Department of Mathematics

College of Science

Salahaddin Univesity-Erbil

Subject: General Topology

Module leader: Dr.Wuria Muhammad Ameen Hussein

Academic Year: 2023-2024

(Semester I, Semester II)

Course Book

1. Course name	General Topology (I)
2. Lecturer in charge	Dr.Wuria Muhammad Ameen
3. Department/ College	Mathematics/Science
4. Contact	e-mail: wuria.hussein@su.edu.krd Tel:
5. Time (in hours) per week	Theory: 2 Practical: 2
6. Office hours	
7. Course code	
8. Teacher's academic profile	- Name: Wuria Muhammad Ameen Hussein - Place and date of birth: Erbil, 14/2/1971 - Academic title: Lecturer - PhD in Mathematics at Plymouth University-United Kingdom in 2016 - M.Sc. in Mathematics at Salahaddin University in 2002 - B.Sc. in Mathematics at Salahaddin University in 1994 - - General field: Mathematics - Specific field: Application of Algebraic Geometry - Job title: Academic staff - Address: Department of Mathematics/College of Science/Salahaddin University
9. Keywords	Topological space, Open sets, limit points, closure operator and subspace.

10. Course overview:

Topology is a branch of mathematics. The word “topology” derives from the Greek words for place (*topo*) and study (*logy*). The study of properties of topology is invariant under any continuous deformation such as “stretching or squeezing, but not tearing or merging.” Topology is a relatively new branch of mathematics; most of the research in topology has been done since 1900. General topology normally considers local properties of spaces, and is closely related to analysis.

The aim of these courses is to introduce the classical theory of general topology. We will provide basic definitions and some theories in topological space.

11. Course objective:

Both courses will cover the following topics:

- Topological space and open sets.
- Some special types of topological spaces.
- Base and subbase of topological spaces.
- Closed sets in topological spaces.
- Neighbourhood of a point in topological space.
- Accumulation, adherent and isolated points of a set in topological spaces.
- Closure, Interior and exterior of a set in topological spaces.
- Subspace of topological spaces.
- Continuous maps in topological space.
- Open and closed maps in topological space.
- Homeomorphism and Homeomorphic topological spaces.
- Topological property.
- Connectedness and compactness.
- Hereditary property.
- Separation axioms.
- Countability axioms.

12. Student's obligation

1. Students are required to attend each lecture on time, staying and listening until the end. Students can leave the class for a short time if necessary.
2. Students are not allowed to be out of attendance for more than 6 hours.
3. Any discussion among the students during the lectures is disallowed unless they get permission.

13. Forms of teaching

1. We use slide visualiser if available, otherwise the white board.
2. Data show projector.

14. Assessment scheme

Students are required to get at least %50 in order to pass this module.
The marks are counted as follows:

1- %40 for annual grade (%20 for midterm exam+%10 for quizzes+%5 for homework+ %5 for assignments).
2- %60 for the final exam.

15. Student learning outcome:

دوای ئەوەی قوتابی ئەم کۆرسە دەخوێنێت و بە سەرکەوتوویی تەواوی دەکات، بنچینەییەکی پتەو بە دەست دەهێنێت لەسەرTopological spaces وئەو پێناسە سەرەکیانەی کە پەیوەندی بە topology هەیە.
ئەو کۆرسە دەست پێدەکات بە خوێندنی Topological spaces و چەند جۆرێکی تایبەت لێیدا. وە دوایی باسی neighbourhood ی point دەکرێت. وە بابەتی base وsubbase لە دوای ئەوەدا دەخوێندرێت، وە پاشان باسی limit point و adherent point وisolated point ی set دەکرێت. وە هەروەها باسی closure و interior و exterior و boundary ی set دەکرێت. وە لە کۆتایی ئەو کۆرسە باس لە subspace of topological space دەکرێت.

16. Course Reading List and References:

1. Kelley, J.L., 2017. *General topology*. Courier Dover Publications.
2. Lipschutz, S., 1965. Schaum's outline of theory and problems of general topology. *(No*

Title).

3. Pervin, W.J., 2014. *Foundations of general topology*. Academic Press.

17. Syllabus of General Topology 2023-2024

Semester I

Chapter 1: Review

Background (Set theory)

Chapter 2: Basic concepts of topology

2.1 Topological space (Definition and examples)

2.2 Restate of definition of topology

2.3 Open sets with examples

2.4 Some types of topology such as trivial, discrete and co-finite topologies

2.5 Some information about countable and uncountable sets

2.6 Co-countable topology

2.7 Usual topology

2.8 Closed set with examples

2.9 Properties of closed sets

2.10 Coarser and finer topologies with examples

2.11 Neighbourhood of a point and a set

2.12 Exercises

Chapter 3: Base and subbase for a topology

3.1 Base for a topology (Definition and examples)

3.2 Necessary and sufficient conditions for a base

3.3 Weight of topological space

3.4 Subbase (Definition and examples)

3.5 Topologies generated by a class of sets

3.6 Exercises

Chapter 4: Closure Operator

4.1 Accumulation, adherent and isolated points (Definitions and examples)

4.2 Closure of a set

4.3 Properties of closure of a set

4.4 Interior, exterior and boundary of set

4.5 Relation between closure and interior of a set

4.6 Properties of interior of a set

4.7 Dense in topology

Chapter 5: Subspace and Relative Topologies

5.1 Subspace of a topological space (definition and examples)

5.2 The base of relative topology

5.3 Closure operator in relative topology

Semester II

Chapter One: Continuity

1.1 Continuous map

1.2 Open and closed maps

1.3 Homeomorphisms

1.4 Homeomorphic spaces

1.5 Topological property

Chapter Two: Connectedness and compactness

2.1 Separation of a set

2.2 Connected and disconnected topological space

2.3 Hereditary property

2.4 Component of a topological space

2.5 Compact topological space

2.6 Finite intersection property

Chapter Three: Separation and countability axioms

3.1 Separation Axioms (T_0, T_1, T_2 (Hausdorff space), Regularity and normality)

3.1.1 T_0-space

3.1.2 T_1-space

3.1.3 T_2 (Hausdorff)-space

3.1.4 Regular and T_3-spaces

3.1.5 Normal and T_4-spaces

3.2 Countability axioms

3.2.1 First countable (axiom) space

3.2.2 Second countable (axiom) space

18. Examinations:

1. ***Compositional:*** In exams, the questions are usually started with:
   i. Show that ….
   In this type of questions, students should prove the question generally.
   For example: Show that the co-finite topology on a finite set is discrete.
   ii. Prove or disprove
   Prove or disprove: If it is correct, then it is the case i., otherwise students should show the disprove by giving a counterexample.
   For example: Every subbase of a topology is a base.
2. **True or false type of questions.**
3. **Fill the blank with the correct answer questions**.