CIV E 636 River Ice Engineering

Winter 2026 - January 05 to April 15

Class time: Friday 11:00-13:50 Location: NRE 2-080

Instructor:

Jennifer Nafziger, PhD, P.Eng, she/her

jnafzige@ualberta.ca
DICE 7-209
Office Hours:

Course Description:

*3.5 (fi) (either term, 3-0-1) Elementary heat transfer analysis. Ice formation processes. Ice hydraulics. Ice mechanics. Interaction of ice and engineering structures

Course synchronous and asynchronous content delivery schedule:

Course lecture material will be delivered in-person synchronously. Contingency plans (attached) have been developed in case of illness or the need to cancel a planned lecture. Assignments and term projects will be completed by students asynchronously. In-class discussions/presentations will be prepared by students asynchronously outside of the class but will be discussed synchronously during lecture times, according to the course schedule. Quizzes may be a combination of synchronous and asynchronous delivery, depending on course and student needs.

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.

Course Objectives & General Content:

This course focuses on topics in River Ice Engineering, focusing of the hydraulics and engineering aspects of river ice. It involves a combination of lectures, readings, interactive discussions, and hands-on calculations. Attendance is required at all lectures and student participation is encouraged and expected.

Learning Outcomes:

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

1. Understand various river ice processes that occur during winter
2. Conduct hydraulic modeling under ice-affected conditions

3. Obtain knowledge of available techniques for ice jam flood forecasting and mitigation
4. Understand strength characteristics of ice and design for different loading scenarios
5. Obtain up-to-date knowledge of the field, identify gaps and potential research areas
6. Appreciate the impacts of river ice in various engineering applications
7. Improve technical writing, communication, and presentation skills

Marking Scheme:

Activity	(A)Synchronous	Due/Scheduled	Weight
Homework Assignments - 5			25%
In-Class Presentations and Discussion - 3			15%
Term Project		April 10, 2025	15%
In-Class Quizzes			5%
Final Exam		TBA	40%

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.

Expectations for AI use

In this course, our primary focus is to cultivate an equitable, inclusive, and accessible learning community that emphasizes individual critical thinking and problem-solving skills. To ensure a fair and consistent learning experience for all students, the use of advanced AI tools such as ChatGPT or Dall-E 2 is strictly prohibited for all academic (written/coding/creative/etc.) work, assignments, and assessments in this course. Each student is expected to complete all tasks without substantive assistance from others, including AI

tools. Any use of AI tool in your academic work may result in academic penalties and 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. The instructor will accept a single exception to the above "No AI" Policy. Students may use AI tools such as ChatGPT, Grammarly, or other tools to assist with clarity and precision when writing in English. This exception is meant to assist with English writing tasks, as distinct from the generation of ideas and content. It remains prohibited to use A.I. tools to generate ideas or factual content. All use of A.I. tools (even for assistance with writing) must be disclosed at the time of submission of any course assessment. Failure to do so may result in academic penalties. If you are unsure what constitutes acceptable use of A.I. pursuant to the above please speak with your instructor prior to submitting any course assessment.

Text and References (Mandatory):

Lecture notes, supplementary notes, and handouts will be provided electronically through the course web page. Students are responsible for printing their own notes and handouts.

Text and References (Recommended):

The following recommended primary reference will be available for download from the course web page:

An Introduction to River Ice Engineering for Civil Engineers by F. Hicks (2016)

The following text books may be of interest:

River and Lake Ice Engineering by G. Ashton (ed.) et al. (1986)
River Ice Jams by Spyros Beltaos (ed.) et al. (1995)
River Ice Breakup by Spyros Beltaos (ed.) et al. (2009)
River Ice Formation by Spyros Beltaos (ed.) et al. (2013)
River Ice Processes and Ice Flood Forecasting by K.-E. Lindenschmidt (2020)
Ice Physics by P.V. Hobbs (1974)

The above books may be available to borrow from Dr. Nafziger for brief periods (1 to 2 days).

Website:

Canvas

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 636 - Winter 2025 Lecture and Assignment Schedule

All Items Are Tentative and Subject to Change - For Planning Information Only

The Most Up-To-Date Schedule Will Be Posted On Canvas

This version accurate as of January 1, 2025

Week	Day	Date	Lecture Plan	Group Discussion	Homework Assignements		Term Project Milestones
					Posted	Due	
Week 1	Tuesday	January 7, 2025	Lecture Cancelled due to Safety Training				
	Thursday	January 9, 2025	Course Intro				
Week 2	Tuesday	January 14, 2025	Intro to Freeze-up Processes				
	Thursday	January 16, 2025	Intro to Breakup Processes				**POSTED**
Week 3	Tuesday	January 21, 2025	River Ice and Remote Sensing		1		
	Thursday	January 23, 2025	River Ice Hydraulics				**Topics Due**
Week 4	Tuesday	January 28, 2025	River Ice Hydraulics	Paper Choices Due	2	1	
	Thursday	January 30, 2025	River Ice Properties				
Week 5	Tuesday	February 4, 2025	Quantifying Thermal Ice Processes			2	
	Thursday	February 6, 2025	Quantifying Thermal Ice Processes		3		**Check-in 1**
Week 6	Tuesday	February 11, 2025	Discussion: Freeze-up and Breakup Case Studies	In-Class Discussion			
	Thursday	February 13, 2025	Discussion: Freeze-up and Breakup Case Studies	In-Class Discussion	4	3	
Reading	Tuesday	February 18, 2025	Reading Week - No Classes				
	Thursday	February 20, 2025	Reading Week - No Classes				
Week 7	Tuesday	February 25, 2025	Ice Jam Formation and Release	Paper Choices Due			
	Thursday	February 27, 2025	Ice Mechanics and Ice Bridge Design		5	4	
Week 8	Tuesday	March 4, 2025	Discussion: Anchor Ice	In-Class Discussion			
	Thursday	March 6, 2025	Discussion: Anchor Ice	In-Class Discussion			
Week 9	Tuesday	March 11, 2025	Winter Hydrometry		6	5	**Check-in 2**
	Thursday	March 13, 2025	Aufeis - Guest Lecture				
Week 10	Tuesday	March 18, 2025	Climate Change and River Ice - Intro	Paper Choices Due	7	6	
	Thursday	March 20, 2025	TBA				**Check-in 3**
Week 11	Tuesday	March 25, 2025	Discussion: Impacts of Climate Change on River Ice	In-Class Discussion		7	
	Thursday	March 27, 2025	Discussion: Impacts of Climate Change on River Ice	In-Class Discussion			
Week 12	Tuesday	April 1, 2025	TBA or Term Project Work Session				
	Thursday	April 3, 2025	TBA or Term Project Work Session				
Week 13	Tuesday	April 8, 2025	Final Lecture Period - Review				**DUE**
		TBA	**Final Exam - Check Final Exam Schedule for Date, Time, and Location**				

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 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)

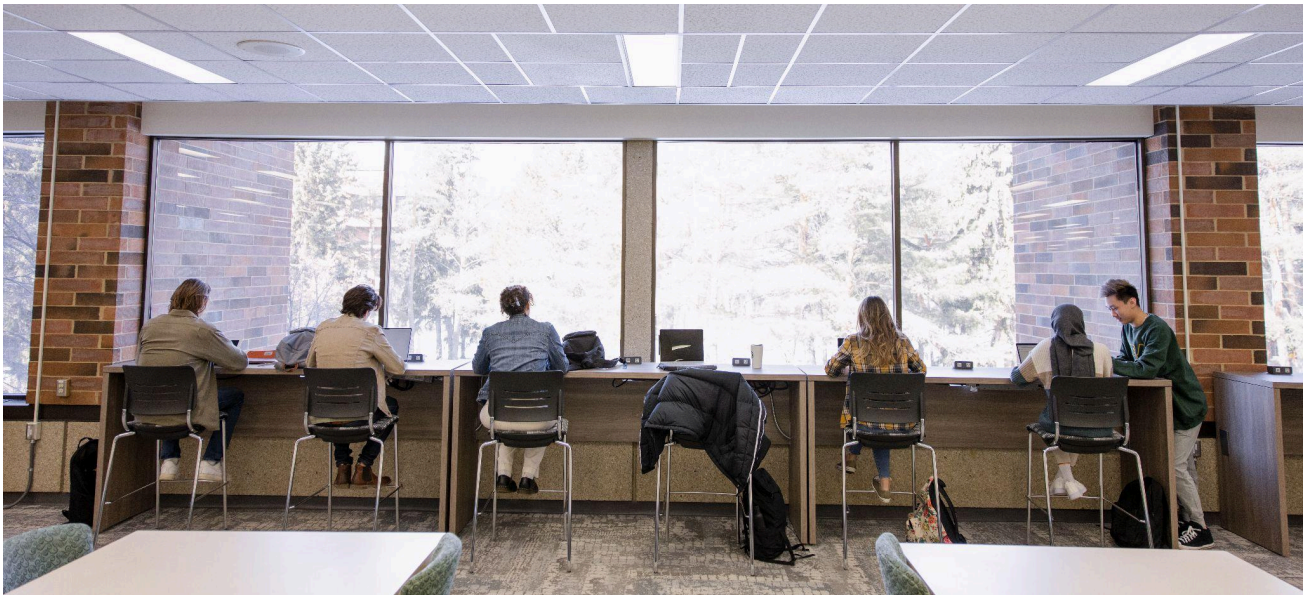
The OSDHR advises confidentially on sensitive issues you may not feel comfortable solving on your own. Contact the OSDHR if you want to get help or to make a report while keeping your privacy. Visit uab.ca/OSDHR to learn more.

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.

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The Most Up-To-Date Schedule Will Be Posted On Canvas

This version accurate as of January 5, 2026

Week	Day	Date	Lecture Plan	Group Discussion	Homework Assignements		Term Project Milestones
					Posted	Due	
Week 1	Friday	January 9, 2025	Course Intro Intro to Freeze-up Processes				
Week 2	Friday	January 16, 2025	Intro to Breakup Processes River Ice and Remote Sensing		A1		**POSTED**
Week 3	Friday	January 23, 2025	Quantifying Thermal Ice Processes 1 Quantifying Thermal Ice Processes 2	Paper Choices Due	A2	A1	
Week 4	Friday	January 30, 2025	River Ice Properties Term project meetings			A2	**TOPICS DUE**
Week 5	Friday	February 6, 2025	Discussion: Freeze-up and Breakup Case Studies	In-Class Discussion			
Week 6	Friday	February 13, 2025	River Ice Hydraulics River Ice Hydraulics	Paper Choices Due	A3		**CHECK-IN 1**
Reading	Friday	February 20, 2025	Reading Week - No Classes				
Week 7	Friday	February 27, 2025	Ice Jam Formation and Release Ice Jam Formation and Release		A4	A3	
Week 8	Friday	March 6, 2025	Discussion: Anchor Ice	In-Class Discussion			**CHECK-IN 2**
Week 9	Friday	March 13, 2025	Winter hydrometry Ice mechanics		A5	A4	
Week 10	Friday	March 20, 2025	Ice bridge design TBA	Paper Choices Due	A6	A5	
Week 11	Friday	March 27, 2025	TBA TBA		A7	A6	**CHECK-IN 3**
Week 12	Friday	April 3, 2025	Discussion: Impacts of Climate Change on River Ice	In-Class Discussion			
Week 13	Friday	April 10, 2025	Final Lecture Period - Review			A7	**DUE**
FINAL	**TBA**	**TBA**	**TBA**				

RECORDING LECTURES

Some lectures may be recorded to accommodate cancellations, illness or those who cannot attend class for legitimate reason (discuss these with Dr. Nafziger directly and in advance whenever possible). The classroom camera and mic are positioned to focus on the lecturer but may pick up the image and voice of those within close proximity or participating online. In accordance with section 33(c) of the FOIP Act, the recording will be used to support teaching and learning and may be disclosed to those registered in the course. Any questions should be addressed to the course instructor.

CONTINGENCY PLAN

In the case of a cancelled lecture, recorded lecture material may be made available on Canvas for asynchronous consumption.

If a student becomes ill during the term, filled-in lecture notes may be requested from Dr. Nafziger. A one-time late assignment grace period (7 days) will be provided. Please discuss with Dr. Nafziger if you are beginning to fall behind in the course due to prolonged illness.

ASSIGNMENTS AND ALL OTHER COURSE WORK

Assignments and term projects will be posted and submitted online through Canvas.

There are 7 Homework Assignments in this class. Your assignment grade will be a composite of your 5 best assignment grades. For each additional assignment completed with a grade of 75% or better you will be assigned a bonus of 1% on your overall grade.

FINAL EXAM

The final exam will be 2 hours long. It will be an open book exam. It will include a mix of theory questions and practical calculations. You may use your class notes, your own assignment solutions, any journal and conference papers you think may be useful. No other textbooks will be permitted. No internet searching will be allowed. No texting or communication with other students will be allowed. Only non-programmable calculators will be permitted. Please check the official University exam schedules for the exam date and time.