CIV E 690 Advanced Foundation Engineering

Winter 2023 - January 05 to April 12

Class time: Tuesday, Thursday 8:00-9:20 Location: GSB 2-11

Instructor:

Lijun Deng, PhD, P.Eng, He/his
(780)492-6210
ldeng@ualberta.ca
Donadeo Innovation Centre For Engineering 6-261
Office Hours: 1:30 - 3:00 pm Monday

Course Description:

*4 (fi 6) (either term, 3-1S-1) Theories of lateral pressures. Limit equilibrium methods, elasticity methods, semi-empirical methods. Soil anchors. Design of retaining walls and strutted excavations. Bearing capacity of shallow and deep foundations. Allowable settlement of structures. Analysis of settlement of shallow and deep foundations. Behavior of pile groups. Design problems in foundation engineering.

Prerequisites: Consent of instructor

Course synchronous and asynchronous content delivery schedule:

Lab Sections:

Section	Day	Time	Location
LAB H1	Monday	15:00 - 15:50	
LAB H2		1:00 - 1:00	

Seminar Sections:

Section	Day	Time	Location
SEM J1		1:00 - 1:00	
SEM J2		1:00 - 1:00	

Course Objectives & General Content:

The course is intended to teach students the design principles and practice of foundations. The foundations include spread footings, piles, and retaining walls. The course reviews the practice of geotechnical site investigation, and develops the foundation design on the basis of soil in-situ tests. The course also trains students on preparing geotechnical investigation report where the design of various foundation types is recommended. The course is a critical part of the Geotechnical Engineering program.

Learning Outcomes:

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

1. Designing foundation for structures.
2. Understand design practice in Canada and follow the Canadian Foundation Engineering Manual
3. Understand principles in foundation design.
4. Advanced understanding of soil and ground behaviour from in-situ tests

Marking Scheme:

Activity	(A)Synchronous	Due/Scheduled	Weight
Assignment	Synchronous		25%
Midterm Exam	Synchronous	Tu March 14	30%
Final Exam	Synchronous	Wed April 19	40%
Lab report	Synchronous		5%

The Faculty recommended grade point average for a 600 level course is 3.3. 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.

Text and References (Mandatory):

There is no single recommended text

Text and References (Recommended):

Course Notes

The Engineering of Foundations, Salgado, R., 2008, McGraw-Hill
Foundation Analysis and Design, Bowles, J., 5th Edition, 1995, McGraw-Hill
Canadian Foundation Engineering Manual, 4th Edition, 2007

Website:

eClass

Previous Examples of Evaluative Materials:

Midterm and final exam samples will be shared with students.

Lab Information:

Lab Topic	Date
Lab 1: Model foundation tests	2023-02-22

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!

CIVE 690
Advanced Foundation Engineering
Course outline – Winter Term 2023

Instructor:	**Lijun Deng, PhD, PEng, Associate Professor**
	Email: ldeng@ualberta.ca
	8:00 – 9:20, Tuesday and Thursday, GSB 2-11
	Office hour: Monday afternoon 1:30 – 3:00 pm, DICE 6-261
Recommended Text:	There is no single recommended text.
References:	Course Notes
	The Engineering of Foundations, Salgado, R., 2008, McGraw-Hill
	Foundation Analysis and Design, Bowles, J., 5th Edition, 1995, McGraw-Hill
	Canadian Foundation Engineering Manual, 4th Edition, 2007
Mark Distribution:	30% Assignment Reports and Lab reports
	30% Midterm Examination (80 min, in-class)
	40% Final Examination (120 min, in the final exam week)

Course Outline (subject to adjustment)

1. Introduction (1.5 weeks)

Genesis of soils
Principle of limit state and working stress design
Geotechnical site investigation reporting
Review of CPT and SPT practice

2. Shallow Foundations (2 weeks)

Bearing capacities
Bearing capacities from in-situ tests
Foundation settlement
Settlement from in-situ tests
Frost heave and frost depth
Ground improvement methods

3. Deep Foundations (3.5 weeks)

Pile types and classification
Pile capacities from analytical methods
Pile capacities from in-situ tests
Negative skin friction
Piles in rock
Frost action on piles
Pile group capacity
Settlement of single pile and pile group
Introduction to pile dynamic analyses
Laterally loaded piles

Integrity of concrete piles
Case study: design and verification of H-piles

Midterm: In-class, 80 min

4. Earth pressure and retaining structures (2.5 weeks)

Classification of retaining structures
Rankine's earth pressure
Coulomb's earth pressure
Design of cantilever retaining wall
Apparent earth pressure and excavation support
Design of ground anchors

5. Geosynthetics (2 weeks)

Classification and functions of geosynthetics
Properties of geosynthetics materials
Testing of geosynthetics
Principle and design of mechanically stabilization earth wall
Reinforced soil slope and embankment
Case study: RSS failure
Embankment on soft ground
Drainage and filtration

***6. Problematic Soils (0.5 to 1 week, optional)**

Collapsible and expansive soils
Lab testing and identification
Foundation on expansive soils: heave estimate and preventive measures

According to University Regulations, you are informed that:

Policy about course outlines can be found in Section 23.4(2) of the University Calendar

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at http://www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

UNIVERSITY AND FACULTY POLICIES

COURSE OUTLINE POLICY

The policy about course outlines can be found in Course Requirements, Evaluation Procedures and Grading of the University Calendar, see https://calendar.ualberta.ca/

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. University is an opportunity for students to explore areas of interest and to potentially pursue a career in a specific field. The Faculty of Engineering prepares students to uphold industry standards to become a Professional Engineer (P. Eng). Respect, professionalism, and accountability must be upheld within the Faculty of Engineering.

Harassment and discrimination are serious issues that have a negative effect on culture and therefore the Student Code of Behaviour states that no student shall discriminate against or harass any person or group of persons. The Faculty expects an environment free of harassment, discrimination, and bullying. Please refer to the University's Discrimination, Harassment, and Duty to Accommodate Policy for definitions.

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, due to intoxication, harassment or discriminatory behaviour, or other reasons, 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. As members, or prospective members, of the engineering profession, it is your responsibility to identify and inform the proper authorities of an unsafe work/learning environment.

AUDIO/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. The use of unauthorized personal listening, communication, recording, photographic and/or computational devices is strictly prohibited. Students should refrain from bringing any unauthorized electronic device into an examination room, including cell phones, high tech watches, high tech glasses or other such devices.

ACADEMIC INTEGRITY

Students at the University of Alberta must read and follow, in its entirety, the

Code of Student Behaviour

Failure to know the code is not an acceptable excuse for breaking the code.

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (on the University Governance website) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

Engineering students studying in the province of Alberta should also follow the

Code of Ethics

by The Association of Professional Engineers and Geoscientists of Alberta (APEGA).

The Code of Student Behaviour should not be too hard to follow. Listen to your instructor, be a good person, and do your own work, as this will lead you toward a path to success. Failure to follow the code can result in a grade of ‘F’ for the course, a transcript remark, suspension, and even expulsion from the university.

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

Engineering at Alberta

NEED HELP?

There are a lot of services available to students on campus and in Edmonton, and sometimes it's hard to know where to go. While this isn't a comprehensive list, the services shown here should at least give you some ideas about where to start. If you're still not sure, check out the services just beneath this box—they'll give you the guidance you're looking for.

DON'T KNOW WHERE TO GO?

Student Service Centre

The U of A's central hub to find the right help for your needs.
uab.ca/ask

24/7 HELP

Empower Me (international)

1-833-628-5589

Edmonton Distress Line

780-482-4357 (HELP)

WELLNESS

Counselling and Clinical Services

Free, short-term, appointment-based counselling and psychiatric services. Also offers drop-in workshops. Book an initial consultation.
P: 780-492-5205
M, R, F, 8:00am-4:00pm; T, W, 8:00am-7:00pm

Interfaith Chaplains' Association

Get guidance, care, and support, whether or not you identify with a particular faith. Make an appointment.
P: 780-492-0339 | E: interfaithchaplains@ualberta.ca

The Landing

Offers drop-in support on matters of gender and sexual diversity.
P: 780-492-4949 | E: thelanding@su.ualberta.ca
M-R, hours vary

Peer Support Centre

Anonymous, confidential help from trained students. By appointment only.
P:780-492-4268 | E: psc@su.ualberta.ca
M-F, 9:00am-8:00pm

Sexual Assault Centre

Free, anonymous, and confidential drop-in counselling.
P: 780-492-9771 | E: sexualassaultcentre@ualberta.ca
M-F, 9:00am-8:00pm

University Health Centre

An on-campus health clinic that provides medical services to staff, students, and their spouses and children.
P: 780-492-2612 | E: hws@ualberta.ca
M-F, 8:30am-4:00pm

ACADEMIC

Engineering Student Services
Drop-in, first-come, first-served advising.
E: enggadvising@ualberta.ca

Engineering Student Success Centre
Drop-in tutoring for first-year courses.
E: dessc@ualberta.ca

Academic Success Centre
Many services to maximize your academic success.
E: success@ualberta.ca
M-F, 8:30am-4:30pm

Academic Accommodations
Connects students with disabilities to accommodations.
E: arrec@ualberta.ca
M-F, 8:30am-4:30pm

Office of the Student Ombuds
Call for complex problems and conflict mediation.
P: 780-492-4689 | E: ombuds@ualberta.ca

FINANCIAL

Student Service Centre
For awards and other funding supports.
uab.ca/ask

Campus Food Bank
Many food support options available.
E: info@campusfoodbank.com

SOCIAL

Unitea
Arrange a time to socialize with a peer.
E: unitea@ualberta.ca

BearsDen
U of A webpage. Find student groups, local events, and volunteer opportunities.

WORRIED ABOUT SOMEONE?

Helping Individuals at Risk (HIAR)
If you're worried about someone because of the things they've been saying or doing, or there's a noticeable change in their behaviour (often in multiple ways), contact HIAR, who will protect your confidentiality and help decide how best to support the person.

780-492-4372
hiarua@ualberta.ca

CONFIDENTIAL SUPPORT

Office of Safe Disclosure and Human Rights

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.

780-492-7357
osdhr@ualberta.ca