UNIVERSITY OF LONDON | INTERNATIONAL PROGRAMMES

Course information 2018–19
MT3170 Discrete mathematics and algebra

This course is intended to give an introduction to the areas of mathematics known as discrete mathematics and the study of modern algebra. A key aim is to provide an insight into the interactions between these areas, in particular to modern applications such as coding and cryptography.

Prerequisite

If taken as part of a BSc degree, courses which must be passed before this courses may be attempted:

MT2116 Abstract mathematics.

Aims and objectives

The course is designed to enable you to:

- obtain general knowledge about the areas of discrete mathematics and algebra
- understand a variety of methods used to construct mathematical proofs
- acquire an insight into applications such as coding and design

Learning outcomes

At the end of the course and having completed the essential reading and activities, you should be able to:

- ☑ demonstrate knowledge definitions, concepts and methods in the topics covered and how to apply these
- ☑ find and formulate simple proofs
- ☑ model situations in a mathematical way and derive useful results.

Essential reading

Biggs, N. *Discrete mathematics. (*Oxford: Oxford University Press, 2002)

Cameron, P.J. Introduction to Algebra. (Oxford: Oxford University Press, 2008)

Cameron, P.J. Combinatorics. (Oxford: Oxford University Press, 2008)

Assessment

This course is assessed by a three-hour unseen written examination.

Students should consult the appropriate *EMFSS Programme Regulations*, which are reviewed on an annual basis. The *Regulations* provide information on the availability of a course, where it can be placed on your programme's structure, and details of co-requisites and prerequisites.

Syllabus

This is a description of the material to be examined. On registration, students will receive a detailed subject guide which provides a framework for covering the topics in the syllabus and directions to the essential reading

This full course develops the mathematical methods of discrete mathematics and algebra and will emphasis their applications.

Counting: selections, inclusion-exclusion, partitions and permutations, Stirling numbers, generating functions, recurrence relations.

Graph Theory: basic concepts (graph, adjacency matrix, etc.), walks and cycles, trees and forests, colourings.

Set Systems: matching, finite geometries, block designs.

Abstract groups: revision of key concepts such as cyclic groups, subgroups, homomorphisms and Lagrange's theorem. Conjugation and normal subgroups. Group actions.

Applications of algebra to discrete mathematics I: permutations, orbits and stabilisers, the orbit-stabiliser theorem; applications to counting problems.

Rings and polynomials: the Euclidean algorithm for polynomials, integral domains, ideals, factor rings, fields, field extensions.

Finite fields: construction, the primitive element theorem, and finite linear algebra.

Applications of algebra to discrete mathematics II: finite Geometry: designs, affine and projective planes.

Error-correcting codes: linear codes, cyclic codes, perfect codes.