Dilla University

College of Natural and Computational Science

Department of Mathematics

Course Title: General Topology | Course Code: Math 611

Credit hr: 3hrs | Tutorial: 2 | Course hrs: 3

Aims of the course: The main theme of this course is to lay a foundation of the basic concepts in topology which are frequently needed to study in advanced mathematics.

Course Description: This course covers the basic properties of a topological space, metric spaces, continuous functions, compactness and connectedness and the separation axioms with applications.

Course Objectives: On completion of the course successful students will be able to:

- give examples of topological spaces
- determine whether a collection of subsets of a set determines a topology
- determine whether a collection of subsets of a topological space form a basis for the topology
- apply the definition of subspace topology
- determine whether a collection of subsets of topological space form a subspace topology
- apply basis, sub basis for a topology, and subspace topology
- construct the product topology on the Cartesian product of finite number of topological spaces
- determine the limits points of a set
- find the closure of a set
- recognize whether or not a topological space is Hausdorff and be familiar with the basic properties of Hausdorff spaces and their proofs
- apply the various properties of a continuous function defined between topological spaces
- prove the some cases whether or not two topological spaces are homemorphic (topologically equivalent)

Chapter 1: **TOPOLOGICAL SPACES AND CONTINUOUS FUNCTION**

1.1 Definition and examples of a topological space

1.2 Basis and subbasis for a topology

1.3 The product topology

1.4 The subspace topology

1.5 Closed sets and limit points

1.6 Continuous functions

Chapter 2: **THE METRIC TOPOLOGY**

2.1 Definition and examples of a metric space

2.2 Open and closed sets in a metric space

2.3 Sequence and convergent sequence in a metric space

2.4 Interior, closure and boundary

2.5 Equivalent of metrics

2.6 The various metrics on $\Re^2$

2.7 Continuous functions on metric spaces

2.8 Complete metric spaces

2.9 Cantor's Intersection theorem

Chapter 3: **CONNECTEDNESS**

3.1 Definition and examples of a connected space

3.2 Basic properties of connected spaces

3.3 Continuous functions on connected sets

3.4 Connected Subsapces of the real line

3.5 The intermediate value theorem

3.6 Components and path components of a topological space

3.7 Connected subsets on $\Re^n$

Chapter 4: **COMPACTNESS**

4.1 Definition and examples of a compact space

4.2 Basic properties of compact spaces

4.3 Continuous functions on a compact space

4.4 Compact Subspaces of the real line and $\Re^n$ (The Heine-Borel Theorem)

4.5 The maximum and minimum value theorem

4.6 Definition and examples of uniform continuous function from a metric space to a metric space

4.7 Compact sets and uniformly continuous function

4.8 Limit point compactness

Chapter 5: **COUNTABILITY AND SEPARATION AXIOMS**

5.1 The countable axioms

1.5.1 Definitions and examples of first and second countability axioms

1.5.2 Some properties of first and second countability axioms

5.2 The separation axioms

5.2.1 Definition and examples of T_0, T_1, and T_2 spaces

5.2.2 Definition and examples of regular and normal spaces

5.2.3 Basic theorems on separation axioms

5.2.4 The Urysohn Lemma

Mode of Assessment:

- Assignment: 20%
- Mid exam: 30%
- Final exam: 50%

References:

- Topology, A First Course by James R. Munkers.
- General Toplogy, S. Willard
- Principles of Topology by FredH. Croom, ISBN θ03-012813-7 Library of Congress Catalog Number: 88-26519, Saunders College Publishing, Philadelphia, New York, Chicago.