Mathematics 5325 (Spring 2019): Topology II

Instructor: Dmitri Pavlov, Assistant Professor
Lectures: TuTh 11–12:30, MA 113
Office hours: TuTh 3:30–5 (no colloquium) or 5–6:30 (colloquium), MA 117C
Midterms: take-home, around February 19 and April 2 (tentative and subject to change)
Final exam: take-home, around Saturday, May 11 (tentative and subject to change)
Credit hours: 3
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1   Course Outline

A classical array of topics will be covered, including the following: homology, cohomology, homotopy groups, covering spaces, homotopy limits and colimits, spectra, sheaf cohomology, point-set theory and Quillen equivalence of topological spaces and simplicial sets.

2   Text

The material will be drawn from a variety of sources, individual texts will be indicated as the course progresses.

3   Catalog Course Description

Point set theory, introduction to combinatorial topology and homology theory.

4   Course Purpose

This course will teach the basics of topology.

5   Course Specific Expected Learning Outcomes

Upon completion of this course, students will be able to apply topology to their area of research.

6   Assessment of Expected Learning Outcomes

Homework assignments will be given throughout the course. Two midterms and a final will be administered as take-home exams.

7   Grading

Final grades are influenced by homework, midterms, and the final exam.

8   Schedule

There will be 30 class meetings on the following days:

January 17: Eilenberg-Zilber and Alexander-Whitney maps.
January 22:
January 24: Cup products.
January 29: Examples of cup products. Cross products.
January 31: Cap products.
February 5: Cap products and examples.
February 7: Simplicial homology as a graded module over the cohomology ring.
February 12: Nerve theorem.
February 14: Relative nerve theorem. Brouwer fixed point theorem.
February 19: Invariance of dimension. Limits and colimits.
February 21
February 26
February 28
March 5: Limits and colimits.
March 7: Limits and colimits.
March 19: Nerve-realization adjunction.
March 21: Groupoids. The fundamental groupod.
March 26: Examples of fundamental groupoids.
March 28: Adjoint functors.
April 2: Coverings.
April 4: Classification of coverings.
April 9: Galois theory of coverings.
April 11:
April 16: Local systems.
April 18: Manifolds.
April 23:
April 25:
April 30: Poincaré duality.
May 2: Kan complexes. Homotopy groups. Simplicial weak equivalences.
May 7: Point-set theory. Equivalence of topological spaces and simplicial sets.

9   Exams

There will be take-home midterms and a final exam around February 19, April 2, and May 11 (tentative and subject to change).

10   Additional Information

The doctoral preliminary examination in topology will be administered in May and August 2019 based on the material taught in this course. Practice problems will be made available.

11   Operating Policy 34.19: Student absence for observance of religious holy day

1. "Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Texas Tax Code §11.20.

2. A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence.

3. A student who is excused under section 2 may not be penalized for the absence; however, the instructor may respond appropriately if the student fails to complete the assignment satisfactorily.

12 Operating Policy 34.22(2b): Reasonable accommodation for students with disabilities

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note: instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services in West Hall or call 806–742–2405.

13 Operating Policy 34.12(5): Academic dishonesty definitions

Students must understand the principles of academic integrity, and abide by them in all class and/or course work at the University. Academic Misconduct violations are outlined Part I, section B.1 of the Code of Student Conduct. If there are questions of interpretation of academic integrity policies or about what might constitute an academic integrity violation, students are responsible for seeking guidance from the faculty member teaching the course in question.

Academic misconduct includes cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, violations of published professional ethics/standards, and any act or attempted act designed to give unfair academic advantage to oneself or another student. Additional information about academic misconduct is available in the Texas Tech University Handbook in Part II, section B of the Community Policies section in the Student Handbook at http://www.depts.ttu.edu/dos/handbook/.