UNIVERSITY OF LONDON

Course information 2020-21
MT3170 Discrete mathematics and algebra

General information

COURSE LEVEL: 6

CREDIT: 30

NOTIONAL STUDY TIME: 300 hours

Summary

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.

Conditions

Prerequisite: If taken as part of a BSc degree, the following course must be passed before this course 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

For full details please refer to the reading list.

Biggs, N. *Discrete mathematics. (*Oxford: Oxford University Press, 2003) [ISBN 978-0198507178]

Please consult the current EMFSS Programme Regulations for further information on the availability of a course, where it can be placed on your programme's structure, and other important details.

Cameron, P.J. *Introduction to Algebra*. (Oxford: Oxford University Press, 2008) second edition [ISBN 978-0198527930]

Cameron, P.J. *Combinatorics*. (Oxford: Oxford University Press, 1994) [ISBN 978-0521457613]

Assessment

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

Syllabus

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, homomorphism's 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.

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