



Unit information 2009–10

42 Optimisation theory (half unit)

This half unit brings together several parts of the wide area of mathematical optimisation, as encountered in many applied fields. The emphasis is on the mathematical ideas and theory used in continuous optimisation.

Prerequisite

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

116 Abstract mathematics.

Students are also strongly encouraged to take 41 Advanced mathematical analysis.

Aims and objectives

This half unit is designed to:

- enable students to obtain a rigorous mathematical background to optimisation techniques used in areas such as economics and finance
- enable students to understand the connections between the several aspects of continuous optimisation, and about the suitability and limitations of optimisation methods for different purposes.

Essential reading

Sundaram, R.K. *A First Course in Optimization Theory*. (Cambridge University Press, 1996) [ISBN 9780521497701].

Assessment

This half unit is assessed by a two hour unseen written examination.

Learning outcomes

At the end of this half unit and having completed the essential reading and activities students:

- ✓ have knowledge and understanding of important definitions, concepts and results, and how to apply these in different situations
- ✓ have knowledge of basic techniques and methodologies in the topics covered
- ✓ have basic understanding of the theoretical aspects of the concepts and methodologies covered
- ✓ be able to understand new situations and definitions, including combinations with elements from different areas covered in the course, investigate their properties, and relate them to existing knowledge
- ✓ be able to think critically and with sufficient mathematical rigour
- ✓ be able to express arguments clearly and precisely.

Students should consult the *Programme Regulations for degrees and diplomas in Economics, Management, Finance and the Social Sciences* that are reviewed annually. The Prerequisites, Exclusions, and Syllabus are subject to confirmation in the *Regulations*. Notice is also given in the *Regulations* of any units which are being phased out and students are advised to check unit availability.

Syllabus

This is a description of the material to be examined, as published in the *Regulations*. 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 unit aims to bring together several parts of the wide area of mathematical optimisation, as encountered in many applied fields.

The unit concentrates on continuous optimisation, and in this sense extends the theory studied in standard calculus courses.

In contrast to the *Mathematics 1* and *Mathematics 2* half units, the emphasis in this Optimisation Theory unit will be on the mathematical ideas and theory used in continuous optimisation. This unit covers the following topics:

- Introduction and review of relevant parts from real analysis, with emphasis on higher dimensions.
- Weierstrass' Theorem on continuous functions on compact set.
- Review with added rigour of unconstrained optimisation of differentiable functions.
- Lagrange's Theorem on equality constrained optimisation.
- The Kuhn-Tucker Theorem on inequality constrained optimisation.
- Finite and infinite horizon dynamic programming.