

**HL 239**  
**SAGD Operations**

**3 Credits**

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Created: 26/03/2012

Revised: 10/09/2018

Approval: 06/02/2019

The Implementation Date for this Outline is 13/08/2018

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## HL 239 Version: 5



## SAGD Operations

### Calendar Description

Steam Assisted Gravity Drainage (SAGD) is an enhanced oil recovery technology for producing heavy crude oil and bitumen. It is an advanced form of steam stimulation in which a pair of horizontal wells are drilled into the oil reservoir, one a few metres above the other. SAGD is used to recover heavy oil that is too deep to mine. The Canadian oil sands have many SAGD projects in progress, since this region is home of one of the largest deposits of bitumen in the world. Understanding SAGD opens a variety of options in the student's future as power engineers.

### 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 industry in Canada that has been development of one of the most important new oil production concepts of the last thirty years; SAGD. Gravity drainage has gone from a marginally-understood approach to the most rapidly growing production methods in the world. The promise: economically unlocking one trillion barrels of viscous oil worldwide. How did gravity drainage suddenly become so important? The Alberta Government invested massively in co-development of technologies with industry in the last 25 years of the 20th century, and one of the key investments was full-scale steam-assisted gravity drainage (SAGD). This is one of the largest growing industries in the world, demanding power engineers of all certificates, the students of Lakeland College will come out one step ahead.

### 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. compile an understanding and familiarity with the SAGD Process.
2. explain in operator terms the SAGD Field Process (Steam Injection).
3. interpret in focused terms the Process and water treatment areas of a SAGD plant.
4. illustrate in depth knowledge of Safety and Environmental practices.

## Resource Materials

### *Required Text(s):*

Course slides

### *Reference Text(s):*

None

## Conduct of Course

Course topics are covered in lecture form using the smartboard, whiteboard, and PowerPoint presentations. 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:

Assignment	5%
Final Project	15%
Lab	10%
Midterm exam	20%
Online quizzes	10%
Final exam	40%
Total	100%

## 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 all classes on time as posted. Attendance is recorded at each session. Students must maintain a 90% hourly attendance in this course.

### Course Units/Topics

1. Introduction
  - a. World oil deposits (heavy oil/bitumen)
  - b. Production estimates (current and future projection)
2. PVT (Pressure-Volume- Temperature) Properties
  - a. Properties related to oil/gas production: bubble point pressure, etc.
  - b. Phase behavior of hydrocarbons
  - c. Darcy equation
3. SAGD Process
  - a. SAGD fundamentals
  - b. History and application: Where it started and where it is used
  - c. Importance to oil and gas industry
  - d. Factors controlling the performance of SAGD
  - e. Future of SAGD
  - f. How to improve SAGD (Solvent + SAGD): current trend
  - g. Simulation of SAGD (basics)
  - h. Components of SAGD process (diagram and brief Introduction)
  - i. Steam Distribution methods
  - j. Hotspots, cold spots
  - k. Temperature and pressure monitoring

- l. Pumping techniques (gas lift, PC pump, recip)
  - m. Pump landing depth
  - n. Screen plugging and unplugging
  - o. Process flow diagrams
  - p. De-oiling and oil process (videos)
  - q. How to operate a SAGD plant
  - r. PLW Exchanger Fouling
  - s. Emerging Technologies
  - t. Evaporators
    - i. Oil production and de-oiling
4. Drilling (specific to SAGD)
    - a. Producer and injector drilling
    - b. Logging and coring
  5. Oil/Water Treatment and Surface Facilities
    - a. De-oiling process and equipment
    - b. Pumping Systems
  6. Economics & Royalties
    - a. Project economics
    - b. Royalty regimes/breaks
  7. Safety and Environmental practices
    - a. Water reuse – Expand this topic



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