

Geographic Information Science & Spatial Data

Department of Earth & Environmental Sciences

ENVS / EARTH / GEOG 3500 Fall 2026

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Teaching Team

Name	Email	Student Hours
Christopher Greene, PhD <i>Course Instructor</i>	Chris.Greene@dal.ca	Thursday 2:30 pm to 4:30 pm Friday 9:30 am to 11:30 am
Emily McLean <i>Teaching Assistant</i>	em382568@dal.ca	-
Emma Taniguchi <i>Teaching Assistant</i>	emmataniguchi@dal.ca	-
Rebeca Pietrosanu <i>Teaching Assistant</i>	R.Pietrosanu@dal.ca	-

Teaching assistants will be rotating lab sections weekly to balance their workload and rotate grading obligations. When grading, assessors will grade sections (or complete works) for the entire class so that grading outcomes are consistent for all students within assessments.

Course Description

Geographic Information Systems (GISystems) provide a powerful platform to process and analyze data with locational information. This course introduces theoretical concepts in Geographic Information Science (GIScience) that provide the foundation for the creation, management, and visualization of geospatial data for a range of disciplines (e.g., Earth Sciences, Environmental Science, Biology, Planning). Topics include principles of spatial object types, spatial data models, concepts of error and uncertainty, overlay, and the integration of satellite derived data (GPS, Remote Sensing Imagery) in spatial projects. Laboratory exercises emphasize how these principles are put into practice in the use of Geographic Information Systems.

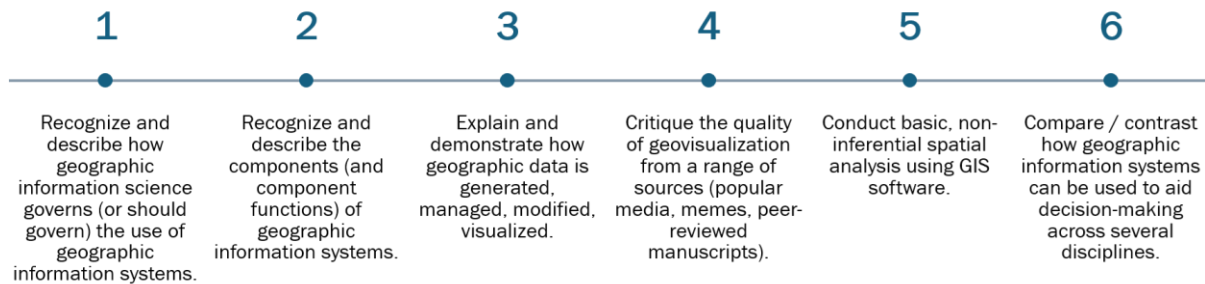
Course Prerequisites

Two years of university study or equivalent or instructor's permission

Course Exclusions

Credit will only be given for one of ENV5/ERTH/GEOG 2850.03, ENV5/ERTH/GEOG 3500.03, SCIE 3600.03, ERTH 5600.03, or ENV5/ERTH/GEOG 3850.03.

Learning Objectives



Student Resources

Student Hours for the Course Instructor are scheduled for Thursdays between 2:30 pm and 4:30 pm and Fridays between 9:30 am and 11:30 am. Students can self-schedule 20-minute appointment times through the MS-BOOKINGS site for Dr. Greene's courses (<https://bit.ly/3C06Pda>).

Students in this class will be given **card access to LSC-3111** and may work in this space from 8:30 am to 9:00 pm when the lab is not in use, including weekends. Please note that **the alarm for the lab auto-arms every day** and if you linger too long you will trigger the alarm.

Students **also may access the Elizabeth May Centre for Geocomputation** (LSC-2012) from 7:00 am to 10:00 pm as an alternative working space (the door code for LSC-2012 will be provided to students in the classroom setting).

Both LSC-3111 and 2012 are academic computing labs and intended for those purposes only. It's fine to take a breather from your work and check the news, social media, etc. However extended time spent on non-academic activities like gaming (local or online) are not permitted and you will be asked to relocate. Other lab policies (non-teaching times) include:

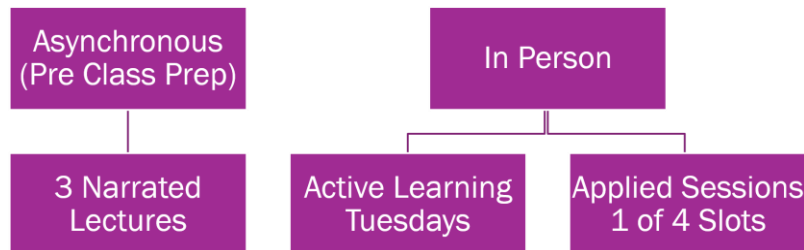
- No food permitted at terminals. Drinks in closed lid containers are allowed.
- Conversations with neighbours are fine but be respectful of other students.
- Use headphones if watching lecture videos, when listening to music, etc.
- Do not provide access to the lab to unauthorized people.

The GIS Centre (located on the 5th floor of the Killam Library) also supports this class by providing access to additional applied help during normal business hours (in person 10 am - 4 pm; virtual 9 am to 4 pm). Appointments with a staff member for help on workshops or projects can be booked through their MS-BOOKINGS page (<https://bit.ly/3OM7dDI>). It is also critical to note that the GIS Centre assists with applied parts of the course only; staff do not assist in answering theory-related questions on class deliverables.

Course Structure

Course Delivery

This course employs a **blended delivery model**, with both **required synchronous and asynchronous elements** to the class. Moreover, the synchronous elements of the class are designed for in-person delivery with several deliverables requiring in-person attendance to complete (i.e., weekly exercises, two term tests).



Finally, this course employs the ESRI platform ArcGIS Pro™. As a U.S.-based Company ESRI observes embargoes placed on several countries by the U.S. government and do not permit exporting / use of the software in those embargoed nations for non-government users. Taken from ESRI's Export Compliance material:

"In addition, ENC products are eligible for export to any nongovernment customer in all destinations except the embargoed countries: Cuba, Iran, North Korea, Syria, Russia, Belarus, and the Regions of Crimea, Donetsk People's Republic, and Luhansk People's Republic of Ukraine."

Lectures / Active Learning

In-person sessions are scheduled on Tuesdays from 5:35 pm to 8:25 pm in Life Sciences Centre Common Area LSC-C236 (near the Tim Horton's towards the Psychology Wing side). These sessions typically run for the first 100 ish minutes of the scheduled slot except on test days, or when making up for missed sessions due to weather events, etc.

Applied Sessions (Laboratories)

A three-hour in-person lab section is held in one of four slots in the new departmental teaching lab, Life Sciences Centre 3111 (eastern loop of the EES wing). Attendance at these sessions is expected / encouraged. If, however, there are circumstances where you must miss a lab, students are permitted to contact the Teaching Assistant via MS-TEAMS with questions during their scheduled lab session.

Course Materials

Recommended Textbook

Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). *Geographic Information Science and Systems* (4th ed.). Wiley Publishing. Available as an e-book through the Killam library at <https://bit.ly/3pLRN53>.

Software

This class requires access to ArcGIS Pro™ 3.7. This software is installed on all Dalhousie campus machines (e.g., the Elizabeth May Teaching Lab, the Wallace McCain Learning Common, Killam Library). ArcGIS Pro™ only operates on the Windows Operating System (OS); if you have a Windows computer and meet the minimum hardware requirements, then the software is available for download (option 1). If you do not have a non-Windows OS or do not meet the minimum hardware requirements, then you may be able to use a web delivered virtual machine (option 2)¹:

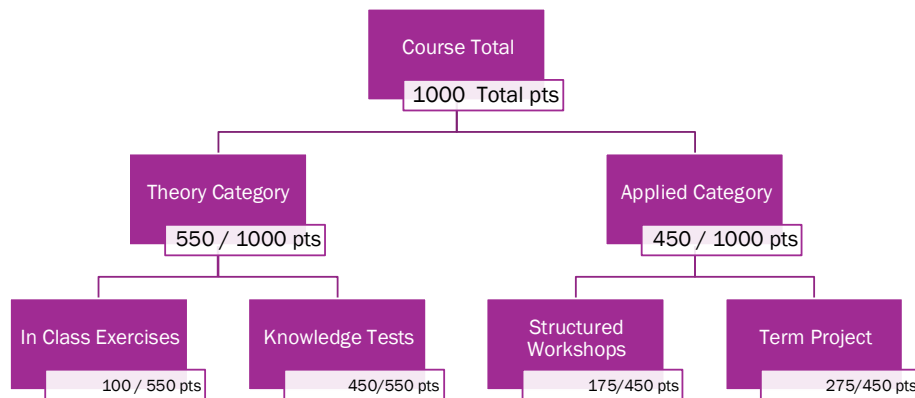
- 1) **Downloading ArcGIS Pro™** through the Dalhousie Software resources to run on a Windows Operating System (<https://software.library.dal.ca/>). It is important to double-check the hardware requirements for the software if using this approach (<https://doc.esri.com/en/arcgis-pro/latest/get-started/arcgis-pro-system-requirements.html>) as video capacity (recommended minimum is an 8 GB GPU) tends to be a common limitation. Using a local install also requires the Dalhousie Virtual Private Network to be installed and active while running ArcGIS Pro™.
- 2) **Web Delivered Access** through a strong, stable broadband connection in a virtual lab environment (<https://apps.vlab.dal.ca/> use: ArcGIS). This method can be used by either Windows or Mac operating systems through a downloadable client, or through a web browser. **This method is not intended to be the primary access method** to the software but is meant to provide short-term access for smaller tasks.

¹ If using either of these options, students are responsible for ensuring they have either an appropriate Windows capable machine at home and / or a stable broadband internet connection (ethernet strongly recommended) to use Omnisca Horizon™.

Digital Storage

Because campus terminals are “frozen”, students will need to save their work to an external location like their Dalhousie OneDrive or to an external USB drive (best practice is to save duplicates in separate locations). I recommend bringing a 64 GB Minimum USB drive (USB-3.0 recommended) to use exclusively for this course to provide an additional save method to OneDrive for applied work.

Assessment



Assignments

Applied – Small Value Lab Deliverables (175 pts.): Standalone, structured exercises completed in a single lab session with a deliverable such as a single map or worksheet to be evaluated. Workshop deliverables are due on Saturday at 5:00 pm for all sections.

Workshops: Why do we do These Assessments?

These small exercises introduce and develop fundamental GIS techniques and data management practices in a prescribed manner to help prepare for the larger Independent Lab Project.

Applied – One Independent Term Projects (275 pts.): One larger, multiple lab session project, requiring students to select and apply techniques learned in the previous standalone, structured exercises. This project has two components:

- Part 1 – Preliminary Report (75 pts.) – Due Saturday, October 24th. at 5:00 pm
- Part 2 – Final Report (200 pts.) – Due Saturday, December 5th, 2026 at 5:00 pm.

Independent Term Project: Why do we do This Assessment?

These projects are intended encourage students to deconstruct skills learned in workshops and reorganize those tasks to a larger workflow. The project also provides practice integrating and contextualizing analytical outputs in a professional product (e.g., PowerPoint Presentation, Technical Report, Story Map).

Synchronous Session – In Class Exercises (100 pts.): Weekly pen & paper exercises completed and discussed in the lecture section of the class. These exercises are pass (full) / pass (partial) / fail (zero) and intended to reinforce specific lecture topics or to demonstrate how the software executes an operation on one or more inputs.

Active Learning Exercises: Why do we do These Assessments?

While these exercises encourage attendance, they are not intended to be primarily attendance grades. The active learning approach provides an opportunity to highlight key topics for additional focus and provide a critical bridge between the prerecorded lecture and the lab setting.

Knowledge Tests

Students will complete two written tests for a total of 450 pts. Each test is valued at 225 pts towards the final grade and has mixed format (multiple choice, fill in the blank, short/long answer). The midterm exam is held in the regular classroom setting with a time limit of 120 minutes.

- Midterm Exam (225 pts) – Tuesday, Oct. 20th, 2026. Content = 1.1 through 3.3.
- Final Exam (225 pts.) – Scheduled by Registrar. Content = 3.4 through 5.6.

Content on the Final Exam not fully “cumulative” but does rely on several scaffolded topics from the previous test that carries through the entire term and underpin later concepts.

Students are permitted to bring a reference sheet (instructor provided template), a scientific calculator, a ruler or straight edge.

Knowledge Tests: Why do we do These Assessments?

An important theme of this class is that GIScience is not software button pressing, but understanding best practices in the creation, management, and visualization of spatial data. Best practices are informed by GIScience theory, which these assessments can directly evaluate.

Other Course Requirements

Grade	Range	Definition and Expectations
+	90-100	Excellent: Considerable evidence of original thinking; demonstrated outstanding capacity to analyze and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.
A	85-89	
-	80-84	
+	77-79	Good: Evidence of grasp of subject matter, some evidence of critical capacity and analytical ability; reasonable understanding of relevant issues; evidence of familiarity with the literature.
B	73-76	
-	70-72	
+	65-69	Satisfactory: Evidence of some understanding of the subject matter; ability to develop solutions to simple problems; benefitting from his/her university experience.
C	60-64	
-	55-59	
D	50-54	Marginal Pass: Evidence of minimally acceptable familiarity with subject matter, critical and analytical skills (except in programs where a minimum grade of 'C' is required).
F	<50	Inadequate: Insufficient evidence of understanding of the subject matter; weakness in critical and analytical skills; limited or irrelevant use of the literature.

Students **must pass both the theory and applied categories of the course**. In other words, to complete the class, students must:

- Earn 275 of the 550 total points in the theory portion of the class, AND
- Earn 225 of the 450 total points in the applied portion of the class.

Students that do not achieve these combined thresholds will be assessed as incomplete and be assigned a grade of F regardless of the total number of points earned.

Course Content

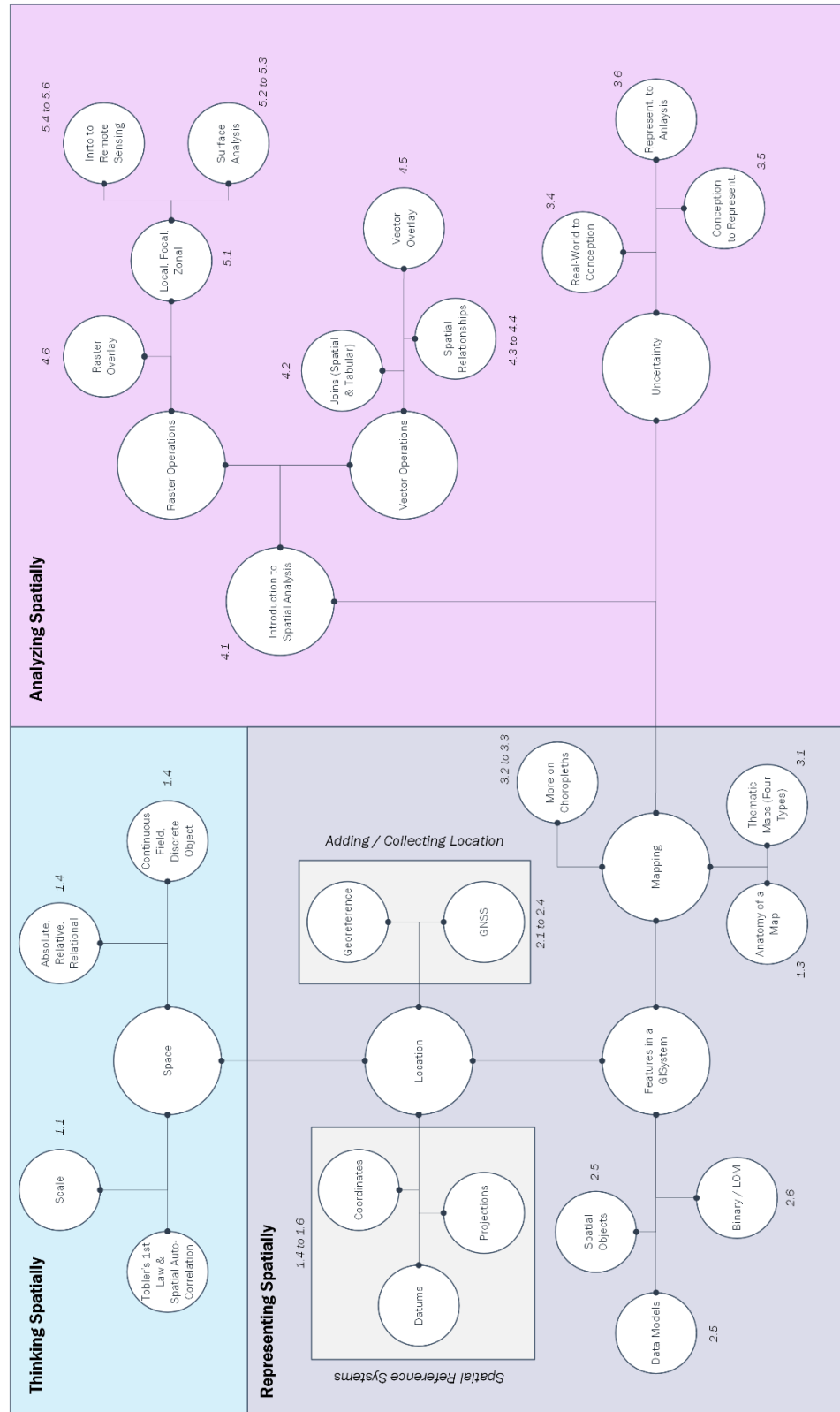
Conditional release rules have been applied to lecture content. The first narrated lecture and slide deck of every module is open, but subsequent lectures and slide decks for the module will not unlock until the previous lecture has been completed. In other words, 1.2 will not be available until 1.1 has been completed; 1.3 will not be available until 1.2 has been completed, etc. The cycle repeats at the start of each module.

Class	Date	Prep	Schedule
1	08-Sep-26	-	Lecture: Class Overview, Onboarding Applied: Workshop-1*
2	15-Sep-26	Lectures 1.1 to 1.3	Lecture: Active Learning Applied: Workshop-2*
3	22-Sep-26	Lectures 1.4 to 1.6	Lecture: Active Learning Applied: Workshop-3*
4	29-Sep-26	Lectures 2.1 to 2.3	Lecture: Active Learning Applied: None. Truth & Reconciliation Day.
5	06-Oct-26	Lectures 2.4 to 2.6	Lecture: Active Learning Applied: Workshop-4*
6	13-Oct-26	Lectures 3.1 to 3.3	Lecture: Review / Active Learning Applied: Workshop-5*
7	20-Oct-26	Study, Study, Study	Lecture: Midterm Exam Applied: Project Part 1 Working**
8	27-Oct-26	Lectures 3.4 to 3.6	Lecture: Active Learning Applied: Workshop-6*
9	03-Nov-26	Lectures 4.1 to 4.3	Lecture: Active Learning Applied: Workshop-7
-	10-Nov-26	Reading Week. No Classes or Applied Sessions	
10	17-Nov-26	Lectures 4.4 to 4.6	Lecture: Active Learning Applied: Workshop-8
11	24-Nov-26	Lectures 5.1 to 5.3	Lecture: Active Learning Applied: Project Part 2 Processing**
12	01-Dec-26	Lectures 5.4 to 5.6	Lecture: Review / Active Learning Applied: Project Part 2 Writing

*Workshop deliverables for all sections are due on Saturday at 5:00 pm.

**Attendance at the first / processing working session can earn an additional discretionary extension towards the project deliverable that working session is intended for.

Topic List



Course Policies on Missed or Late Academic Requirements

Audits

As per section 10 of the Undergraduate calendar, audits of this course are only permitted if permission to audit the course is given by the course instructor and a plan of what constitutes the planned audit is agreed upon by the instructor and student.

Synchronous Sessions

There are no direct grade penalties for being absent from the scheduled synchronous sessions (i.e., attendance). There are, however, weekly active learning assessments and term tests delivered and submitted during the synchronous sessions over the semester. Moreover, these sessions are also intended to provide a forum to ask clarification questions about lecture content, the term project, and upcoming tests or exams. Material covered in the synchronous session are not replicated in other media. Students are responsible for any information and assessments missed in the synchronous sessions.

Learning Management System (LMS)

Important information is posted to the LMS (“Brightspace”) several times a week. It is the responsibility of each student to check the LMS and their Dalhousie email on a regular basis to ensure they are not missing any important materials, updates, announcements, etc.

Materials posted to the Learning Management System are for personal use only and are not to be shared (see Copyright Disclaimer at the end of this course outline and in the LMS Course Shell). Sharing class materials with other students (registered in the class, not in the class, or outside the institution) is not permitted. Posting class materials to course sharing sites is also not permitted and could be considered both a copyright issue as well as a breach of academic integrity.

Course Variations

The course will be taught as close to the listed schedule as possible; however, some deviation from this schedule may be required as the term progresses.

Student Absence Declaration

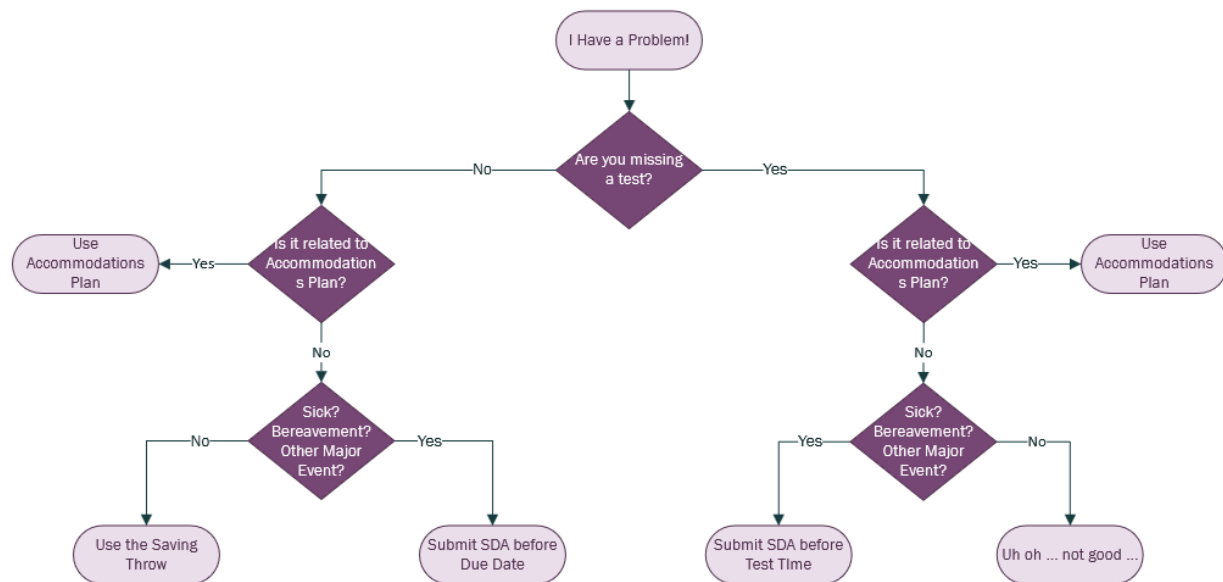
This course has opted into the student declaration of absence in lieu of sick notes. This mechanism is meant to substitute for sick notes from a doctor related to short absences (less than three days) and does not provide an automatic exemption from any missed assessments. Accommodating the absence whether by exemption or makeup assessment is at the discretion of the course instructor. The SDA process can only be used twice in the course. It is important to remember that the SDA policy indicates you must contact the instructor before the assessment deadline has passed regarding your intention to submit an SDA as a part of the SDA process.

Discretionary Extensions (“the Saving Throw”)

In addition to any accommodations provided by the SDA policy and long-term absence policy, each student begins the semester with five discretionary extensions they may use on any applied assessment (workshop or lab project). Students may choose to use a discretionary extension to nullify the first calendar day late penalty on that assessment for any reason not covered by standard accommodation policies, with no questions asked. Only one saving throw may be used per applied assessment, however attending a project working session earns an additional +1 saving throw that can be used to either apply an additional +24-hours or a +2.0% bonus to the related project if a complete project is submitted on or before the original deadline.

When using discretionary extensions / saving throws the teaching staff must be informed prior to the deadline for the assessment passing to use these extensions for the extension to apply. You are permitted to use a saving throw after the deadline, however half the late penalty (or “half damage” for any tabletop gaming peeps out there) will be applied for that saving throw (-10% instead of -20% for a larger project; -50% instead of -100% for a workshop deliverable).

These discretionary extensions are meant to supplement applicable policies such as the SDA (i.e., they are in addition to existing policies) and not meant to act as replacement for these existing policies. If you are sick, have accommodations with the Accessibility Centre that include extensions, if you are in bereavement, then the policies that normally govern those conditions (SDA, Accessibility, etc.) take precedence and should be used over a saving throw.



Missed Small Deliverables (Module-Related Exercises and Structured Workshops)

For both the module related exercises and the structured workshops, the lowest individual item for each will be dropped from the total score. If a student does not submit an item, that item is assigned a 0 and will count as the lowest score item.

Missed Tests / Exams

Students that miss the midterm for valid, accepted reasons will be offered a makeup exam on Sunday, October 25th, 2026 at 10:00 am (specific location to be determined). Students with accessibility plans will follow Accessibility guidelines for makeups as this date is on a weekend when the test centre may not be open.

Students that miss the final exam for valid, accepted reasons will have an “incomplete” applied as their final grade and offered a makeup exam on Wednesday, January 15th, 2026 at 5:30 pm (specific location to be determined) in the first week of classes in the Winter Semester. An earlier makeup may be available by request if the final exam is scheduled early in the exam period by the registrar.

Submission of Work and Late Penalties

To reduce the carbon footprint related to class delivery, a considerable number of assessments will be submitted and graded electronically in the Brightspace LMS and or Crowd Mark to reduce paper use. Late penalties for written work without accommodation from the instructor vary by type of assessment.

Deliverables related to the term project are subject to -20% per calendar day. Late penalties begin to accrue after the assigned submission time has been reached. For example, if the project is due on September 30th at 5:00 pm, submissions past that time (plus a brief “grace period”) are subject to the first application of a -20% late penalty.

Workshop submissions do not have late penalties. If the assigned submission time (plus a brief “grace period”) is reached before a submission is made, a 0 is applied to the submission. Submission dates may be extended through discretionary extension, the student declaration of absence, and accessibility accommodations where applicable and approved by the course instructor.

An important note for students with extension accommodations as a part of their accessibility plans: workshops cannot be extended beyond the start of the earliest lab section of the week. If, for example, you submit a discretionary extension on Saturday for +24 hours to extend to Sunday at 5:00 pm, then request an additional +72 hours tied to your accommodations plan, you will not have until Wednesday at 5:00 pm. You will have until Wednesday at 8:35 am, the beginning of the first lab section of the week (+63.5 hours).

Social Media

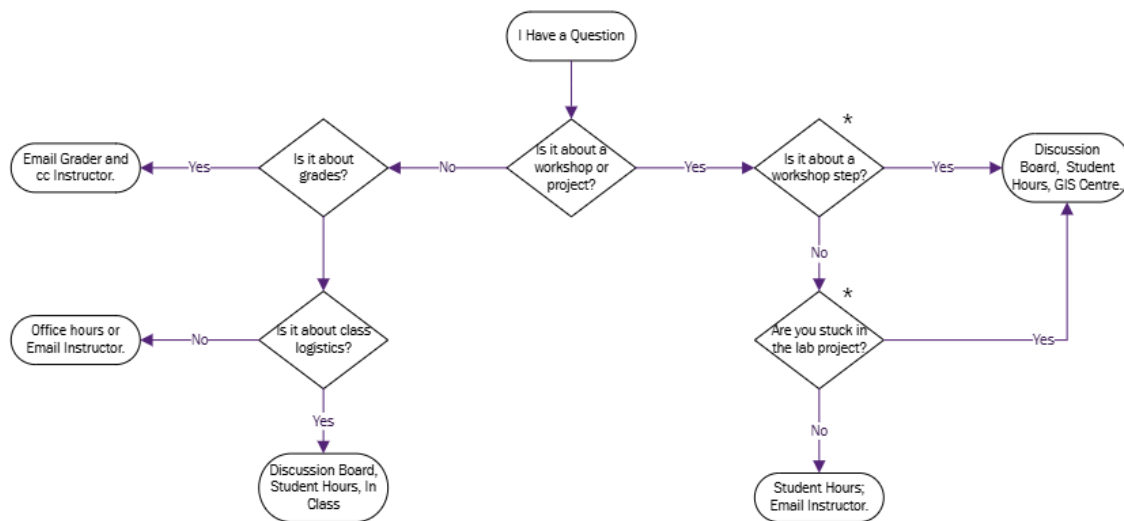
It can be disheartening to see your instructor posting material to social media that negatively discusses their students, even when those posts do not identify individuals. As students in this class, you have my commitment to not publicly post anything negative about participants in this class.

Communications

Students are required to use discussion boards in the Learning Management System for many communication types, especially if related to course management and assessments that have applicability to the entire class cohort. If the Instructor, Lab Instructor, or Teaching Assistants receive an email and feel the question should go to the discussion boards, they will ask the student to replicate their question there for a full response or to ask the question in the next scheduled synchronous session.

Discussion boards will be set up to allow anonymous posting to increase the comfort level of students posting publicly. Please note that even with anonymous posting the moderator (i.e., the teaching staff) will know the identity of the user posting. Please endeavor to be courteous in all communications, including discussion boards.

Due to the volume of emails received during the semester, I am unable to guarantee immediate responses to email enquiries. Typically, students should expect an average of one business day for turnaround of responses to emailed questions. A rough decision tree to assist students in what communications tools to employ has been provided below.



* "Step ____ won't work, what do I do?" questions are generally not answered through email. The teaching team will respond to these questions with "post to discussion board" as the default response.

Course Policies related to Academic Integrity & Artificial Intelligence

All written work may be subject to evaluation using a plagiarism detection service approved by Dalhousie. All students are responsible for ensuring the product they submit to the LMS is the one they intended to submit. There has been an ongoing trend of "I submitted the wrong draft" as a justification for high similarity in originality detection, or as an effort to buy time to avoid late penalties from submitting after the scheduled due date. If a resubmission is

permitted by the instructor, that submission will be subject to a grade penalty unless there is timely notification from the student to the instructor that the wrong draft was submitted.

Unless otherwise noted by the instructor, independent work is required for each student. General discussion and peer tutoring are acceptable and encouraged; however, assessments with highly similar structure and flow of ideas are not acceptable and could be submitted to the faculty academic integrity officer for review.

Generative Artificial Intelligence (or “GenAI”)

Limited use of Generative AI (“GenAI”) is begrudgingly permitted (though not encouraged) in this course under the following principles:

Principles for Use of GenAI

- A GenAI tool cannot / will not do the learning for you as a student.
- GenAI tools cannot be used to produce original content for submission.
- Use of GenAI tools must be acknowledged / attributed.

Before outlining use cases, some general cautions / considerations.

- A GenAI model is a machine trained to recognize patterns and then reflect those patterns back to the user. Text responses are based on correlational patterns between words and phrases.
- Related, GenAI models have been trained to be confident, not correct. There is a plethora of examples of AI outputs confidently asserting factual errors. It is your responsibility to cross-reference / validate that information is correct from legitimate sources.
- GenAI models are tied to the models used to train them and are vulnerable to being discriminatory. If there are biases in the training data (and there will be), these models can perpetuate that bias.
- There are significant privacy concerns with the use of GenAI applications. Use of the Dalhousie Licensed Microsoft Copilot application is recommended.

Specifically, how can you use GenAI in this course?

What Can I do?		What Can't I do?	
☒	Have a GenAI tool explain a general concept.	☒	Upload or paste any past or present course material* into a GenAI tool.
☒	Ask a GenAI tool to provide questions for study.	☒	Use a GenAI tool to create original work for assessments unless directed to do so.
☒	Use a GenAI tool to provide feedback on notes you have created.	☒	Ask a GenAI tool for direct answers to workshops, assignments, quizzes, etc.
☒	Ask a GenAI tool for suggestions for improving spelling and grammar on original work.	☒	Use a GenAI tool to create graphics like maps or flow charts for an assessment / submission.
☒	Use a GenAI tool to brainstorm topics (i.e., what are five emerging topics in _____).		
☒	Use GenAI as directed in any assignment instructions.		

*Course material examples include lecture videos, presentation slides, pdf notes, assignment instructions, tests, workshop instructions, etc.

Course Accessibility

For information on accessibility, refer to the [Student Accommodation Policy](#) for details on how Dalhousie instructors and staff work collaboratively with students to create and sustain an accessible educational environment. Be sure to include information for students about accessing academic accommodations, eligibility, and contact information (see below for suggested inclusions):

Students are eligible for accommodations based on [protected characteristics](#) such as religion. If you have [religious, cultural, or community-significant observances](#) that conflict with course requirements, reach out to me to collaboratively find alternatives for completing the course requirements. To begin the process of requesting a formal academic accommodation, contact the [Student Accessibility Centre](#).

Syllabus Appendix

(Formerly University Policies and Statements)

Link to university policies, and guidelines. This link replaces the previously required list of statements and policies that were at the end of course outlines in previous years. The intention is to redirect students to resources and policies hosted on a website that are regularly updated as policies, statements, resources, and guidelines change or are amended.

[Syllabus Appendix: Student Supports & University Statements, Policies, and Guidelines](#)