Mathematics 5324 (Fall 2018): Topology I

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 (few students) or 113 (many students)
Midterms: September 27 and November 1
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.

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 at scheduled times.

7 Grading

At the end of the course the number of completed assignments will be divided by the number of all assignments, and the final grade will be assigned according to the following rubric:

$$[.9, 1] \mapsto A, \qquad [.8, .9) \mapsto B, \qquad [.7, .8) \mapsto C, \qquad [.6, .7) \mapsto D, \qquad [0, .6) \mapsto F.$$

8 Schedule

There will be 28 class meetings on the following days:

August 28: What is topology? Applications of topology. Simplices.

August 30: Maps of simplices. Geometric realization of simplices.

September 4: Simplicial sets.

September 6: Example: the simplicial sphere. The Yoneda embedding.

September 11: Example: simplices as simplicial sets. Simplicial maps.

September 13: Examples of simplicial maps: a simplex maps to a sphere. The Yoneda lemma.

September 18: Consequences of the Yoneda lemma. The Yoneda yoga. Generators and relations for simplicial sets.

September 20: §9. Generators and relations for simplicial sets.

September 25: §10. Simplices of a simplicial set.

September 27: Midterm 1.

October 2: §11. Categories.

October 4: §12. Functors.

October 9:

October 11: §13. Coproducts and coequalizers of simplicial sets.

October 16: §14. Natural transformations.

October 18: §15. Simplicial chains.

October 23: §16. Homology.

October 25: §16. Examples of homology.

October 30: §16. Functorial properties of homology.

November 1: Midterm 2.

November 6: Smith normal form.

November 8: §17. Singular simplicial sets. Nerves.

November 13: §18. Homology with coefficients.

November 15: §19. The Euler characteristic.

November 20: §20. Examples of cohomology.

November 27: §21. Products and equalizers of simplicial sets.

November 29: Tensor products.

December 4: Computing tensor products.

9 Midterms

There will be midterms on September 27 and November 1.

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/.