

## **PET E 478 Thermal Methods in Heavy Oil Recovery**

**Winter 2025 - January 06 to April 09**

Class time: Tuesday, Thursday 11:00-12:20      Location: GSB 5-53

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### **Instructor:**

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6-273

Office Hours: Booking via Email

### **Course Description:**

\*3 (fi ) (either term, 3-0-0) A design course covering new developments in the area of heavy oil recovery. Will include modeling and designing heavy-oil recovery applications and thermal methods.

**Prerequisites:** PET E 295 or PET E 373

**Course synchronous and asynchronous content delivery schedule:**

### **Land Acknowledgment:**

The University of Alberta respectfully acknowledges that we are situated on Treaty 6 territory, traditional lands of First Nations and Métis people.

### **TA Information:**

Nana Yaw Kwarteng-Kumi

nkwarten@ualberta.ca

### **Course Objectives & General Content:**

This is a design course covering new developments in the area of heavy oil recovery. It will include modeling and designing heavy-oil recovery applications and thermal methods. All the course lectures will be delivered in person. The course is an important fourth-year course dedicated to applying the knowledge learned in the past academic years to carry out real-world designs of heavy oil recovery processes. It is an essential course in the petroleum engineering program offered at the University of Alberta since heavy oil takes the largest share in the oil produced in Alberta.

### **Learning Outcomes:**

By the end of this course, students should be able to:

1. Identify the major differences in the recovery mechanisms between steam flooding, cyclic steam stimulation and steam assisted gravity drainage
2. Analyze the phase behavior and physical properties of water, heavy oil and their mixtures
3. Select the most appropriate recovery method for a given heavy oil reservoir based on the reservoir properties
4. Analytically model steam flooding process and apply the analytical models in preliminary engineering design
5. Analytically model cyclic steam stimulation process and apply the analytical models in preliminary engineering design
6. Analytically model steam assisted gravity drainage and apply the analytical models in preliminary engineering design
7. Design steam flooding process for heavy oil recovery
8. Design cyclic steam stimulation process for heavy oil recovery
9. Design steam assisted gravity drainage process for heavy oil recovery
10. Design a thermal recovery process that maximizes the net present value

**Marking Scheme:**

<b>Activity</b>	<b>(A)Synchronous</b>	<b>Due/Scheduled</b>	<b>Weight</b>
Four assignments	Asynchronous	TBA	15%
Midterm exam (1.5 hours)	Synchronous	Feb 13 (In Class)	10%
Open-ended design project	Asynchronous	11 PM April 9	40%
Final exam	Synchronous	TBA	30%
Attendance			5%

The deferred exam for this course will be held on May 10, 2025 or May 17, 2025.

The Faculty recommended grade point average for a 400 level course is 3.1. Instructors have the leeway to deviate from this average and can assign grades based on their own scheme. All grades are approved by the department chair (or delegate). The office of the Dean has final oversight on all grades.

**Term Work**

All term work solutions will be posted no later than the last day of classes. All term work will be returned to students by the final day of classes, with the exception of major term work due in the last week of classes. The latter will be returned by the day of the final examination or the last day of the examination period if there is no final examination in the course as per university policy; instructors will make accommodations to return these term work. It is the responsibility of the student to pick up all their term work at the specified time and place. Any unreturned term work, shall be retained and then shredded six months after the deadline for reappraisal and grade appeals. Final examinations will be kept for one year as required by

university guidelines and the Government of Alberta's Freedom of Information and Protection of Privacy Act.

### **Calculator Policy**

Approved programmable or approved non-programmable calculators are permitted in examinations. Any calculator taken into an examination must have a sticker identifying it as an acceptable programmable calculator (green sticker) or non-programmable calculator (gold sticker). Students can purchase calculators at the University Bookstore with the stickers already affixed. Calculators purchased elsewhere can be brought to the Student Services where the appropriate sticker will be affixed to the calculator.

### **Expectations for AI use**

In this course, we commit to AI use guided by ethical and transparent principles. While students are allowed to use advanced automated tools (such as ChatGPT or Dall-E 2) for certain written assignments, it is crucial to adhere to the following guidelines:

Seek prior approval from the instructor for AI use in specific assignments.

When allowed, clearly attribute and cite any AI-generated content in your work, including prompts and AI outputs as part of your academic record. Include an additional reflection component in your assessments, discussing how AI tools contributed to your learning process.

**IMPORTANT:** Please note that AI use is strictly prohibited in assessments and assignments not approved by the instructor. Failure to abide by this guideline may be considered an act of cheating and a violation as outlined in the relevant sections of University of Alberta (November 2022) [Code of Student Behaviour](#) .

### **Text and References (Recommended):**

Students are not required to buy textbooks. The lecture notes cover contents mostly from the following books and some journal articles:

1. Roger M. Butler's "Black Book": Thermal Recovery of Oil and Bitumen. Prentice-Hall, Inc. 1991.
2. Green D.W.; Willhite G.P.: Enhanced Oil Recovery. SPE Textbook. 2018. The digital version of this book is available from the UofA library.

### **Website:**

eClass

### **Previous Examples of Evaluative Materials:**

Previous midterm exam papers will be provided to the students prior to the midterm.

*Did you know that the University of Alberta has various low-to-no-cost services to help students succeed? Visit <http://www.deanofstudents.ualberta.ca/> for information about the academic, wellness, and various other support services available to U of A students. It's never too early or too late to seek help!*

- Lecture 1 Overview of Thermal Recovery Methods
- Lecture 2 Thermal Properties of Water, Heavy Oil and Reservoir Rocks
- Lecture 3 Heat Conduction within Solids
- Lecture 4 SAGD Design
- Lecture 5 Steam Flooding Design
- Lecture 6 Heat Losses during Steam Injection

## University and faculty policies



### Respect and professionalism



The Faculty of Engineering is committed to fostering and protecting an equitable, inclusive, and respectful work and study environment in line with University of Alberta policies and professional engineering industry standards.

The faculty prepares students to uphold industry standards to become a Professional Engineer (P.Eng). Therefore, respect, professionalism, and accountability must be upheld within the Faculty of Engineering and the University of Alberta.

### Academic integrity and student conduct

The University of Alberta is committed to the highest standards of academic integrity and honesty, as well as maintaining a learning environment that fosters the safety, security, and the inherent dignity of each member of the community, ensuring students conduct themselves accordingly. Students are expected to be familiar with the standards of academic honesty and appropriate student conduct, and to uphold the policies of the University in this respect.

Students are particularly urged to familiarize themselves with the provisions of the [Student Academic Integrity Policy](#) and the [Student Conduct Policy](#), and avoid any behaviour that could

potentially result in suspicions of academic misconduct (e.g., cheating, plagiarism, misrepresentation of facts, participation in an offence) and non-academic misconduct (e.g., discrimination, harassment, physical assault). Academic and non-academic misconduct are taken very seriously and can result in suspension or expulsion from the University.

All students are expected to consult the [Academic Integrity website](#) for clarification on the various academic offences. All forms of academic dishonesty are unacceptable at the University. Unfamiliarity of the rules, procrastination or personal pressures are not acceptable excuses for committing an offence. Listen to your instructor, be a good person, ask for help when you need it, and do your own work – this will lead you toward a path to success. Any academic integrity concern in this course will be reported to the College of Natural and Applied Sciences. Suspected cases of non-academic misconduct will be reported to the Dean of Students. The College, the Faculty, and the Dean of Students are committed to student rights and responsibilities, and adhere to due process and administrative fairness, as outlined in the [Student Academic Integrity Policy](#) and the [Student Conduct Policy](#). Please refer to the policy websites for details on inappropriate behaviours and possible sanctions.

The College of Natural and Applied Sciences (CNAS) has created an [Academic Integrity for CNAS Students](#) eClass site. Students can self-enroll and review the various resources provided, including the importance of academic integrity, examples of academic misconduct & possible sanctions, and the academic misconduct & appeal process. Students can also complete assessments to test their knowledge and earn a completion certificate.

*"Integrity is doing the right thing, even when no one is watching."* – C.S. Lewis

The Faculty of Engineering expects an environment free of harassment, discrimination, and bullying. We encourage you to talk to the [Office of Safe Disclosure and Human Rights](#) about experiences, questions, or concerns. Additional resources and support for students are attached below.

Engineering students studying in the province of Alberta must also follow the [Code of Ethics](#) set by the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

Course outline policies, course requirements, evaluation and grading information can be found in the [University Calendar](#).



## Safety during learning activities



In all Faculty of Engineering courses, labs, seminars or other learning activities, safety is of paramount importance. In some cases, laboratory work in a program requires high standards for risk management to keep potential hazards safely under control.

Anyone found to be unable to function safely in the class, lab, seminar or other learning activity may be asked to leave or be removed for their and the safety of other participants and instructors in alignment with the [Student Academic Integrity Policy](#) and [Student Conduct Policy](#). As members, or prospective members, of the engineering profession, it is your responsibility to identify and inform the proper authorities of unsafe work.

## Audio and video recording



Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan.

Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

Only those items specifically authorized by the instructor may be brought into the exam facility. Students must not bring any unauthorized electronic device into an examination room, including cell phones or other devices.



# Student services and support

## Health & Wellness Support

### Counselling and Clinical Services

Free, short-term, appointment-based counselling and psychiatric services. Also offers drop-in workshops. Book an initial consultation. Visit [uab.ca/CCS](http://uab.ca/CCS) to learn more.

### Wellness Supports Social Workers

Free one-on-one support for students in the areas of housing, finances, academics, personal wellness, life skill development, family dynamics, system navigation, and any area of life where there is a desire to invite change. Visit [uab.ca/wellness](http://uab.ca/wellness) to learn more.

### Sexual Assault Centre

Free, anonymous, and confidential drop-in counselling. Visit [uab.ca/UASAC](http://uab.ca/UASAC) to learn more.

### The Office of Safe Disclosure & Human Rights (OSDHR)

The OSDHR advises confidentially on sensitive issues you may not feel comfortable solving on your own. Contact the OSDHR if you want to get help or to make a report while keeping your privacy. Visit [uab.ca/OSDHR](http://uab.ca/OSDHR) to learn more.

### HIAR (Helping Individuals at Risk)

If you're worried about someone, contact HIAR, who can help assess risk and connect individuals to support. Learn more at [uab.ca/HIAR](http://uab.ca/HIAR).

### Immediate External Supports

Health Link Alberta: 811  
Suicide Crisis Helpline: 988



## Academic support



### Academic Success Centre

Access to a variety of services to maximize your academic success. Learn more at [uab.ca/ASC](http://uab.ca/ASC).



### Accessibility Resources

Connects students with disabilities to accommodations. Learn more at [uab.ca/Access](http://uab.ca/Access) under accommodations + accessibility.



### Decima Robinson Support Centre

Academic support for 100- or 200-level introductory calculus, linear algebra and statistics courses. Visit [uab.ca/DSC](http://uab.ca/DSC) to learn more.



### Engineering Student Success Centre

The Faculty of Engineering provides drop-in tutoring for first-year courses. Visit [uab.ca/ESSC](http://uab.ca/ESSC) to learn more.



### Office of the Student Ombuds

Call for complex problems and conflict mediation. Learn more at [uab.ca/ombuds](http://uab.ca/ombuds).



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## Financial support



### **Student Service Centre**

For awards and other funding support. Learn more at [uab.ca/ask](https://uab.ca/ask).



### **Campus Food Bank**

The Campus Food Bank Society is an independent charity supporting University of Alberta students, faculty, staff, and alumni for up to five years. For additional information visit their website at [campusfoodbank.com](https://campusfoodbank.com).

