UNIVERSITY OF ALBERTA

2023-2024

MASTER OF **ENGINEERING**

GEOTECHNICAL ENGINEERING

WELCOME TO THE **M.ENG. PROGRAM**

The University of Alberta's Master of Engineering (M.Eng.) course-based programs are valuable for engineers at any career stage wishing to enhance their technical, managerial, and leadership skills. Our students learn from some of the top academics in their fields and train in internationally renowned facilities. Students participate in practical Alberta-focused projects that prepare them to demonstrate their skills and knowledge to potential employers.

M.Eng. students have access to the University of Alberta's Engineering Employment Center resources (job postings, workshops, networking opportunities, career fairs) and benefit from a dedicated student coach, who provides communications support.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

M.ENG.
PROGRAM INFO

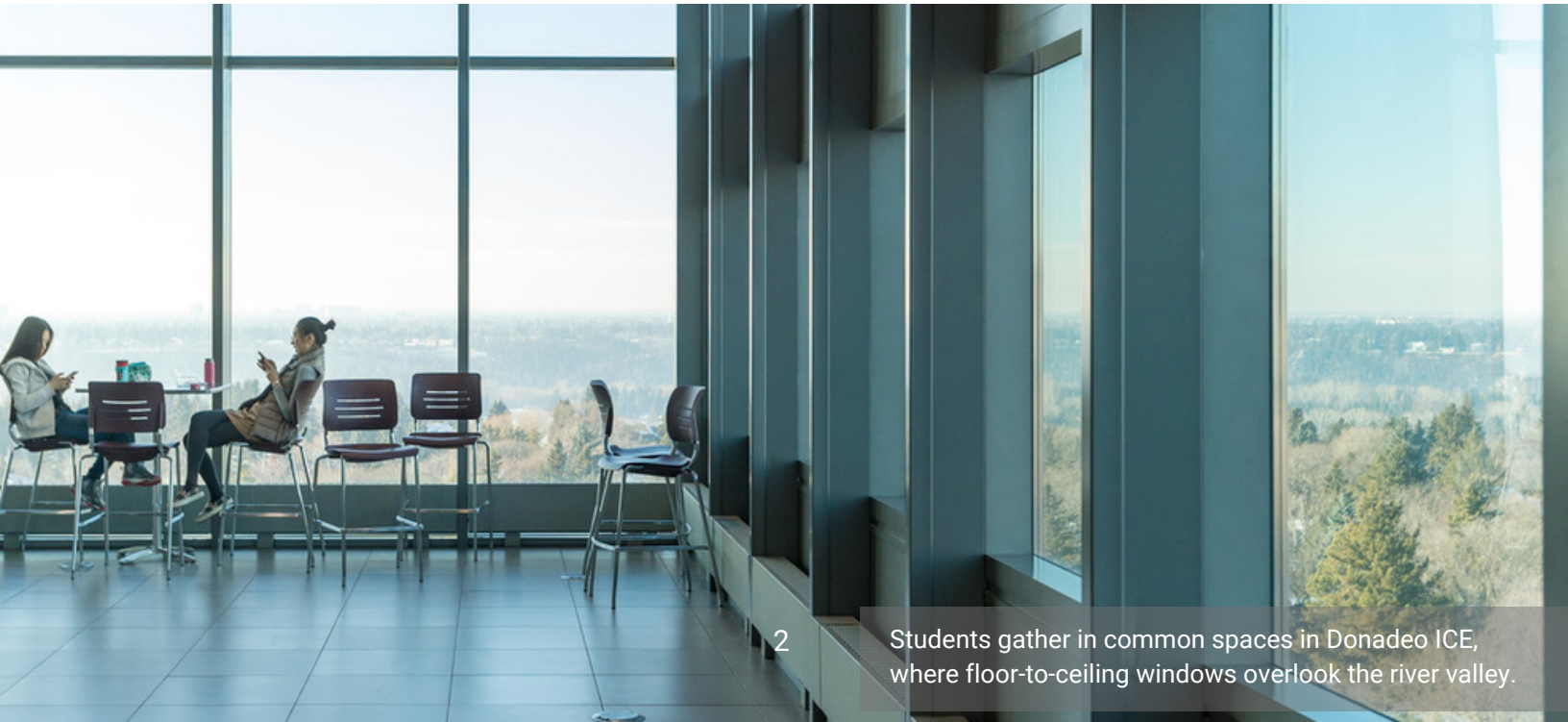
PROGRAM
OBJECTIVES

The M.Eng. Program is designed to prepare students for engineering practice in modern Geotechnical Engineering. It will also equip students with the required knowledge, skills, methods, tools, experience, and professional communication capability to contribute to Civil Engineering industry and society at large.

The program prepares students for engineering practice in modern Geotechnical Engineering, involving areas of design, analysis, inspection, monitoring, and maintenance. It will equip students with the required knowledge, skills, methods, tools, experience, and professional communication capability to contribute to the civil industry and the society.

LEARNING
OUTCOMES

- Gain and apply knowledge of mechanics, analysis, design, and data analytics in engineering practice for a variety of geotechnical structures (e.g., cut slopes, embankments, foundations, dams).
- Understand and follow national or international standards, codes and industry manuals to design safe and economical geotechnical structures and perform ground investigations.
- Obtain relevant knowledge about emerging technologies and techniques to manage geotechnical projects in the modern society.
- Collaborate effectively with team members on capstone projects and communicate to team members as well as other target audiences.
- Develop the foundational knowledge and awareness for life-long learning to continue the professional growth, thus being adaptable to the ever-evolving industry needs.
- Understand ethical and professional responsibilities and make informed judgments considering the impact of engineering solutions in global, economic, environmental, and societal contexts.



Students gather in common spaces in Donadeo ICE, where floor-to-ceiling windows overlook the river valley.

M.ENG.
PROPOSED COURSE SEQUENCE

The length of the program is two years. Students can accelerate the program or prolong it after approval from the M.Eng. Academic Advisor (see program contacts on page 4).

Please refer to the Graduate Handbook for full program policies.

FALL **2023**	CIV E 680 (Properties of Soils) CIV E 697 (Rock Engineering) CIV E 789 (Writing/Comm for Engineers)
WINTER **2024**	CIV E 690 (Advanced Foundation Engineering) CIV E 695 (Soil Structures) **Plus one of** CIV E 609 (Underground Trenchless Construction) CIV E 698 (Petroleum Geomechanics)
FALL **2024**	CIV E 683 (Site Investigation Practice) CIV E 684 (Engineering Geology & Terrain Analysis) **Plus one of** CIV E 682 (Environmental Geotechnics) CIV E 779 (Advanced Topics in Structural Engineering)
WINTER **2025**	CIV E 900 Capstone project (Directed Research – Geotechnical section)

STUDENT **SUPPORT**

GRADUATE **PROGRAM ADVISORS**

Trina Cattral – 7-387 Donadeo ICE
Christina Ezekowitz – 7-381 Donadeo ICE
Arlene Figley – 7-389 Donadeo ICE
Ellie Kim – 7-385 Donadeo ICE

Email: cgradvis@ualberta.ca

M.ENG. **ACADEMIC ADVISOR**

Dr. Yuntong (Amy) She – 7-259 Donadeo ICE
Email: civmeng@ualberta.ca

ASSOCIATE DEAN **GRADUATE STUDENTS CEE/MP**

Dr. Zaher Hashisho – 7-241 Donadeo ICE
Email: ad.ceegrad@ualberta.ca

GEOTECHNICAL **GRADUATE COORDINATOR**

Dr. Michael Hendry – 6-226 Donadeo ICE
Email: hendry@ualberta.ca

STUDENT COACHING **SERVICES**

The Department of Civil and Environmental Engineering is committed to supporting its M.Eng. students as they move through the program.

Students will be provided career and professional development supports throughout their program to aid them in developing their academic and career goals, recognizing and addressing challenges, and building upon their personal strengths to move past their limitations.

Dr. Robyn Braun will support students with their various writing projects and serve as instructor for the communications course. Dr. Braun will also serve as an additional resource and support for students as they navigate the program, the University, and the city of Edmonton.

Contact Dr. Braun at: robyn4@ualberta.ca

WORKING IN **CANADA**

INTERNATIONAL **STUDENT SERVICES**

International Student & Visitor Services (ISVS) provides programs, services and events for U of A international students. Their team of licensed immigration consultants and student advisors supports international students with adjusting to living in Edmonton, immigration and additional support to help international students succeed at the U of A.

You can book time with their team of licensed immigration consultants, who can assist you with study permits and extensions, immigration, and working in Canada. Drop-in appointments are available Monday to Friday (1–3 pm) by visiting the International Services Centre (142 Telus Centre) or book an appointment online at: ualberta.ca/international/about-uai/contact-us/international-services-centre

POST GRADUATION **WORK PERMIT**

The Post-Graduation Work Permit Program (PGWPP) allows students who have graduated from eligible Canadian designated learning institutions (DLIs) to obtain an open work permit to gain valuable Canadian work experience. Our program also provides academic credentials that are recognized by Alberta licensing organization (APEGA) for students with an undergraduate program in a foreign engineering program.

To work in Canada after you graduate, you must apply for a work permit under the Post-Graduation Work Permit Program (PGWPP). Check the University's ISVS and the Government of Canada websites for more information about the post-graduation work permit program.

Our program's learning outcomes are inline with Engineers Canada competencies and professional development hours count towards yearly professional requirements.

UNIVERSITY OF ALBERTA **RANKINGS**

	WORLD	CANADA
ACADEMIC RANKING OF WORLD UNIVERSITIES	**91**	**4**
QUACQUARELLI SYMONDS	**111**	**4**
TIMES HIGHER EDUCATION	**118**	**6**

WELCOME HOME

Edmonton is Alberta's capital city and is one of the sunniest cities in Canada with an average of 2,300 hours of sunshine per year. The river valley that winds through the city has more than 160 kilometres of maintained pathways and 20 major parks.

HOUSING

You may choose from many housing options for students, both on campus and around Edmonton. International Student Services has online resources for finding a place to live, including temporary accommodations when you first arrive.

EXCEPTIONAL **PUBLIC SCHOOLS**

Our Kindergarten through grade 12 public school system is one of the best in Canada. Alberta's students rank No. 2 in the world for reading and science and in the top 12 for math.

UNIVERSAL **HEALTH CARE**

Alberta Health Services provides health care to all Albertans in hospitals, at the doctor's office, and on the Internet. 811 is a telephone service providing free 24/7 nurse advice and general health information for Albertans.

COMMUNITY

More 150 neighbourhood community leagues provide plenty of opportunities to participate in social and recreational activities and get to know your neighbours.

Plus farmers' markets offer small agricultural producers the opportunity to sell fresh produce, including meat and vegetables that are grown in the Edmonton area. The city supports community gardens for those who want to grow their own food but need the space to do it.

TRANSPORTATION **BUS, BIKE, TRAIN**

Public transit buses and Light Rail Transit (LRT) connect the city along with well-maintained bike lanes and paths.

Maps, schedules and fare info at: edmonton.ca/edmonton-transit-system-ets

INDUSTRY
NETWORKING MIXER

Academic knowledge is only part of the equation when preparing students for the workforce. Therefore, we commit to helping our students develop communication skills and professional networks.

In February 2023, the Department of Civil and Environmental Engineering and the School of Mining and Petroleum hosted a networking mixer for our Master of Engineering students. The mixer was part of an ongoing program to support grad students by providing communications training and professional development opportunities.

The mixer, held at the prestigious Royal Glenora Club in Edmonton's River Valley, brought together about 100 grad students and more than a dozen industry representatives for three hours of speakers, professional networking, and delicious food.

Structural engineer at DIALOG and UofA graduate Cam Franchuk gave an inspirational talk reflecting on what he's learned over his 21 years as an engineer. He gave practical advice about lifelong learning and getting your boots muddy, but a recurrent and appropriate overarching theme was the importance of communication. After his presentation, each industry representative came to the podium to introduce themselves, their company, and their work. The last part of the evening was dedicated to mingling and conversation between industry professionals and students.

Our students prepared for the event with a mock mixer training workshop earlier in the week. Dr. Robyn Braun, the Department's Instructor of Communications, and consultants from WorkSpark covered professional dress, conversation starters, handshakes, introducing yourself, and following up after the event.

The mixer and preparation workshop are just part of the support we provide graduate students to help them develop as professional engineers in Canada.

M.Sc. students Aisha Elgarhy, Veronica Wambura, and Syeda Narmeen Zehra at the graduate networking mixer.
Photo: Heather Egger

Our department supports students with opportunities to develop professional communication skills and access to career resources.

We support our students in developing effective communication, teamwork, and adaptability through industry networking events, experiential learning opportunities, and professional development.

Through our professional development and communications support team, we help students develop their resumes, practice interviewing skills, and connect with potential employers. We also provide students with access to job fairs, networking events, and other professional development opportunities to help them build relationships and make valuable industry connections.

INSTRUCTOR OF **COMMUNICATIONS**

Dr. Robyn Braun – 7-240 Donadeo ICE
Email: robyn4@ualberta.ca

WORKSPARK **CONSULTING**

Professional development workshops in resume writing and networking
Web: workspark.ca

BENEFITS OF **NETWORKING**

Career opportunities Networking allows students to connect with potential employers, learn about job opportunities, and gain insights into the engineering profession.

Industry insights By connecting with professionals in their field, students can stay up-to-date with industry news and developments, helping them make informed career decisions.

Mentorship Networking provides students with the opportunity to connect with experienced professionals who can offer guidance and support as they navigate their career path.

Collaboration Working with others can help graduate students develop new skills, gain experience, and expand their engineering knowledge.

Personal development Networking helps students develop essential skills such as communication, teamwork, and interpersonal competence. By attending events, meeting new people, and building relationships, students develop confidence and expand their professional network.

COURSE INFO

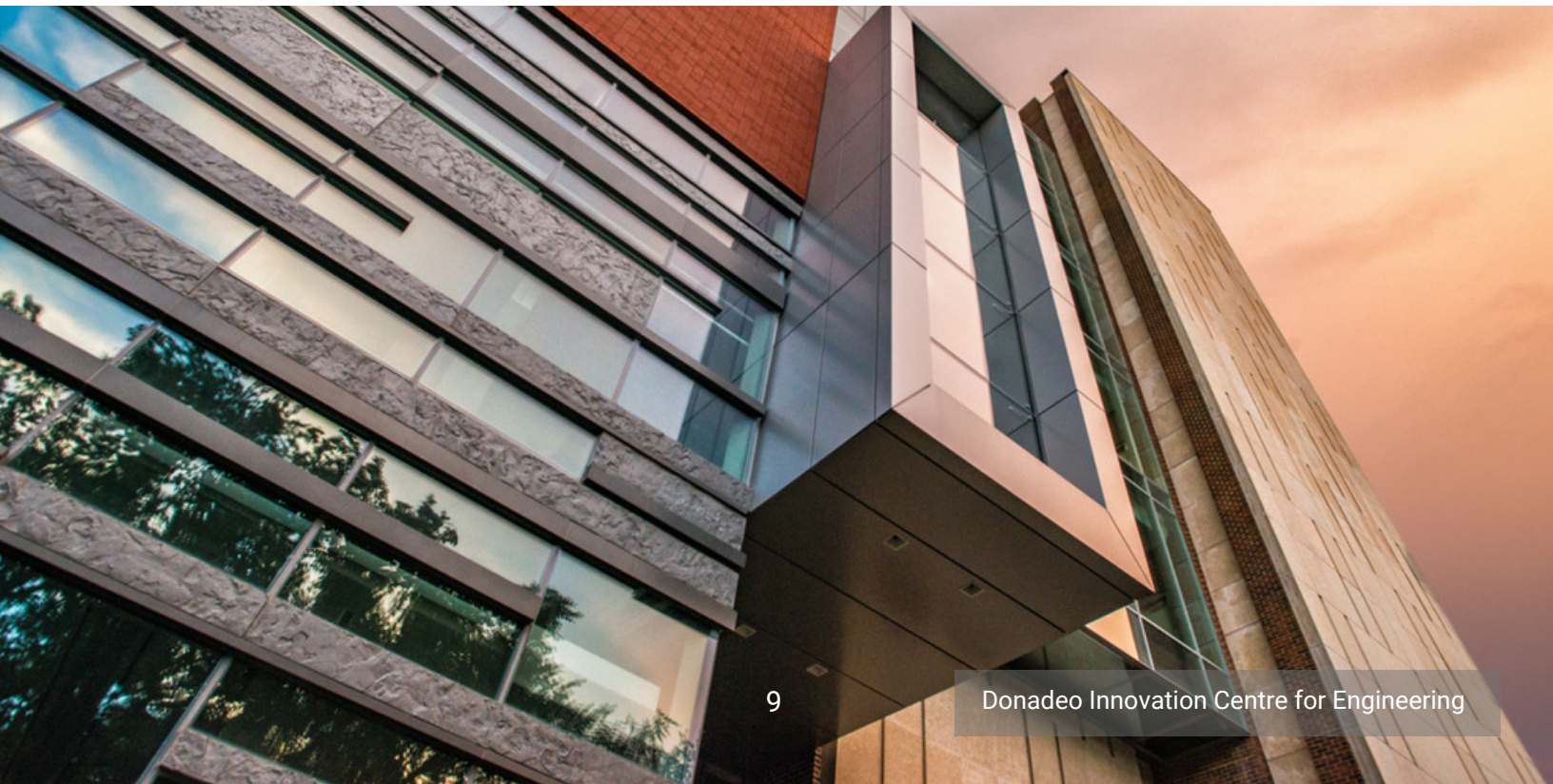
CIV E 609
UNDERGROUND TRENCHLESS CONSTRUCTION

COURSE OBJECTIVES

Introduction to underground pipeline infrastructure. Focus on pipeline condition assessment. New construction such as horizontal directional drilling, pilot tube microtunneling, pipe bursting, and pipe jacking. Rehabilitation methods such as cured in place pipe lining, geotechnical consideration. Risk considerations for underground projects.

LEARNING OUTCOMES

- Understand the underground infrastructure and learn about the complexities of the utility system
- Learn about different underground trenchless construction methods and the advantages and disadvantages of each method.
- Design a new pipe installation method using Horizontal Directional Drilling (HDD) from a desktop study to complete the design stage and learn all aspects of the construction phase.
- Design a rehabilitation method using Cured In Place Pipe (CIPP) method and identify all details required for the lining of a pipe
- Get a comprehensive skill with respect to reading and understanding ground conditions and identifying the right technology for the proposed utility line.



COURSE INFO

CIV E 680
ENGINEERING PROPERTIES OF SOILS

COURSE OBJECTIVES

Principle of effective stress, clay-water systems, soil compressibility and theories of consolidation. Pore pressure parameters. Strength of granular and cohesive media. Anisotropy of soils. Laboratory measurement of strength and deformation properties. Stress-strain relations.

LEARNING OUTCOMES

- Develop an understanding of the impact of soil composition and clay mineralogy on the mechanical behaviours of soils.
- Develop an advanced understanding of the concept and importance of effective stress.
- Be able to calculate and plot the total and effective stress paths of common soil testing methods. And the basis for deriving these paths for other conditions.
- Identify the meaning of the concepts of yield, strength and critical state and relate this to observed soil responses to triaxial testing.
- To apply elastic-plastic models (example: Cam Clay) to represent elastic and plastic deformation of soil in both shear and volumetric strain and to evaluate the effect of the soil's pore pressure response to loading during undrained or partially drained conditions.

CIV E 681
SEEPAGE AND DRAINAGE

COURSE OBJECTIVES

Elements of hydrogeology; regional groundwater flow, borehole logging methods. Theory of groundwater flow through soils and rocks, permeability, Darcy's law, field governing equations and their solution by approximate methods, finite difference and finite element methods, unsaturated flow. Civil engineering applications, seepage in earth structures, design of dewatering systems for excavations and slopes, field testing, grouting.

LEARNING OUTCOMES

- Understand the nature of groundwater flow.
- Analyze and quantify seepage through porous media.
- Design for the influence of seepage on engineering projects.
- Design seepage control methods.
- Understand seepage in rocks and contaminant transport

COURSE INFO

CIV E 682
ENVIRONMENTAL GEOTECHNICS

COURSE OBJECTIVES

Environmental laws and regulatory processes; geotechnical characterization for environmental problems; transfer processes; concepts in thermodynamic equilibrium chemistry; geochemical processes in groundwater and mineral-water-atmosphere interaction; geotechnical and geochemical aspects of mine waste management.

LEARNING OUTCOMES

- Understand and apply management practices that protect the geoenvironment from deleterious and adverse stressor impacts generated from sources associated with the efforts in support of the needs of humans. Specific objectives and topics include:
- Understand the physical and chemical stressors imposed by mining resource extraction on the geoenvironment
- Understand the regulatory environment pertaining to mine waste management
- Apply the fundamental principles and theories of geotechnical engineering and geomechanics for sustainable management of mine waste
- Understand the fundamental principles and theories of geochemistry for sustainable management of mine waste

CIV E 683
SITE INVESTIGATION PRACTICE

COURSE OBJECTIVES

Techniques of site investigation for geotechnical engineering, in situ testing, instrumentation for field performance studies, case histories covering both rock and soil applications.

LEARNING OUTCOMES

- Plan, review and criticize geotechnical site investigations for a variety of geotechnical projects, with the aim of developing adequate geotechnical models,
- Select the most appropriate methods for sub-surface investigation, testing, and sampling, in light of the required level of detail for the project (conceptual, feasibility, detail design, etc.),
- Identify the needs for adopting geophysical and remote sensing techniques, as well as knowing the advantages these techniques bring in terms of enhanced density of information and potential cost-reduction for increased design confidence; and their limitations;
- Plan, review and criticize geotechnical monitoring requirements, instrumentation selected and frequency; to monitor for deformations and pore water pressures and with some discussions of stress and load measurements; and,
- Understand the site investigation requirements for geo-environmental investigations.

COURSE INFO

CIV E 684
ENGINEERING GEOLOGY AND TERRAIN ANALYSIS

COURSE OBJECTIVES

Information sources in engineering geology and terrain analysis, elements of the geology of sediments and glacial geology. Glacial and periglacial land forms. Photogeology and airphoto interpretation applied to geotechnical engineering. Case histories based on specific materials and regional problems.

LEARNING OUTCOMES

- Recognize and identify virtually all the significant terrain types and landforms found in Canada.
- Understand and describe the geomorphology and landforming processes active in Canadian landscapes.
- Understand and apply the basic principles of terrain evaluation using aerial photographs.
- Predict and estimate the engineering properties of surface soils on the basis of aerial photographs..
- Design, optimize and plan comprehensive field investigations and drilling programs with aerial photos
- Complete conceptual level engineering designs for large engineering projects such as river crossings, dams and waste repositories using aerial photos.
- Complete route location and associated risk analysis for major infrastructure projects such as railways, pipelines, power lines with aerial photos.

CIV E 690
ADVANCED FOUNDATION ENGINEERING

COURSE OBJECTIVES

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.

LEARNING OUTCOMES

- Select in-situ investigation methods including SPT and CPT and interpret engineering parameters for design purpose
- Design shallow foundations using the principle of ultimate limit states; be familiar with the foundation design manuals in Canada
- Design single deep foundations and pile groups for the axial and lateral limit states using the manuals in Canada; understand the piling practice and pile test methods
- Calculate earth pressures for design purpose; select and design earth retaining systems of various types and the structures for deep excavation support; be familiar with the manuals
- Understand the functions of geosynthetics; design for internal and external stability of mechanically-stabilized earth walls and slopes; select and design geosythetics for drainage purpose.

COURSE INFO

CIV E 695
SOIL STRUCTURES

COURSE OBJECTIVES

Stresses in slopes. Limit equilibrium methods of analysis. Landslides in soil. Design of earth dams and embankments. Case histories of earth and rockfill dams. Dam foundations. Soft ground tunnelling.

LEARNING OUTCOMES

- Develop an understanding of the physical meaning of limit equilibrium analyses for evaluating slope stability and the underlying calculations, assumptions and implications associated with common methods of limit equilibrium analyses.
- Conduct and critically review limit equilibrium analyses of slopes, and evaluate Factors of Safety.
- Develop an understanding of the physical meaning of shear strength reduction methods for evaluating slope stability and the underlying calculations, assumptions and implications associated with these methods.
- Conduct and critically review shear strength reduction analyses of slopes, and evaluate Factors of Safety.
- Develop an understanding of the impacts of soil type and settings on evaluating the Factors of Safety.
- Identify the setting for stability analyses applicable to dams and the design and construction methods employed to improve the survivability and serviceability of final structures.

CIV E 697
ROCK ENGINEERING

COURSE OBJECTIVES

Elements of structural geology, analysis of the geometry of rock defects, properties of intact rocks. Properties of rock masses and stresses in rock masses, stability of rock slopes. Rock foundations and underground excavations in rock. Case studies.

CIV E 698
PETROLEUM GEOMECHANICS

COURSE OBJECTIVES

Application geotechnical engineering principles to petroleum engineering problems. Principles of thermo-poroelasticity are reviewed. Borehole stability, hydraulic fracturing, subsidence/heave, sand production, formation damage and reservoir-geomechanical modelling are the major topics for the course. Special attention is given to geomechanical influences on reservoir flow processes.

COURSE INFO

CIV E 789
WRITING/COMMUNICATION SKILLS FOR ENGINEERS

COURSE OBJECTIVES

This course introduces M.Eng. students to the development of standard documents used in an engineering career, as well as the fundamentals of technical writing and communication, and of effective professional communication.

LEARNING OUTCOMES

- Communicate effectively and respectfully in diverse settings, in person and via standard business documents, such as email.
- Identify and abide by the rules of plagiarism and academic and professional standards of communication.
- Evaluate their own writing process and institute changes when necessary.
- Solicit and provide actionable feedback on writing and other forms of communication.
- Recognize and produce standards for specific technical documents.
- Research and consider the context, audience, and purpose of their writing projects.
- Write a thesis statement and organize their writing at various levels, from document-level through to sentence structure.
- Identify active and passive voice, and use each appropriately.
- Recognize and evaluate rhetorical devices, strategies, and techniques.

CIV E 900
CAPSTONE DIRECTED RESEARCH PROJECT
GEOTECHNICAL SECTION

The Department of Civil and Environmental Engineering offers the Capstone project course to M.Eng. students in the Geotechnical Engineering stream.

Students will complete directed research projects as part of this course using the knowledge they have gained throughout their undergraduate and graduate program.

Please see the M.Eng. Academic Advisor for information about the Geotechnical section.

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