Liverpool John Moores University

Title:	NUMERICAL METHODS
Status:	Definitive
Code:	**5103MATHS** (124199)
Version Start Date:	01-08-2021
Owning School/Faculty:	Computer Science and Mathematics
Teaching School/Faculty:	Computer Science and Mathematics

Team	Leader
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Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	56
Total Learning Hours:	200	**Private Study:**	144		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	33
Practical	11
Tutorial	11

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Portfolio	AS1	Numerical methods problem based learning in equations coming from various application areas. Applications of Chaos & Fractals	75	
Exam	AS2	Exam testing Numerical methods and it's application	25	1

Aims

Develop an understanding of the need to analyse and interpret numerical solutions to problems.
Enable students to study and investigate the error of certain numerical methods.
Provide practical experience in the use of numerical methods and appropriate software.

Computations involving real and complex dynamical systems.
Gain understanding of methods of constructing fractals.
Gain confidence in independent study to solve equations and problems arising in dynamical systems and fractal analysis.

Learning Outcomes

After completing the module the student should be able to:

1	Understand the importance of numerical methods for applied problems with no analytical solutions.
2	Develop appropriate analysis of the numerical methods
3	Identify stable and robust numerical methods and their software implementation.
4	Analyse and interpret numerical solutions to problems.
5	Identify and analyse abstract and real systems which exhibit chaotic behaviour.
6	Construct fractals from simple patterns and replication rules.

Learning Outcomes of Assessments

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

Num methods, Chaos/Fractals	1	2	3	5	6
Exam	1	3	4		

Outline Syllabus

Decimal search, bisection and linear interpolation.
Fixed point iteration, secant and Newton Raphson methods. Analysis of the methods.
Taylor series and its error term.
Error analysis of the above methods.
Numerical integration: mid-point, trapezium, Simpson's rules. Error analysis/order of convergence and applications to Richardson's extrapolation and Romberg integration.
Solution of Ordinary Differential Equations: First and second order, Euler, modified Euler, Runge-Kutta order 4, Taylor methods.

Computations of fixed and periodic points in real and complex dynamic systems.
Logistic and Mandelbrot maps.
Construction of iterated function systems using contractive affine maps.

Learning Activities

Through lectures, tutorials and private study students will investigate the mathematics and practical implementation of numerical methods and then go on to use appropriate mathematical software to develop their understanding of the subject area.

Notes

Acquaint the student with practical methods for solving applied problems. Develop an understanding of the analysis of the methods used. The fractals and chaos element of the module will enable the students to apply advanced mathematical techniques to 3D graphics and the analysis of dynamical systems.