

## **Course information 2023-24**

### **MT3095 Further mathematics for economists**

#### **General information**

**COURSE LEVEL:** 6

**CREDIT:** 30

**NOTIONAL STUDY TIME:** 300 hours

#### **Summary**

This course provides students with the mathematical techniques and methods which find application in economics and related areas, and enables students to understand why, and in what circumstances, these techniques work.

#### **Conditions**

**Prerequisite:** If taken as part of a BSc degree, the following courses must be attempted before you can register on this course:

- MT1186 Mathematical methods **OR**
- MT1174 Calculus **OR**
- **BOTH** MT105a Mathematics 1 **AND** MT105b Mathematics 2

**Exclusions:** You may not register for this course in the same year as:

- MT2116 Abstract mathematics
- MT2175 Further linear algebra
- MT2176 Further calculus

#### **Aims and objectives**

The course is designed to:

- enable students to acquire skills in further methods of calculus and linear algebra, as required for their use in advanced economics-based subjects
- enable students to understand the underlying theory behind these techniques and those of more basic mathematics courses (such as 05a Mathematics 1 and 05b Mathematics 2)
- prepare students for advanced study in theoretical aspects of economics-based subjects.

#### **Learning outcomes**

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

- use the concepts, terminology, methods and conventions covered in the unit to solve mathematical problems in this subject.
- demonstrate an understanding of the underlying principles of the subject.

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.

- solve unseen mathematical problems involving understanding of these concepts and application of these methods.
- prove statements and to formulate precise mathematical arguments.

## Essential reading

For full details please refer to the reading list.

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Simon, C.P. and L. Blume *Mathematics for Economists*. (New York and London: W.W. Norton and Company)

Anton, Howard A. *Elementary Linear Algebra*. (Wiley Text Books)

Ostaszewski, A. *Advanced Mathematical Methods*. (Cambridge: Cambridge University Press)

## Assessment

This course is assessed by a three-hour and fifteen-minute closed-book written examination.

## Syllabus

**Linear algebra:** Vector spaces, linear independence and dependence, bases and dimension, rank and nullity of a matrix. Linear mappings, their rank and nullity, their matrix representation, and change of basis. Eigenvalues and eigenvectors. Diagonalisation of matrices, with applications to systems of difference and differential equations (including stability). Quadratic forms and orthogonal diagonalisation. Inner product spaces, norms, orthogonality and orthonormalisation.

**Functions and mathematical analysis:** Sets and functions. Supremum and infimum of bounded sets. Limits of sequences in  $\mathbf{R}$  and  $\mathbf{R}^m$ . Limits and continuity of functions.

Open subsets and closed subsets of  $\mathbf{R}^m$

Compact subsets of  $\mathbf{R}^m$ . Convex sets, convex and concave functions. Gradients and directional derivatives. The Jacobian derivative. The Edgeworth Box and contract curves.

**Optimisation:** Unconstrained optimisation and the second-order conditions. Constrained optimisation and the Kuhn-Tucker theorem. Envelope Theorems. Theory of linear programming (computational methods will not be included). Duality, with applications. Basic Game Theory.

**Note:** *Candidates will be expected to work with formal definitions and be able to prove results as well as apply techniques and methods.*

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