Liverpool John Moores University

Title:	COMPLEX DYNAMICS
Status:	Definitive
Code:	**6008MATHS** (117483)
Version Start Date:	01-08-2016
Owning School/Faculty:	Applied Mathematics
Teaching School/Faculty:	Applied Mathematics

Team	Leader
Paul Strickland	Y

Academic Level:	FHEQ6	**Credit Value:**	24	**Total Delivered Hours:**	72
Total Learning Hours:	240	**Private Study:**	168		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24
Practical	48

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Alternative representations of 3D rotations and interpolation.	25	
Report	AS2	Advanced matrix algebra.	25	
Report	AS3	Applications of Chaos and Fractals.	50	

Aims

An ability to analyse a range of real-world applications of number systems beyond the reals.
Identification of areas where complex dynamics apply, and associated computation.
Development of 3- and higher dimensional intuition through appropriate tools.

Learning Outcomes

After completing the module the student should be able to:

1 Identify and analyse abstract and real systems which exhibit chaotic behaviour.
2 Construct fractals from simple patterns and replication rules.
3 Calculate the generalised dimension of a set.
4 Perform calculations relating to different representations of rigid body transformations.
5 Apply the algebra of square matrices.

Learning Outcomes of Assessments

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

3D rotations	4		
Matrix algebra	5		
Chaos and Fractals	1	2	3

Outline Syllabus

Rigid movements in 3D space
Euler Angle
Complex Numbers and Quaternions
Eigenvalues and Eigenvectors
The Cayley-Hamilton theorem.
Orthogonal matrices in higher dimensions
One-dimensional dynamical systems.
The Mandelbrot set and its associated Julia sets.
Fractals via replication rules.
Examples of approximate fractals in nature.
Fractals with a random element.
Applications in computer graphics.
Towards a definition of chaos

Learning Activities

Students will use appropriate mathematical software to develop their understanding of the subject area.

Notes

This module will enable the students to apply advanced mathematical techniques to 3D graphics and the analysis of dynamical systems.