

Summary Information

Module Code	5100MATHS
Formal Module Title	Further Mathematical Methods
Owning School	Computer Science and Mathematics
Career	Undergraduate
Credits	20
Academic level	FHEQ Level 5
Grading Schema	40

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Vincent Kwasnica	Yes	N/A

Module Team Member

Contact Name	Applies to all offerings	Offerings
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Partner Module Team

Contact Name	Applies to all offerings	Offerings
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Teaching Responsibility

LJMU Schools involved in Delivery
Computer Science and Mathematics

Learning Methods

Learning Method Type	Hours
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Lecture	33
Practical	2
Tutorial	20

Module Offering(s)

Offering Code	Location	Start Month	Duration
SEP-CTY	CTY	September	12 Weeks

Aims and Outcomes

Aims	To further the study of mathematical methods in the areas of multidimensional calculus such as partial differentiation and multiple integration and applications, together with elements of discrete mathematics such as linear programming, difference equations, graph theory & networks, game theory, etc.
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Learning Outcomes

After completing the module the student should be able to:

Code	Description
MLO1	Integrate and differentiate functions of several (two) variables.
MLO2	Apply calculus of several (two) variables in relevant problem scenarios.
MLO3	Model, solve and analyse problems involving the use of: difference equations, game theory, graph theory, and linear programming.

Module Content

Outline Syllabus
Partial differentiation: Taylor series, unconstrained and constrained optimisation with Lagrange multipliers. Hessians and convexity/concavity. Integration of functions of two variables: Iterated integration, change of order in integration, transformation to polar coordinates. Difference equations: Modelling discrete time problems. Solution to difference equations (simple analytical problems). Applications: e.g. population growth, amortization. Graphs: Graphs as models, directed graphs, graphs and matrices; trees, planarity. Shortest paths: 'Greedy algorithms', Dijkstra's algorithm. Spanning trees: Prim's algorithm, Kruskal's algorithm. Hamiltonian paths & cycles: Travelling Salesperson problem. Eulerian paths and circuits: Chinese postman problem. Fleury's algorithm. Linear Programming: graphical and algebraic methods. Game Theory: Nash Equilibria, Saddle points, Mixed Strategies, Types of game situation e.g. Prisoner's Dilemma, Hawk Dove.

Module Overview
This module continues to build on mathematical methods and elements of discrete/finite mathematics which have increasing application in science, engineering and business decision making.

Additional Information

This module continues to build on mathematical methods and elements of discrete/finite mathematics which have increasing application in science, engineering and business decision making. This module lays the foundations for further study at level 6.

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Learning Outcome Mapping
Report	Problem solving	30	0	MLO1
Centralised Exam	Examination	70	2	MLO3, MLO2, MLO1