Faculty of Science Course Syllabus
Department of Earth & Environmental Sciences

ERTH3500 Geoscience Information Management (Summer 2023)

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Course Instructor:	Dr. Christopher Greene (Chris.Greene@dal.ca) Virtual Student Hours (via Bookings) – Tue from 3:00 to 5:00 pm
Lab Instructor:	Beau Ahrens (BeauAhrens@dal.ca) Virtual Help (via Bookings) – Mon, Wed, Fri from 5:00 to 7:00 pm
Marker / Demonstrator	Bay Berry (bay.berry@dal.ca)
Asynchronous Online Lectures:	4-6 narrated lectures per module (1 module = 1 week).
Synchronous Online Lecture / Tutorials:	Thursdays from 1:05 – 2:25 pm
Weekly Asynchronous Laboratories:	1-2 small value deliverable exercises per module. 2 large value projects per semester.

All times listed are in the Atlantic Time Zone. Scheduling of Office Hours may be modified to improve effectiveness if the Teaching Team identifies conflicts or low demand early in the semester.

Course Description

Geographic Information Systems (GIS), as a tool for the management of georeferenced data, have become indispensable for disciplines where location of objects and pattern of processes is important. GIS plays a fundamental role for a wide range of applications, from modeling, to analysis and predictions, to decision making. The course is designed for a broad base of potential users and draws on examples of the role of GIS in global climate change, mineral exploration, preservation of biodiversity, coastal zone management, resource depletion, and many other present and future environmental issues. The course material will be of interest to those studying geoscience, environmental science, ecology, marine biology, oceanography, epidemiology, urban and rural planning, civil engineering, and any other field involving spatial data. Laboratory exercises emphasize the principles of raster and vector GIS, and the integration of databases and GPS (global positioning systems) data into GIS. Exercises draw on the diversity of GIS applications in a number of topical areas.

Course Prerequisites

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

CROSS-LISTING: ERTH 5600, GEOG 3500, ENVS 3500

Course Exclusion

EXCLUSIONS: Credit will only be given for one of ERTH 3500.03, ERTH 5600.03, GEOG 3500.03, SCIE 3600.03 or ENVS 3500.03

Learning Objectives

With successful completion of the course, students will be able to:

- recognize and describe how geographic information science governs (or should govern) the use of geographic information systems;
- recognize and describe the components (and component functions) of geographic information systems;
- explain and demonstrate how geographic data is generated, managed, modified, visualized;
- critique the quality of geovisualization from a range of sources (popular media, memes, peer-reviewed manuscripts);
- conduct basic, non-inferential spatial analysis using GIS software; and
- compare / contrast how geographic information systems can be used to aid decision-making across several disciplines.

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 e-book through library here: https://bit.ly/3pLRN53.

Software:

Access to ArcGIS Pro™ 2.9.5 is required and is installed on all Dalhousie campus machines (e.g., the Elizabeth May Teaching Lab, the Wallace McCain Learning Common, Killam Library). The software may also be available to you on your own computer through two alternative methods[1]:

1) The first is by **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://bit.ly/3jGbk4k) as video capacity (minimum 2 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™. **Do NOT upgrade to ArcGIS Pro™ 3.0 as the projects are not backwards compatible** to ArcGIS Pro™ 2.9.5.

2) The second method for accessing the software off campus is through **a strong, stable broadband connection in a virtual lab environment** (https://apps.vlab.dal.ca/, use: ArcGIS) or **through a remote desktop connection** (https://remoteaccess.labstats.com/dalhousie-university). This method can be used by Windows or Mac operating systems through a downloadable client, or through the browser. The first week's workshop provides an example of using the virtual lab environment and remote desktop.

[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 to use VMWare or Remote Desktop.

Brightspace Learning Management System (LMS): Narrated lectures, assignment instructions, data delivery, assignment submission, important course announcements, and discussion forums are delivered through the Brightspace Learning Management System.

Synchronous Lectures / Tutorials will be delivered online through conferencing software (either MS-TEAMS or Zoom). Meeting links will be posted to the LMS and are not to be shared with other students. Please **ensure your username is not a nickname or alias or you may not be permitted to join the class session** from the waiting room. Due to the amount of time devoted to question and answer with students, these sessions are not recorded for privacy purposes.

Semester Tests: The three term tests are delivered as open book, online tests and are being held during the scheduled synchronous class time. Test papers are obtained by completing a brief quiz in Brightspace, completed in a word processor and the completed test uploaded to Brightspace. Students are responsible for submitting within the test time limit. A 5% per minute late penalties will be applied to any tests exceeding the test time limit.

Virtual Office Hours: For the spring / summer offering, office hours for both the Course Instructor and Teaching Assistant will be virtual and by appointment. Appointment times can be self-selected through the MS-BOOKINGS interface at the following link https://bit.ly/3CKb2RB.

Weekly Applied Sessions and Help: The applied portion of the class is scheduled to be asynchronous, however the Teaching Assistant will have blocks of availability throughout the week for students to book appointments via MS-TEAMS if help is required with an exercise. Additionally, questions can (and should) be posted to the Discussion Boards, can be asked during the synchronous lecture / tutorials, discussed during a scheduled meeting with the Course Instructor or Lab Instructor, or can be brought to the Dalhousie GIS Centre for assistance (virtual appointment, limited drop-ins; refer to https://libraries.dal.ca/hours-locations/gis-centre.html).

Course Assessment

Category	Component	Weight (% of Final Grade)	Category Weight	Date
Theory	In Class Exercises	5	50	Throughout (Synchronous)
	Test 1 [1]	15		June 15th, 2023
	Test 2 [1]	15		June 29th, 2023
	Test 3 [1]	15		July 13th, 2023
Applied	Workshop Deliverables	10	50	Tue & Fri at 10:00 pm
	Independent Project 1	20		June 22nd, 2023 at 10:00 pm
	Independent Project 2	20		July 17th, 2023 at 10:00 pm
Total			100	

[1] Tests will be delivered as remote, open-book assessments and delivered during the synchronous session. Proctoring software is not required for these tests.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

Grade	Range	Definition and Expectations
A+ **A** **A-**	90-100 85-89 80-84	**Excellent:** Considerable evidence of original thinking; demonstrated outstanding capacity to analyze and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.
B+ **B** **B-**	77-79 73-76 70-72	**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.
C+ **C** **C-**	65-69 60-64 55-59	**Satisfactory:** Evidence of some understanding of the subject matter; ability to develop solutions to simple problems; benefitting from his/her university experience.
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.

Course Policies

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.

> ## 10. AUDIT OF COURSES
>
> Students who have been admitted to a faculty may audit many of the courses offered with the permission of the instructor. Registration for an audit is available from the first day of courses until the last day to add a course. Students auditing courses will not be eligible to write examinations in the audited course and will not in any circumstance be granted credit for it. Fees are payable as indicated under **Fees**. A course may not be changed from credit to audit or from audit to credit status after the last date for dropping courses without 'W' (see the schedule of **Academic Course Add/Drop Dates**).

COVID-19 Safety and the GIS Teaching Lab

If choosing to work in the Elizabeth May Centre for Geocomputation, students are expected to adhere to current Department and University's safety plans. Moreover, as a computer lab the Elizabeth May GIS Teaching Lab has more restrictive policies in place generally students should be aware of (e.g., no food or drink in the lab; access restricted to students scheduled in the lab section; keeping noise low to minimize distraction). An updated policy document will be made available to students through the Learning Management System.

Synchronous Sessions

There are no direct grade penalties for not attending the scheduled synchronous session (i.e., attendance). **There are, however, assessments such as in-class exercises 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, lab projects, and upcoming tests or exams. Material covered in the synchronous session may not be replicated in other media. Students are responsible for any information missed in the synchronous sessions. Because these sessions have a strong component of questions and answer from students, the synchronous sessions are not recorded to minimize potential privacy concerns.

Course Completion

To successfully complete the course, **students must receive 50% of the total possible points or higher for both the theoretical and applied portions of the course.** Not meeting this minimum threshold will result in a grade of F for the course, even if an overall score of 50% or greater is achieved.

Communications

Students are required to use discussion boards in the Learning Management System for a large proportion of communications, especially if related to course management and assessments that have applicability to the class. If the 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 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 endeavour 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 at the end of Section A of the Syllabus.

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 promise that I will not publicly post anything negative about participants in this class.

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.

Learning Management System (LMS)

Important information is posted to the LMS 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 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.

Student Absence Declaration

This course has opted into the student declaration of absence in lieu of sick notes. Please refer to https://bit.ly/2NJS8jw for specific details about the use of the Student Declaration of Absence. 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.

The Saving Throw: Extensions for Applied Work not Covered by Policy

In addition to accommodations provided by the SDA policy and long-term absence policy, each student begins the semester with five "Saving Throw" cards they may use on any applied assessment (workshop or lab project). Students may choose to use a "Saving Throw" card to buy a +24-hour extension on that assessment for any reason not covered by standard accommodation policies, with no questions asked. Up to a maximum of 3 "Saving Throws" can be applied to the same assessment for a maximum total of +72-hr extension.

Please note, the **teaching staff must be informed prior to the deadline (see Communications Decision Tree)** for the assessment passing to use the "Saving Throw" for it to apply. You can use a saving throw after the deadline, however half damage (i.e., half the late penalty) will be applied for that saving throw. Additional saving throws for the same assessment requested prior to the deadline are treated independently.

These Saving Throws are **in addition to applicable policies such as the SDA, and not a replacement for** these existing policies. If you are sick, have accommodations that include extensions, are in bereavement, then the policies that govern those conditions (SDA, Accessibility, etc.).

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

If a term test is missed for valid reasons, the weight of that test will be added to the remaining term tests. If more than one test is missed for valid reasons, accommodations will be determined on a case-by-base basis after consultation with the student.

Submission of Work

To reduce the carbon footprint related to class delivery, most work will be submitted and graded electronically in the Brightspace LMS to reduce paper use. All written work may be subject to evaluation using a plagiarism detection service (see Academic Integrity Policy for further detail).

Late penalties for written work without accommodation from the instructor are -20% per calendar day. Late penalties begin to accrue after the assigned submission time has been reached. For example, if an assignment is due on

September 4th at 12:00 pm, submissions past that time (plus a brief "grace period") are subject to the first application of a -20% late penalty.

All students are responsible for ensuring the product they submit to the LMS is the one they intended to submit. There has been an emerging 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, 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. Additionally, unless explicitly indicated in individual assessment instructions AI ChatBot generated text (e.g., ChatGPT, browser extensions) will not be considered as independent student work and is not permitted for use in assessment submissions.

Course Structure and Assessment Schedule

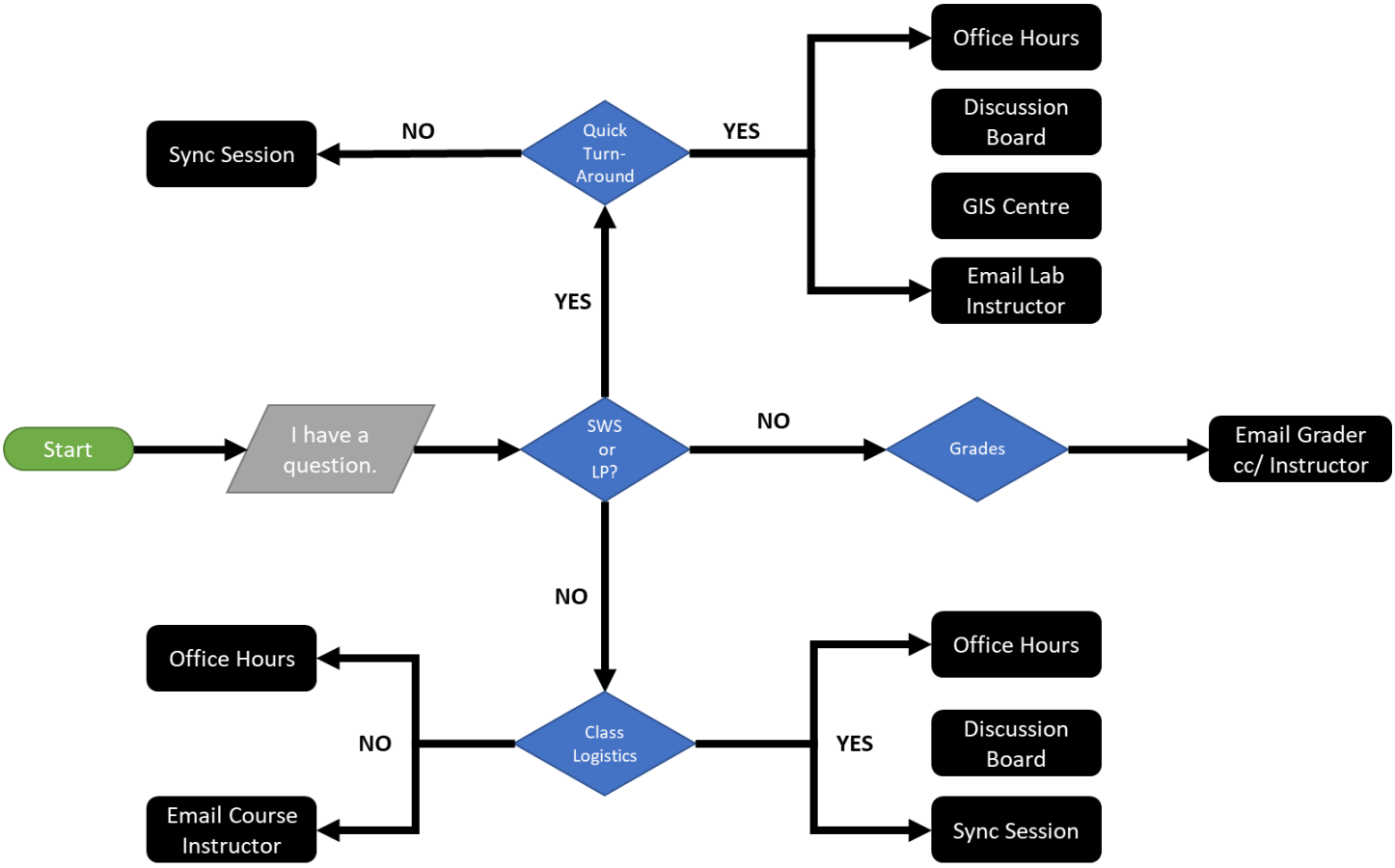
Week	Start	End	Workshop	Applied Submission	Test Dates
1	29-May-23	04-Jun-23	Structured: SWS-0 (A) Structured: SWS-1 (B)	-	-
2	05-Jun-23	11-Jun-23	Structured: SWS-2 (A) Structured: SWS-3 (B)	Tue: SWS-1 (Map) Fri: SWS-2 (Map)	-
3	12-Jun-23	18-Jun-23	Working: LP-1 (A) Working: LP-1 (B)	Tue: SWS-3 (Map)	Thu: Test 1 (Synch)
4	19-Jun-23	25-Jun-23	Working: LP-1 (A) Structured: SWS-4 (B)	Thu: LP-1 (Presentation)	-
5	26-Jun-23	02-Jul-23	Structured: SWS-5 (A) Structured: SWS-6 (B)	Tue: SWS-4 (Map) Fri: SWS-5 (Worksheet)	Thu: Test 2 (Synch)
6	03-Jul-23	09-Jul-23	Structured: SWS-7 (A) Working LP-2 (B)	Tue: SWS-6 (Worksheet) Fri: SWS-7 (Web App)	-
7	10-Jul-23	16-Jul-23	Working LP-2 (A) Working LP-2 (B)	-	Thu: Test 3 (Synch)
-	17-Jul-23	-	-	Mon: LP-2 (Story Map)	-

Topic List

Module	Lecture	Reference
1	1-1: Geographic? Spatial? Geospatial?	Longley et al Ch. 1 pp. 1-9
	1-2: Geographic Information Science? Or Systems	Longley et al Ch. 1 pp. 3-32
	1-3: A Primer on Map Making	Longley et al Ch. 11 pp. 237-265
	1-4: Geographic Views and Spatial Objects	Longley et al Ch. 3 pp. 55-66
	1-5: Data Models Representing Spatial Objects	Longley et al Ch. 3 pp. 66-69
	1-6: Binary and Levels of Measurement	-
2	2-1: Assigning Coordinates to Locations	Longley et al Ch. 4 pp. 77-86
	2-2: From Measurement to Map	Longley et al Ch. 4 pp. 86-98
	2-3: Adding Location to Unreferenced Data	-
	2-4: Uncertainty & Error – Conception of Phenomena	Longley et al Ch. 5 pp. 99-111
	2-5: Uncertainty & Error – Representation of Phenomena	Longley et al Ch. 5 pp. 111-117
	2-6: Uncertainty & Error – Analysis of Phenomena	Longley et al Ch. 5 pp. 117-126
3	3-1: Governing Concepts in Understanding Geographic Phenomena	Longley et al Ch. 2 pp. 33-54
	3-2: Classification and Choropleth Mapping	Longley et al Ch. 11 pp. 248-253
	3-3: More on Counts and Zones in Choropleth Mapping	Buckley (2013)
	3-4: Geovisualization – Other Ways to Consider Spatial Data	Longley et al Ch. 12 pp. 266-280
4	4-1: Databases I – an Overview of Types and Terms	Longley et al Ch. 9 pp. 194-200
	4-2: Databases II – Normalization vs. Table Join	-
	4-3: Database III – SQL, Boolean Terms, Select by Attributes	Longley et al Ch. 9 pp. 202-202
	4-4: Databases IV – Adding Geographic Functions	Longley et al Ch. 9 pp. 202-206
	4-5: Databases V – Structuring Geographic Data	Longley et al Ch. 9 pp. 206-212
5	5-1: Spatial Analysis – An Introduction to Spatial Analysis	Longley et al Ch. 13 pp. 290-294
	5-2: Spatial Analysis – Analysis by Location	Longley et al Ch. 13 pp. 295-303
	5-3: Spatial Analysis – Analysis by Distance	Longley et al Ch. 13 pp. 303-317
	5-4: Spatial Analysis – Vector Overlay	Jensen Ch. 6
	5-5: Spatial Analysis – Raster Overlay	Jensen Ch. 6
	5-6: Spatial Analysis – Raster Operations	Jensen Ch. 6
6	6-1: Remote Sensing – Electromagnetic Radiation	-
	6-2: Remote Sensing – How Data is Stored	-
	6-3: Remote Sensing – Resolution(s)	-
	6-4: GNSS – The Three Segments	Shelito Ch. 4
	6-5: GNSS – Estimating Locations	Shelito Ch. 4
	6-6: GNSS – Sources of Positional Error	Shelito Ch. 4
7	7-1: Models – Differentiating Data Models and Spatial Models	Longley et al Ch. 15 pp. 339-351
	7-2: Models – Accuracy and Validity in Spatial Models	Longley et al Ch. 15 pp. 354-356

**The timing of these topics is approximate. Some shifting of topics will occur depending on total timing of narrated lectures. Names of narrated lectures will be longer and more refined than provided in this coarse overview. **

Communications Decision Tree



General Email Guidance: Who is Responsible for What?

- General course management questions – **Course Instructor**
- Missed assessments and Student Declaration of Absence questions – **Course Instructor**
- Questions about structured workshops and Lab Projects – **TA or Lab Instructor**
- Use of the "Saving Throw" – **TA or Lab instructor** with **Course Instructor** copied
- Initial question about grade just posted – **Marker / Demonstrator / Grader** with **Course Instructor** copied

Faculty of Science Course Syllabus (Section B)

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: http://www.dal.ca/cultureofrespect.html

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loaduseredits=False

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Faculty of Science Course Syllabus (Section C)

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html

Dalhousie COVID-19 information and updates: https://www.dal.ca/covid-19-information-and-updates.html