

## Course information 2025-26

### EC3120 Mathematical Economics

#### General information

**MODULE LEVEL:** 6

**CREDIT:** 30

**NOTIONAL STUDY TIME:** 300 hours

**MODE:** Locally Taught and Independent Learner Route (not available for Online Taught students)

#### Summary

Mathematical modelling is particularly helpful in analysing a number of aspects of economic theory. The course content includes a study of several mathematical models used in economics. Considerable emphasis is placed on the economic motivation and interpretation of the models discussed.

#### Conditions

Please refer to the relevant programme structure in the EMFSS Programme Regulations to check:

- where this course can be placed on your degree structure; and
- details of prerequisites and corequisites for this course.

You should also refer to the Exclusions list in the EMFSS Programme Regulations to check if any exclusions apply for this course.

#### Aims and objectives

The course is specifically designed to:

- Demonstrate to the student the importance of the use of mathematical techniques in theoretical economics.
- Enable the student to develop skills in mathematical modelling.

## Learning outcomes

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

- Use and explain the underlying principles, terminology, methods, techniques, and conventions used in the subject.
- Solve economic problems using the mathematical methods described in the subject.
- Discuss the main types of risks faced by banks, and use the main techniques employed by banks to manage their risks.

## Employability skills

Below are the three most relevant employability skills that students acquire by undertaking this course which can be conveyed to future prospective employers:

1. Complex problem solving
2. Decision making
3. Adaptability and resilience

## Essential reading

For full details please refer to the reading list.

Dixit, Avinash K. Optimization in Economics Theory. (Oxford University Press, 1990) second revised edition [ISBN 978-0198772101]

Sydsæter, Knut, Peter Hammond, Atle Seierstad and Arne Strom Further Mathematics for Economic Analysis. (Pearson Prentice Hall, 2008) second edition [ISBN 978-0273713289]

## Assessment

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

## Syllabus

**Techniques of constrained optimisation.** This is a rigorous treatment of the mathematical techniques used for solving constrained optimisation problems, which are basic tools of economic modelling. **Topics include:** Definitions of a feasible set and of a solution, sufficient conditions for the existence of a solution, maximum value function, shadow prices, Lagrangian and Kuhn Tucker necessity and sufficiency theorems with applications in economics, for example General Equilibrium theory, Arrow-Debreu securities and arbitrage.

**Intertemporal optimisation.** Bellman approach. Euler equations. Stationary infinite horizon problems. Continuous time dynamic optimisation (optimal control). Applications, such as habit formation, Ramsey-Kass-Coopmans model, Tobin's  $q$ , capital taxation in an open economy, are considered.

**Tools for optimal control: Ordinary differential equations.** These are studied in detail and include linear 2nd order equations, phase portraits, solving linear systems, steady states, and their stability.