DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Mathematics and Statistics
MATH 4180
Intro Algebraic Topology
Fall 2018

Instructor(s): *Dorette Pronk* *pronkd@dal.ca* *Chase 302*

Lectures: *TR 10:05 -11:25* *LSC-C216*

Course Description

An introduction to algebraic topology including the following topics: the definitions, properties and methods of computation of the fundamental group of a topological space; simplicial, singular and cellular homology groups; basic properties and methods of computation of homology groups; a selection of application such as the classification of surfaces and fixed point theorems.

Course Prerequisites

MATH 3501

Course Objectives/Learning Outcomes

- Know and can work with basic topological concepts: (local) connectedness, (local) compactness, Hausdorffness, continuity;
- Can work with constructions of topological spaces: products, coproducts, quotients, joins, smash products, cylinders, suspensions, function spaces;
- Be familiar with cell complexes, simplicial complexes, and projective spaces and their topological properties;
- Know the definitions and basic properties of the fundamental group and fundamental groupoid;
- Be able to calculate the fundamental groups and groupoids for sufficiently nice spaces;
- Know and be able to prove the Jordan Curve Theorem;
- Know and be able to prove Brouwer's Fixed Point and Domain Invariance Theorems;
- Know the definition and some basic properties of homology groups.

Course Materials

Textbook: Ronald Brown, *Topology and Groupoids,* Booksurge 2006.
You can order this book online through Amazon, but it is printed on demand, so it may take a bit more time than usual to get it. However, a more up-to-date version of the book is freely available online: https://groupoids.org.uk/pdffiles/topgrpds-e.pdf

I will also make additional notes available through the course website on Brightspace.
We will cover parts of Chapters 1-6, 8-10 of the book.

Course Assessment

- There will be weekly assignments, to be submitted in class on Thursday.
- The midterm will be on October 18, in class.
- The final exam will have an in-class theory component and a take-home component that will ask you to work out a couple of examples.

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Component	Weight (% of final grade)	Date
Midterm	*20%*	*October 18, 2018*
Final exam	*40%*	*to be determined*
Assignments	*40%*	*weekly on Thursdays*

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

A+ (90-100)	**B+** (77-79)	**C+** (65-69)	**D** (50-54)
A (85-89)	**B** (73-76)	**C** (60-64)	**F** (<50)
A- (80-84)	**B-** (70-72)	**C-** (55-59)	

Course Policies

- *My office hours are Wednesday 1:30-2:30 PM, Thursday 12-1 PM, Friday 2-3 PM You may use office hours for any type of questions you have in regard to the course, including requests for hints or help on assignment questions.*
- *Assignments are due in class on Thursdays, but I will accept them until 10 AM the next day. If you need to hand them in later, you need to ask for permission before the assignment is due.*
- *You are allowed to collaborate on solving the assignment questions, but not on the write-up. So I expect your submitted work to look distinct.*
- *As an undergraduate student in this course you are not required to give a presentation. However, if you are interested in studying a topic related to the course and giving a presentation, you may request to do that and receive an adjusted grading scheme: presentations are worth 5% or 10% depending on the length and amount of work involved.*

Course Content

- Intro to topology: open and closed subsets, continuity, product spaces and subspaces
- Topological properties: Hausdorffness, compactness, connectedness, homeomorphisms
- Identification spaces and their interaction with subspaces and products
- Cell complexes
- Projective spaces, simplicial complexes, joins and the smash-product, function spaces
- Categories and groupoids
- The fundamental groupoid
- Homotopies
- The fundamental groupoid of a union of spaces.
- The combinatorics of groupoids
- Computing fundamental groupoids: the Van Kampen Theorem
- The Jordan Curve Theorem
- The Brouwer Fixed Point Theorem
- The Brouwer Domain Invariance Theorem
- Covering Spaces and Covering Groupoids
- The Universal Covering Space
- Simplicial homology for simplicial complexes: connection with the fundamental group and some calculations.

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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://www.dal.ca/academics/important_dates.html

University Grading Practices

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

Missed or Late Academic Requirements due to Student Absence (policy)

https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

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/academic-advising.html

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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/services-support/student-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