وزارة التعليـم العالـي والبحـث العلمـي

Sétif 1 University-Ferhat ABBAS
Faculty of Sciences
Department of Mathematics

Setif 1 University - Ferhat ABBAS

FACULTY OF SCIENCES

INTRODUCTION TO TOPOLOGY

FOR THE SECOND YEAR LMD MATHEMATICS STUDENTS

Prepared by:

Dr. CHOUGUI Nadhir

E-mail : nadhir. chougui@univ-setif.dz

Syllabus (2024/2025)

This document contains the syllabus for the module "Introduction to Metric and Topological Spaces" for the 2024/2025 academic year.
Every student is required to read it carefully and understand its content. This module introduces many new mathematical concepts, which demand special attention to assimilate. Any student wishing to study general topology must first be familiar with the basic concepts of a real-valued function (differentiation and integration), as well as real sequences and series. We recommend that students review these concepts, as they will be used throughout the course.

Official Module Content

- Metric Spaces: Distance, open balls, closed balls, and the topology of metric spaces.
- Cauchy Sequences. Complete spaces, and the fixed-point theorem.
- Fundamental Notions of Topology: Open sets, closed sets, neighborhoods, adherence, interior, boundary, basis of a topology, product topology, induced topology, continuity in topological spaces.
- Separated Space.
- Compact Spaces. Connected spaces, and connected sets.

Module Website

The module website will contain:

- **Introduction to metric and topological spaces**: Lecture notes that you must have at all times.
- Tutorials and their solutions.
- All announcements related to the module.

It is highly recommended to regularly check the website for the latest announcements.

Evaluation

- **Class Grade**: 10% (Attendance, participation, and regularity)
- **Quizzes**: 30% (Short exams during tutorial sessions)
- **Final Exam**: 60% (An exam covering the entire module content)

Lectures

- According to university regulations, attendance at lectures is not mandatory.
- It is highly recommended to attend the lectures.
- Talking during lectures is strictly prohibited.
- You must turn off your phone or set it to silent mode during lectures.
- You must have a printed copy of the lecture notes with you at all times.
- Please read the lessons in the course materials before coming to class.

Tutorials

- According to university regulations, attendance at tutorial sessions is mandatory.
- Tutorials will start from the second week of the semester.
- Attendance will be recorded starting from the second week of the semester.
- Three (3) unexcused absences or five (5) absences, even if excused, will result in exclusion from the module.
- There are eight (8) sets of exercises, which will be distributed only once during the lectures.
- Solving the tutorial exercises is the responsibility of the students, not the tutorial instructor.
- Students must attempt to solve the exercises before attending the tutorial sessions.
- Once a set of exercises has been covered, proposed solutions will be made available on the module's website.

Academic Dishonesty

All forms of academic dishonesty are prohibited, and penalties are determined according to university regulations. Academic dishonesty includes (but is not limited to) cheating, plagiarism, copying, collusion, falsification, forging someone else's signature, etc. For more details, you should refer to the Internal Regulations available on the department website.

Behavior During Exams

Every student must follow the following instructions:

- Present their university ID card during the exam as stipulated in university regulations.
- Write their name, surname, group, and registration number on the answer sheet.
- Completely turn off all mobile phones and other communication devices.
- Use their own materials (calculator, pen, etc.).
- Face the consequences if these instructions are not followed.

Tables of contents

1.8.1 Continuous Mappings
1.8.2 Uniform Continuity
1.8.2 Lipschitz and Contraction Mappings and Applications

1.9 Isometry

1.10 Normed spaces

- **2. Complete Metric Spaces (4 hours)**

  2.1 Convergence in a metric space

  2.2 Cauchy sequences and completeness

  2.3 Contractive mapping theorem

- **3. Topological Spaces (9 hours)**

  3.1 Topology, Open sets and Closed sets

  3.2 Neighborhoods

  3.3 Comparison of topologies

  3.4 Base and Neighborhood base

  3.5 Interior points, Adherent points, Accumulation points, Isolated points, Boundary points, Exterior points and Dense sets

  3.6 Separated Spaces (Hausdorff Spaces)

  3.7 Induced topology, Product topology

  3.8 Convergent sequences

  3.9 Continuous applications

  3.10 Homeomorphism

- **4. Compact Metric Spaces (5 hours)**

  4.1 Compactness in Topological Spaces

  4.2 Compactness in metric spaces

- **5. Connected Metric Spaces (5 hours)**

  5.1 Connectivity in Topological Spaces

  5.2 Connectedness in Metric Spaces