke drum/process/cutting/storage & handling
 - Fractionation
 - Fluid Coking
 - Flexi Coking
5. Gas Recovery Process
 - Compression section
 - Fractionation and Gas Absorption
6. Hydrotreating process
7. Sulfur Recover

- Sulfur and the environment
 - Sour water stripping
 - Amine regeneration
 - Clause Process
 - Scott process
8. Hydrogen Plant
- Steam Methane Reforming
 - Hydrogen purification
 - Compression
 - Distribution and Uses



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