PET E 476 Well Completion and Stimulation

Fall 2024 - September 03 to December 09

Class time: Monday, Wednesday, Friday 13:00-13:50 Location: NRE 2-127

Instructor:

Huazhou Li, PhD, P.Eng

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Donadeo Innovation Centre For Engineering 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 well engineering. Will include construction, completion, and stimulation of oil/gas wells. Co-requisite: PET E 364

Course synchronous and asynchronous content delivery schedule:

Land Acknowledgment:

The University of Alberta respectfully acknowledges that we are located on Treaty 6 territory, a traditional gathering place for diverse Indigenous peoples including the Cree, Blackfoot, Métis, Nakota Sioux, Iroquois, Dene, Ojibway/ Saulteaux/Anishinaabe, Inuit, and many others whose histories, languages, and cultures continue to influence our vibrant community.

TA Information:

Vishnu Jayaprakash (jayapra1@ualberta.ca)

Course Objectives & General Content:

The course is designed to teach students how to properly design the completion and stimulation scheme of a given well in a safe and economic manner. The course will also cover how to design wells that comply with the directives from local jurisdictions (Alberta Energy Regulator in Alberta). It is a fourth year design course that plays an important bridging role in the petroleum engineering program. It fills the gap between drilling engineering courses and production engineering courses.

Learning Outcomes:

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

1. Compare and contrast different well completion methods and identify the most appropriate method for completing a given well considering the on-site environmental conditions.
2. Determine tubing/packer forces considering various downhole temperature and pressure conditions.

3. Determine optimum perforation size and density for a maximum production performance (i.e. minimize perforation related skin factor and increase production rate)

4. Apply design procedures for executing hydraulic fracturing treatment.

5. Determine the formation pore pressure and fracture pressure gradient of various formations anticipated to be drilled during the construction of a well.

6. Determine the casing setting depth for a planned well construction.

7. Determine composition of casing string (i.e. weight, grade and length of each casing section) considering anticipated collapse, burst and tensile loads such that selected composition will be safe and economic.

8. Determine the cement slurry composition, density, and volume required for the cementing job, and provide the hydraulic design (i.e. determine flow rate, frictional pressure losses, surface injection pressure, effective bottom hole pressure, etc.) of the cement circulation.

9. Design by selection the most appropriate screen size, slotted liner size, and gravel size for effective sand control.

10. Design, as part of a major team open-ended project, a well construction program for a planned well, which includes designing all aspects of casing, cementing and tubing characteristics such that the roposed project will be safe, economic and have the minimum environmental impact.

Marking Scheme:

Activity	(A)Synchronous	Due/Scheduled	Weight
Attendance	Asynchronous	Signature required for each class	5%
Open-ended design project	Asynchronous	11:55 PM, Dec 9	35%
Quiz (5 or 10 multiple choice questions for each quiz)	Synchronous	TBA (around 5 quizzes in total)	15%
Assignments (4)	Asynchronous	TBA	15%
Final Exam	Synchronous	1-4 PM Dec 17	30%

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

Only approved non-programmable calculators are permitted in examinations. Any calculator taken into an examination must have a sticker identifying it as an acceptable 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):

Bourgoyne et al. Applied Drilling Engineering. SPE, 1991.
Economides et al. Petroleum Production Systems. Prentice Hall, New Jersey, USA, 1994.
Bellarby, J. Well Completion Design. Elsevier, 2009.

Website:

eClass

Previous Examples of Evaluative Materials:

Previous quiz examples will be provided.

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 OUTLINE

- Introduction
- Lecture 1 Well Completion Methods
- Lecture 2 Casing Program Design
- Lecture 3 Cementing Design
- Lecture 4 Perforating Design
- Lecture 5 Tubing Design
- Lecture 6 Sand Control Design
- Lecture 7 Well Completion Design
- Lecture 8 Hydraulic Fracturing Design
- Lecture 9 Acidizing Design
- Lecture 10 Well Completion Design - Field Case Studies

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)

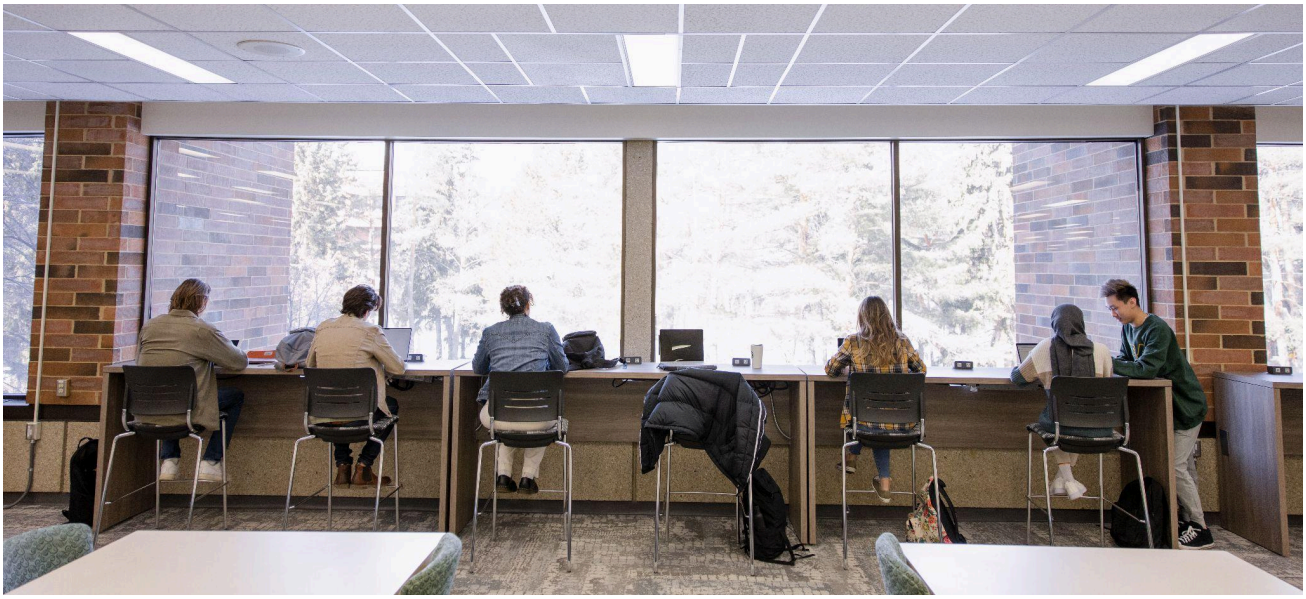
The OSDHR advises confidentially on sensitive issues you may not feel comfortable solving on your own. Contact the OSDHR if you want to get help or to make a report while keeping your privacy. Visit uab.ca/OSDHR to learn more.

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.

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.