Algebraic Topology - Web course

COURSE OUTLINE

This is a basic course in algebraic topology where we introduce the notion of fundamental groups, covering spaces, methods for computing fundamental groups using Seifert Van Kampen theorem and some applications such as the Brouwer's fixed point theorem, Borsuk Ulam theorem, fundamental theorem of algebra. We discuss some classical groups and their fundamental groups.

The second part of the course concerns singular homology theory and would cover all the standard machinery such as homotopy invariance of homology, relationship with the fundamental group, excision and the Mayer Vietoris sequence. After discussing the relative versions, the course closes with the proof of the famous Jordan Brouwer separation theorem.

COURSE DETAIL

Sl No.	Topics
1	Introduction
2	Preliminaries from general topology
3	More Preliminaries from general topology
4	Further preliminaries from general topology
5	Topological groups
6	Test -I
7	Paths, homotopies and the fundamental group

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Mathematics

Pre-requisites:

- General Topology.

Additional Reading:

- Detailed Bibliography is provided

Coordinators:

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8	Categories and functors
9	Functorial properties of the fundamental group
10	Brouwer’s theorem and its applications
11	Homotopies of maps. Deformation retracts
12-13	Fundamental group of the circle
14	Test -II
15	Covering projections
16	Lifting of paths and homotopies
17	Action of $\Pi_1(X, x_0)$ on the fibers $p^{-1}(x_0)$
18	The lifting criterion
19	Deck transformations
20	Orbit spaces
21	Test -III
22	Fundamental groups of $SO(3, R)$ and $SO(4, R)$
23-24	Coproducts and push-outs
25	Adjunction spaces

26	The Seifert Van Kampen theorem
27	Test -IV
28	Introductory remarks on homology theory
29-30	Singular complex of a topological space
31	The homology groups and theori functoriality
32	Abelianization of the fundamental group
33	Homotopy invariance of homology
34	Small simplicies
35	The Mayer Vietoris sequence
36	Maps of spheres
37	Relative homology
38	Excision theorem
39	Test -V
40	Inductive limits
41	Jordan Brouwer separation theorem

References:

- W. S. Massy, A basic course in algebraic topology, Springer Verlag, 1991. Indian reprint, New Delhi 2007.

- J. Vick, Homology theory, Springer Verlag, 1994.