



At the end of the course, students should:

- (i) understand constrained optimisation including interpretation of Lagrange multipliers, envelope theorems and inequality constraints and be able to apply their knowledge to economic models;
- (ii) understand harder first-order and linear second-order differential and difference equations and be able to apply their knowledge to economic models;
- (iii) understand linear and non-linear systems of differential and difference equations and be able to apply their knowledge to economic models.

Constrained optimisation: meaning of Lagrange multipliers, envelope theorems, inequality constraints and the Kuhn-Tucker theorem.

Mean value theorem, l'Hôpital's rule, Taylor's theorem. The circular functions.

Complex numbers.

Harder first-order differential equations: solution by integrating factor, Bernoulli's equation. Linear second-order differential and difference equations.

Eigenvalues and eigenvectors. Linear systems of difference and differential equations, stability of stationary solutions. Nonlinear systems of differential equations: linearisation, stability of stationary solutions.

Malcolm Pemberton and Nicholas Rau, *Mathematics for Economists: An introductory textbook*, Fifth Edition, Manchester University Press, 2023

20% course work

80% examination