PET E 275 Petroleum Reservoir Fluids

Fall 2024 - September 03 to December 09

Class time: Tuesday, Thursday 12:30-13:50 Location: NRE 2-020

Instructor:

Shanshan Yao, PhD
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shansha3@ualberta.ca
Donadeo Innovation Centre For Engineering 7-324
Office Hours: By appointment

Course Description:

*3.8 (fi) (either term, 3-0-3/2) Qualitative and quantitative phase behavior of petroleum reservoir fluids through the algebraic and numerical application of thermodynamic theory, equations of state, and empirical correlations. Determination of engineering PVT parameters. Oilfield waters. Introduction to mass transfer.

Prerequisites: CHEM 105

Course synchronous and asynchronous content delivery schedule:

Land Acknowledgment:

The University of Alberta acknowledges that we are located on Treaty 6 territory, and respects the histories, languages, and cultures of First Nations, Métis, Inuit, and all First Peoples of Canada, whose presence continues to enrich our vibrant community.

TA Information:

Mohammadamin Rashidi (mrashidi@ualberta.ca)
Ying Zhou (yzhou3@ualberta.ca)

Lab Sections:

Section	Day	Time	Location
LAB D11	Monday	14:00 - 16:50	NRE 2-052
LAB D12	Monday	14:00 - 16:50	NRE 2-052
LAB D21	Tuesday	14:00 - 16:50	NRE 2-052
LAB D22	Tuesday	14:00 - 16:50	NRE 2-052
LAB D51	Friday	14:00 - 16:50	NRE 2-052
LAB D52	Friday	14:00 - 16:50	NRE 2-052

Course Objectives & General Content:

At the end of this course the students should be able to infer the physical properties of petroleum reservoir fluids underground as accurately as possible from what is available of the (usually limited) data.

Learning Outcomes:

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

1. Name and draw the chemical structures of complex organic compounds in petroleum fluids.
2. Name and classify the five types of petroleum reservoir fluids.
3. Read various types of phase diagrams (pressure-temperature, pressure-volume, and pressure-composition) and correlation charts correctly, in particular, the Cox chart, the Standing Katz chart, Suttons correlation, the Stiff diagram.
4. Understand and use the concepts of pseudo-critical and pseudo-reduced properties of natural gases.
5. Use the compressibility equation of state to determine the phase behavior of the reservoir fluids and/or deduce the physical properties of interest, such as the z-factor, fluid density, fluid compressibility, fluid viscosity and specific gravity of the fluids.
6. Analyze the data of reservoir fluid studies, in particular constant composition expansion, differential liberation and separator test experiments.
7. Determine which correlation equation(s) to use based on the available information / data, and apply them correctly to obtain key parameters such as the formation volume factors, solution gas-oil ratios and the coefficient of isothermal compressibility.
8. Determine the major physical properties of oilfield brines.
9. Use experimental apparatus and methods to measure the properties of petroleum fluids, including viscosity and density and obtain their phase behavior.
10. Infer the physical properties of petroleum reservoir fluids underground, as accurately as possible, from the usually limited available data.

Marking Scheme:

Activity	(A)Synchronous	Due/Scheduled	Weight
Lecture Attendance			5%
Homework Assignments		Due one week after they are announced	15%
Laboratory Activity and Reports		Scheduled	25%
Midterm Exam		TBA	20%
Final Exam		TBA	35%

The Faculty recommended grade point average for a 200 level course is 2.8. 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

There is no calculator policy in this course; students are free to use the calculator they wish for all assessments.

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 (Mandatory):

Course notes (on eClass)

Text and References (Recommended):

William D. McCain, Jr. “The properties of Petroleum Fluids”, 3rd Edition Pennwell Publishing Company (2017)
The 2nd Edition also works.

Lab Information:

Lab Topic	Date
Lab 1: Properties of Petroleum Fluids	
Lab 2: Rolling Ball Viscometer	
Lab 3: Phase Behaviour: Single Component Study Using PVT Simulator	
Lab 4: Phase Behaviour: Saturation Pressure of a Binary System Using PVT Simulator	

Students will undergo lab specific safety training as a part of this course and are expected to follow appropriate lab safety procedures at all times.

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!

Course Contents & Tentative Schedule

1. **Course Introduction, Units & Errors** (1 Session)
2. **Topic 1** Organic Chemistry (3 Sessions)
3. **Topic 2** Phase Behavior (3 Sessions)
4. **Topic 3** Equations of State (2 Sessions)
5. **Topic 4** The Five Reservoir Fluids (1 Session)
6. **Topic 5** Properties of Dry Gases (2 Sessions)
7. **Topic 6** Properties of Black Oils (8 Sessions)
8. **Topic 7** Properties of Oil Field Waters (2 Sessions)
9. **Topic 8** Gas Hydrates (1 Session)

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

All students are expected to follow the University of Alberta's Student Code of Behaviour and Student Conduct Policy. The faculty 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 Code of Behaviour 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 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 to learn more.

Sexual Assault Centre

Free, anonymous, and confidential drop-in counselling. Visit uab.ca/UASAC to learn more.

The Office of Safe Disclosure & Human Rights (OSDHR)

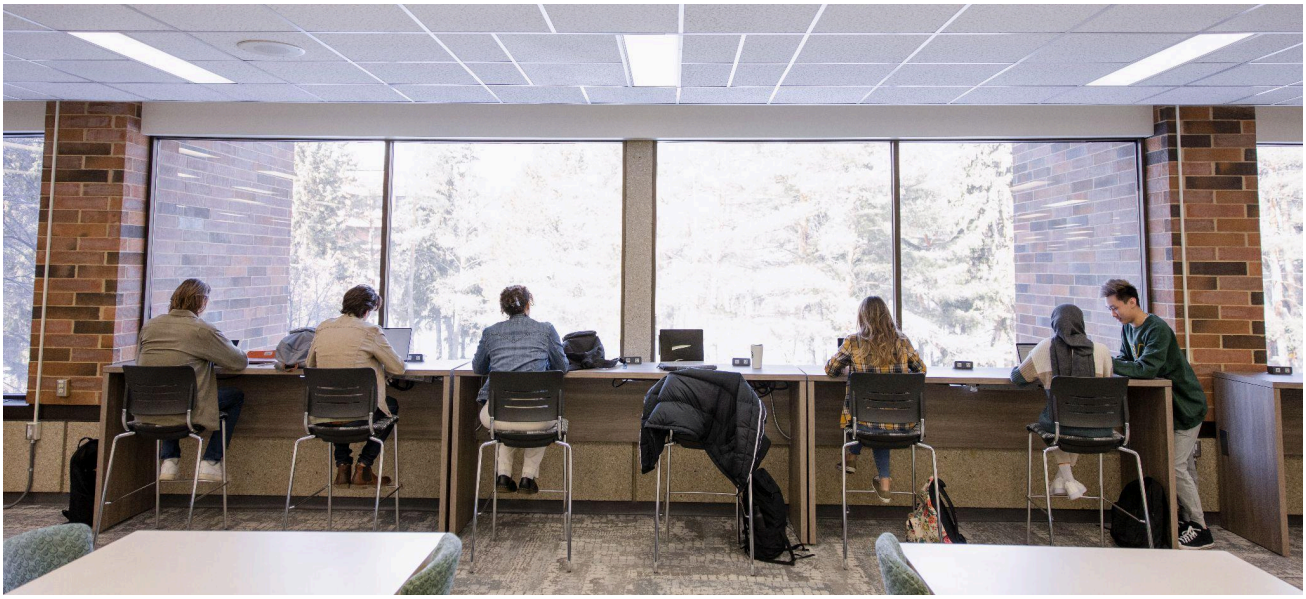
The OSDHR advises confidentially on sensitive issues you may not feel comfortable solving on your own. Contact the OSDHR if you want to get help or to make a report while keeping your privacy. Visit uab.ca/OSDHR to learn more.

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.

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.

Accessibility Resources
Connects students with disabilities to accommodations. Learn more at 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 to learn more.

Engineering Student Success Centre
The Faculty of Engineering provides drop-in tutoring for first-year courses. Visit uab.ca/ESSC to learn more.

Office of the Student Ombuds
Call for complex problems and conflict mediation. Learn more at uab.ca/ombuds.

UNIVERSITY OF ALBERTA

Financial support

Student Service Centre

For awards and other funding support. Learn more at 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.