From Groups to Geometry and Back
Instructor: Professor Sam Nariman
Course Number: MA 49500G
Credits: Three
Time: 12:30–1:20 PM MWF

Description

Groups arise naturally as symmetries of geometric objects, and so groups can be used to understand geometry and topology. Conversely, one can study abstract groups by using geometric techniques and ultimately by treating groups themselves as geometric objects. We shall explore this connection between group theory and geometry and we introduce some of the main ideas of transformation groups, algebraic topology and geometric group theory. We shall follow the book with the same title by Climenhaga and Katok.

Pre-requisite:

Calculus MA 362, Linear algebra (MA 353), basic real analysis (341 or 301)

Introduction to Number Theory
Instructor: Professor Trevor D. Wooley
Course Number: MA 49500N
Credits: Three
Time: 11:30 AM–12:20 PM MWF

Description

Prerequisite: This course is intended for third- or fourth-year students who have taken and obtained a grade of B- or better in MA 35301 (Linear Algebra II). Students should have basic competence in mathematical proof.

Number Theory studies the properties of integers, and includes the theory of prime numbers, the arithmetic structures that underlie cryptosystems such as

RSA, Diophantine equations (polynomial equations to be solved in integers, including the topic of Fermat's Last Theorem), and rational approximations that distinguish algebraic and transcendental numbers. Although a topic studied for more than two millenia, it is the subject of intense active current research, and connects with many other areas of Mathematics.

This course serves as an introductory exploration of Number Theory, without an abstract algebra prerequisite, so that final year students without a pure mathematics background will find this accessible. Connections with abstract algebra will, however, be noted for interested students, and the material should provide reinforcement and preparation for abstract algebra for those with ambitions in this direction.

Content: We begin with a reasonably brisk discussion of the basic notions: the Euclidean algorithm, primes and unique factorisation, congruences, Chinese Remainder Theorem (Public Key Cryptosystems), primitive roots, quadratic reciprocity, arithmetic and multiplicative functions. The second part of the course is devoted to topics: binary quadratic forms, Diophantine approximation and transcendence, continued fractions, Pell's equation and other Diophantine equations, and quadratic fields (subject to time constraints).

Companion Text: An Introduction to the Theory of Numbers (Niven, Zuckerman and Montgomery, 5th edition, Wiley, 1991.)

The course will be based on the instructor's comprehensive web-page hosted LaTeXed notes.

Assessment: Course credit will be based on weekly homeworks – the top 10 scores are totalled; two mid-terms and final exam.