Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2019-2020

Course Handout Part II

Date: 06-01-2020

In addition to Part-I (General Handout for all courses appended to the time table), this portion gives further specific details regarding the course.

Course No. : MATH F423
Course Title : INTRODUCTION TO ALGEBRAIC TOPOLOGY
Instructor-in-Charge : SHARAN GOPAL

Scope and Objective of the Course: Algebraic Topology is an important branch of mathematics having several connections with many areas of modern mathematics as well as other fields like data analysis. This course is designed to lay down a foundation of algebraic topology. It enables students to study topological spaces through algebraic invariants like homology groups and fundamental groups. They will learn the computation of these invariants for topological spaces that will sharpen their geometric intuition. There are various homology theories but in this course, emphasis will be on understanding the simplicial complexes and computation of simplicial homology and their applications. This course also includes the study of covering spaces and singular homology to see mathematical applications of these concepts and their relations to various other fields.

Textbooks:

1. Deo, Satya, "Algebraic Topology-A Primer", 2nd Edition, Hindustan Book Agency, 2018.

Reference books

1. Hatcher, Allen, "Algebraic Topology" Cambridge University Press, 2002.
2. Fulton, William "Algebraic Topology-A first course" Springer-Verlag, 1995.

Course Plan:

Lecture No.	Learning Objectives	Topics to be Covered	Chapter in the text book
1 - 3	Review of Topology	Euclidean and Product spaces, Continuous map and Homeomorphisms, Quotient spaces and Quotient topology, Compact and connected spaces.	1.1 - 1.7
4 - 5	Concept of homotopy will be introduced	Homotopic maps, Homotopy types, Contractible spaces.	2.1 - 2.3
6 - 10	Definition of	Construction of fundamental group,	2.4 - 2.6

	fundamental group, its properties and its calculation for circle will be learnt.	Properties of fundamental groups, Fundamental group of circle.	
11 - 14	To study finite simplicial complexes	Simplicial complexes, Polyhedra and Triangulation.	3.1 - 3.2
15 - 17	To define Barycentric subdivision and learn simplicial approximation theorem.	Simplicial approximation and Barycentric subdivision.	3.3 - 3.4
18-22	To introduce and compute simplicial homology	Orientation of simplicial complexes Chain complex and Homology, Computation of Homology groups.	4.1 - 4.4
23-29	To study properties and applications of homology groups	Properties of Homology groups Homomorphisms between Homology groups, Degree of a map, Invariance of Homology groups.	4.5 - 4.9
30-34	To study covering projections, homotopy lifting theorem and its applications	Introduction of Covering projections and its properties, Applications of Homotopy Lifting Theorem.	5.1 - 5.3
35-41	To study the notions of covering homomorphisms and universal covering spaces	Lifting arbitrary maps, Covering Homomorphisms, Universal covering spaces.	5.4 - 5.6

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage*	Date, Time	Nature of Component
1.	Quiz 1	To be announced in the class	5%	To be announced in the class	Closed Book
2.	Assignment 1	To be announced in the class	10%	To be announced in the class	Open Book
3.	Mid-Semester Test	90 min	30%	7/3 11.00 -12.30 PM	Closed Book
4.	Quiz 2	To be announced in the class	5%	To be announced in the class	Closed Book

5.	Assignment 2	To be announced in the class	10%	To be announced in the class	Open Book
6.	Comprehensive Examination	180 min	40%	14/05 AN	Closed Book

***** The total marks including all the components will be 100.

Chamber Consultation Hour: To be announced in the class.

Notices: The notices concerning this course will be displayed on the CMS site only.

Make-up Policy: Make-up will be given only for very genuine cases and prior permission has to be obtained from the IC.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
MATH F423