School of Mathematics

Course 421—Algebraic Topology 1998-99
(Optional JS & SS Mathematics, SS Two-subject Moderatorship)

Lecturer: Dr. D. R. Wilkins

Requirements/prerequisites: Basic analysis and algebra (covered in 111 and 121).

Duration: 21 weeks.

Number of lectures per week: 3

Assessment:

End-of-year Examination: One 3-hour examination

Description:

Michaelmas Term: survey of basic point set topology (topological spaces, continuous functions, compact and connected spaces etc.); covering maps; lifting theorems; winding numbers; applications to topology in the plane (the Fundamental Theorem of Algebra, the Brouwer Fixed Point Theorem and Hairy Ball Theorem in the two-dimensional cases; the fundamental group.

Hilary Term: simplicial complexes and homology groups; basic homological algebra; the Mayer-Vietoris exact sequence and its applications; closed surfaces and their topological classification.

Algebraic topology is concerned with the study of algebraic invariants (typically groups) that can be associated to subsets of Euclidean spaces (and to more general topological spaces) and that are invariant under homeomorphism or continuous deformation. Such methods are used to attack topological classification problems (e.g., the topological classification of closed surfaces). Famous results in the subject include the Brouwer Fixed Point Theorem and related theorems which have been applied in mathematical economics to prove the existence of economic equilibria in a variety of economic models. Topological methods have also become commonplace in theoretical physics in recent years.

Course 212 (topology) is not an essential prerequisite for this course, though those who have not taken Course 212 may find that extra effort may be required of them at the beginning of the course, where the essentials of basic point set topology (e.g., the notion of a continuous function between topological spaces) will be briefly and quickly reviewed.

June 10, 1998