2-Year Master's Program in Mathematics (NEP-2020)
ALGEBRAIC TOPOLOGY

Master's Mathematics (2nd Semester) Total Credits: 04
Course Code: MMTHDAT226 (15 hours per credit) Total Marks: 100
Continuous Assessment: Marks 30, Theory: Marks 70 **Time Duration: 2½ hrs**

Course Learning Outcomes(CLO's): After successful completion of the course, the students will be able to:

CLO1. Understand concepts of path homotopy, deformation retracts, and basic topological constructions.

CLO2. Compute fundamental groups and apply them to classical theorems in topology and algebra.

CLO3. Analyze covering spaces and apply lifting theorems in topological contexts.

CLO4. Develop an understanding of simplicial complexes and compute simplicial homology using Mayer-Vietoris sequences.

Unit-I

Introduction to Homotopy, Paths and path homotopy, homotopy equivalence, relative homotopy, contractibility, deformation retracts. Strong deformability, Comb space and its contractibility.

Unit-II

Fundamental groups: construction of fundamental groups, fundamental group of circle. Application to Fundamental Theorem of Algebra, Brouwer's Fixed Point Theorem and the Borsuk-Ulam Theorem.

Unit-III

Covering spaces: covering spaces of S^1 and $S^1 \times S^1$. Lifting: path and homotopy lifting, lifting properties, Lifiting Criterion, regular covering spaces.

Unit-IV

Cell complexes, subcomplexes with examples. Simplicial complexes, barycentric subdivision, stars and links. Simplicial Homology, Mayer-Vietoris Sequences, long exact sequences.

CLO-PLO Mapping Matrix (Strength version)

CLO ↓ PLO →	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	Average CLO
MMTHDAT226.1	3	2	2	3	2	1	2	2	**2.13**
MMTHDAT226.2	3	1	3	2	2	2	3	3	**2.38**
MMTHDAT226.3	3	3	2	1	3	1	2	3	**2.25**
MMTHDAT226.4	3	2	1	3	2	3	2	2	**2.25**
Average PLO	**3**	**2**	**2**	**2.25**	**2.25**	**1.75**	**2.25**	**2.5**	**2.25**

Recommended Books:

1. A. Hatcher, Algebraic Topology, Cambridge Univ. Press, Cambridge, 2002.
2. W. Fulton, Algebraic topology: A First Course, Springer-Verlag, 1995.
3. W. Massey, A Basic Course in Algebraic Topology, Springer-Verlag, Berlin, 1991.
4. J. J. Rotman, An Introduction to Algebraic Topology, Springer (India), 2004.
5. J. R. Munkres, Elements of Algebraic Topology, Addison-Wesley, 1984.
6. S. Deo, Algebraic Topology, A Primer, Springer.