Liverpool John Moores University

Title:	FURTHER MATHEMATICAL METHODS
Status:	Definitive
Code:	**5000MATHS** (103223)
Version Start Date:	01-08-2018
Owning School/Faculty:	Applied Mathematics
Teaching School/Faculty:	Applied Mathematics

Team	Leader
Vincent Kwasnica	Y

Academic Level:	FHEQ5	**Credit Value:**	24	**Total Delivered Hours:**	74
Total Learning Hours:	240	**Private Study:**	166		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24
Practical	6
Tutorial	42

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Report on multivariate calculus supplemented with considerable mathematical analysis, problem solving and investigation.	15	
Report	AS2	Report on discrete mathematics supplemented with considerable mathematical analysis, problem solving and investigation.	15	
Exam	AS3	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 discrete mathematics.
4 Apply the methods of difference equations, game theory, graph theory, and linear programming.
5 Use appropriate software to solve calculus problems of several (two) variables.
6 Use appropriate software to solve discrete mathematics problems.

Learning Outcomes of Assessments

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

Multivariate calculus	2	5
Discrete mathematics	4	6
Examination	1	3

Outline Syllabus

Partial differentiation: Taylor series, unconstrained and constrained optimisation with Lagrange multipliers. Hessians and convexity/concavity. Systems of differential equations.
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 computer-based modelling laboratories.

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 aims to lay the foundations for further study in advanced mathematical methods & the module Operational Research at NQF level 6.