

MTH 516/616: Topology II

Semester 2, 2022-23

General information

Instructor: Dr. Kashyap Rajeevsarathy

Office: AB1 (Infinity building) - 314

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Venue:

- Offline classes: AB1 (Infinity building) - 316
- Online classes: Google Classroom - [nvpqzee](#)

Schedule: SLOT I (in [Time Table](#))

Day	Timing
Monday	12 pm - 1 pm
Thursday	2 pm - 3 pm
Friday	12 pm - 1 pm

Course webpage: Click [here](#).

Course structure

Topics

- **Simplicial Homology.** Simplicial Complexes, Barycentric Subdivision, and Simplicial Homology with examples.

- **Singular and Cellular Homology.** Definition with examples, Homotopy Invariance, Exact Sequence of Relative Homology, Excision, Mayer-Vietoris Sequence, Degree of Maps, and Cellular Homology, Jordan-Brouwer Separation Theorem, Invariance of domain and dimension, Borsuk-Ulam Theorem, Lefschetz-Hopf Fixed Point Theorem, Axioms for homology, Fundamental group and homology, and Simplicial Approximation Theorem.
- **Cohomology.** Universal Coefficient Theorem, Künneth Formula, Cup Product and the Cohomology Ring, Cap Product, Orientations on Manifolds, and Poincaré Duality.
- **Higher Homotopy Groups.** Definition with examples, Aspherical Spaces, Relative Homotopy Groups, Long Exact Sequence of a triple, n -connected spaces, and Whitehead's Theorem.

Suggested references

1. A. Hatcher, *Algebraic Topology*, Cambridge University Press, 2002.
2. E. H. Spanier, *Algebraic Topology*, Springer, 1994.
3. J. R. Munkres, *Elements of Algebraic Topology*, Westview Press, 1996.
4. J. J. Rotman, *An Introduction to Algebraic Topology*, Springer, 1988.
5. M. J. Greenberg & J. R. Harper, *Algebraic Topology: A First Course*, Perseus Books Publishing, 1981.
6. W. S. Massey, *A Basic Course in Algebraic Topology*, Springer International Edition, 2007.
7. G. Bredon, *Topology and Geometry*, Springer International Edition, 2006.

Course policies

Classes

- As this is an advanced course, it would be in the best interest of the students to have offline lectures during scheduled class hours.

- However, if the need arises to have online lectures for an extended period of time, please make note of the following points:
 - Reading material and prerecorded video lectures will be posted weekly at the Google Classroom portal. You are responsible for checking the portal for any updates (from my end) and coming prepared for the interactive sessions.
 - There will be live interaction sessions every week during the scheduled lecture hours. These sessions will primarily enhance your conceptual understanding of the reading material and video lectures posted during the week. Therefore, you are advised to effectively use these sessions to clarify your doubts about the topics being covered.
 - If you face any difficulties participating in the live interaction sessions due to limitations in internet connectivity, data availability (or coverage), or technology, please contact me immediately. I will try to provide additional help or make alternative arrangements for you. Note that all live sessions will be recorded and posted in Google Classroom for the benefit of students with poor internet/data connectivity.

Continuous assessments

Continuous assessment will carry 30% weightage in your final grade as per the current academic policy (available [here](#)). This component of your grade will be computed based on two continuous assessment sub-components, namely homework assignments and class presentations, which will each carry a weightage of 15%.

Homework assignments

- Practice problem sets will be posted every other week. **It is highly imperative that you try solving these problems on your own, as your homework assignments will constitute select problems from these sets.**
- Up to four homework assignments will be given during the semester that you will have to turn in. Your top three perfor-

mances in these assignments will together count towards one continuous assessment component.

- The problems to be turned in and the due dates will be posted on Google Classroom. So it is your responsibility to check the Google Classroom for updates regularly.
- If you must miss the due date (for genuine reasons), try turning in your assignment in advance or write to me seeking an extension.
- If the physical submission is not possible, your solutions should be turned in via email either as a typed document or as a scanned softcopy of handwritten solutions.
- Problems written should be legible and indicate the steps to arrive at the solution.
- While you are encouraged to share and discuss ideas with your classmates, I would strongly caution you against copying solutions verbatim from your classmate/friend. **Please be warned that:**
 - (a) **Assignments with nearly identical solutions will not be graded.**
 - (b) **If there is evidence that even a part of an assignment is copied (or plagiarized), the entire assignment will be given a score of zero.**

Class presentations

- **You will be asked to present important theorems from one (or more) of the prescribed books during the semester.**
- You are expected to read these theorems thoroughly on your own.
- While presenting these theorems, you must ensure that you fill in any gaps or straightforward conclusions in the argument (left out by the authors).
- You will be assessed based on your communication skills, presentation skills, and your overall knowledge of the topic.

Mid-semester and end-semester exams

- **In adherence with the current academic policy (available [here](#)), mid-semester and end-semester examinations will carry weights of 30% and 40% in your final grade.**
- These exams will be administered in the officially assigned classrooms. However, if the need arises, the exams may be hosted on any online proctoring platform endorsed by the Institute. In such situations, students may be required to take the quiz while sitting in front of their computer webcams/mobile phone cameras during the entire duration of the examination.
- The final exam will be comprehensive, with possibly more emphasis on the topics covered after the mid-semester exam.
- When graded exams are returned, please check them carefully for any grading errors. All grading issues should be brought to my attention as soon as possible. Note that test scores are not renegotiable after final grades are submitted.
- Do not make travel plans that might prevent you from taking any scheduled exam. If you have a verifiable reason for not being present at an exam, you must contact me in advance to make an alternative arrangement.

General policies concerning assessment

- Books, notes, or electronic devices of any kind are strictly prohibited while taking tests (exams and quizzes). Your ethical (and moral) responsibility is to exercise honesty and integrity while taking them.
- When graded tests are returned, please check them carefully for any grading errors. All grading issues should be brought to my attention as soon as possible. Note that your scores are not renegotiable after the final grades are submitted.

- Do not make plans that might prevent you from taking any scheduled exam or quiz. If you have a good reason for missing a scheduled test, please contact me in advance to make an alternative arrangement.
- Strong disciplinary action will be initiated against students indulging in academic malpractices (or misconduct) during quizzes (or exams) which include any form of cheating, impersonation, copying, plagiarism, etc., as per the prevailing academic norms of the Institute available at [Circular - Disciplinary actions for various acts of academic malpractices](#).

Grading scheme

A total of 100 percentage points will be distributed as follows:

Component	Weightage
Continuous assessment	30%
Mid-semester examination	30%
Final examination	40%