

Liverpool John Moores University

Title: FURTHER MATHEMATICAL METHODS
Status: Definitive
Code: **5100MATHS** (124196)
Version Start Date: 01-08-2021

Owning School/Faculty: Computer Science and Mathematics
Teaching School/Faculty: Computer Science and Mathematics

Team	Leader
Vincent Kwasnica	Y

Academic Level: FHEQ5 **Credit Value:** 20 **Total Delivered Hours:** 57
Total Learning Hours: 200 **Private Study:** 143

Delivery Options

Course typically offered: Semester 1

Component	Contact Hours
Lecture	33
Practical	2
Tutorial	20

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Problem solving	30	
Exam	AS2	Examination	70	2

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.

Learning Outcomes

After completing the module the student should be able to:

- 1 Integrate and differentiate functions of several (two) variables.
- 2 Apply calculus of several (two) variables in relevant problem scenarios.
- 3 Model, solve and analyse problems involving the use of: difference equations, game theory, graph theory, and linear programming.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Multivariable Calculus	1		
Examination	1	2	3

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.

Learning Activities

Lectures reinforced by tutorial classes and online problems.

Notes

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.