Liverpool John Moores University

Title:	ADVANCED CALCULUS AND DATA MINING
Status:	Definitive
Code:	**6010MATHS** (120292)
Version Start Date:	01-08-2018
Owning School/Faculty:	Applied Mathematics
Teaching School/Faculty:	Applied Mathematics

Team	Leader
Ivan Olier-Caparroso	Y
Sandra Ortega Martorell	

Academic Level:	FHEQ6	**Credit Value:**	24	**Total Delivered Hours:**	75
Total Learning Hours:	240	**Private Study:**	165		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	36
Tutorial	36

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Report based on questions on Fourier series and complex analysis.	20	
Report	AS2	Report based on analysis of data using neural networks.	20	
Exam	AS3	Examination.	60	3

Aims

To further develop the student's ability to understand and use a wide range of mathematical methods in the solution of problems arising in the field of applicable mathematics.

To introduce the student to exploratory analysis and non-linear inferential procedures applied to multivariate data.

Learning Outcomes

After completing the module the student should be able to:

1	Use complex analysis to solve problems in calculus.
2	Determine the gradient, divergence and curl of scalar and vector quantities as appropriate, state the theorems of Gauss, Green and Stokes and apply them in a selection of case studies from physics and engineering.
3	Analyze periodic phenomena into corresponding Fourier series, using both analytic and numerical techniques.
4	Classify future multivariate observations into one of a number of known populations.
5	Apply neural network algorithms.
6	Report their conclusions in an appropriate manner.

Learning Outcomes of Assessments

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

Fourier series	1	3			
Data analysis	4	5	6		
Examination	1	2	3	4	5

Outline Syllabus

Fourier series: functions of arbitrary period, Odd and even functions,
Vector calculus: gradient, divergence and curl.
Complex function theory, including concepts of continuity, analyticity, integration, residues and poles.
Multiple integrals in Cartesian co-ordinates only. Theorems of Gauss, Green and Stokes with physical applications.
Analytical form of the logistic regression classifier
Understanding of objective functions and their role
Flexible modeling with the Multi-Layer Perceptron (MLP)
Control of model smoothness using weight decay regularization
Clustering with the k-means method, Radial Basis Functions
Incremental learning - Adaptive Resonance Theory (ART)
Interpretation of models with nomograms and Boolean rules
Tutorial session and exam revision.

Learning Activities

Lectures, tutorials.

Notes

This module gives students the opportunity to apply mathematics to scientific problems, and to learn about state-of-the-art methods of data analysis.