Algebraic Topology - MA816

This file contains a short description of the material covered in each of the lectures.

- Lecture 1 - Covering maps, path lifting and homotopy lifting for covering maps.
- Lecture 2 - Fundamental groups, some examples.
- Lecture 3 - Fundamental group of S^1, proof of fundamental theorem of algebra using fundamental groups, dependence of fundamental group on base point.
- Lecture 4 - Lifting Theorem for covering maps and applications, branch of logarithm, Borsuk-Ulam.
- Lecture 5 - Seifert-van Kampen Theorem - Universal properties and construction of some universal objects.
- Lecture 6 - Proof of Seifert-van Kampen Theorem.
- Lecture 7 - Galois correspondence for covering maps.
- Lecture 8 - Fundamental groups and Deck transformations. Homotopy equivalent spaces have isomorphic fundamental groups.
- Lecture 9 - Singular homology groups. Some easy examples. Maps induced on singular homology by continuous maps. Homotopic maps induce same map. Homotopy equivalent spaces have isomorphic homology groups.
- Lecture 10 - Barycentric subdivision.
- Lecture 11 - Barycentric subdivision induces identity on homology.
- Lecture 12 - Mayer-Vietoris sequence and homology of S^n.
- Lecture 13 - Homology of pairs, excision.
- Lecture 14 - Abelianization of fundamental group and H_1.
- Lecture 15 - CW complexes.
- Lecture 16 - CW homology and isomorphism with singular homology.

- Lecture 17 - Homology with coefficients, universal coefficients theorem.
- Lecture 18 - Singular cohomology, relationship with homology, Mayer-Vietoris sequence, Universal coefficients.
- Lecture 19 - Kunneth formula, cup product.
- Lecture 19.5 - A brief introduction to simplicial complexes and simplicial homology. Isomorphism between simplicial and singular homology.
- Lecture 20 - Simplicial approximation theorem, Lefschetz Fixed Point Theorem for finite simplicial complexes.
- Lecture 21 - Leray Hirsch Theorem.
- Lecture 22 - Applications of Leray Hirsch Theorem, ring structure on cohomology of $\mathbb{P}^n_{\mathbb{C}}$, cohomology of projective bundles, cohomology of Grassmannians.