

COURSE SPECIFICATION FORM

DEPARTMENT OF: Mathematics				Academic Session: 2017-18	
Course Code:	MT3280	Course Value:	0.5	Status: <i>(ie:Core, or Optional)</i>	Optional
Course Title:	Non-Linear Dynamical Systems: Routes to Chaos			Availability: <i>(state which teaching terms)</i>	Term 1
Prerequisites:	MT1720 and MT1820			Recommended:	
Co-ordinator:					
Course Staff					
Aims:	To introduce the fundamentals of the analysis of nonlinear dynamical systems and, in particular, to investigate whether the behaviour of a nonlinear system can be predicted from the corresponding linear system.				
Learning Outcomes:	<p>On completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • identify and classify the critical points for both discrete and continuous dynamical systems; • understand when and why the direct and indirect Liapunov methods are appropriate and use them both; • understand when a limit cycle can, and cannot, occur and prove the non-existence as appropriate; • recognize the role of the linear system in predicting the long-term behaviour of the non-linear system. 				
Course Content:	<p>Systems of first order linear differential equations: Similarity types for 2×2 matrices and their connection with linear systems. Classification of two-dimensional linear phase portraits. Extension to three dimensions.</p> <p>Nonlinear differential equations: Liapunov's stability analysis, periodic solutions and limit cycles, Poincaré-Bendixson theorem. Applications to problems from physics, biology and economics.</p> <p>Non-linear difference equations: Poincaré surface of section, stability of critical points, routes to chaos.</p>				
Teaching & Learning Methods:	<p>33 hours of lectures and examples classes. 117 hours of private study, including work on problem sheets and examination preparation. This may include discussions with the course leader if the student wishes.</p>				
Key Bibliography:	<p>Dynamical Systems, Differential Equations, Maps and Chaotic Behaviour – D K Arrowsmith and C M Place (Chapman & Hall). <i>Library Ref. 515.41 ARR</i></p> <p>Differential Equations, Dynamical Systems and an Introduction to Chaos – M W Hirsch, S Smale and R Devaney (Academic Press). <i>Library Ref. 515.41 HIR</i></p> <p>Elementary Differential Equations and Boundary Value Problems – W E Boyce & R C di Prima (Wiley). <i>Library Ref. 515.41 BOY</i></p>				
Formative Assessment & Feedback:	Formative assignments in the form of 8 problem sheets. The students will receive feedback as written comments on their attempts, and discussion within classes.				
Summative Assessment:	<p>Exam (%) A two-hour paper: 100%</p> <p>Coursework (%) None</p>				

Updated September 2017

The information contained in this course outline is correct at the time of publication, but may be subject to change as part of the Department's policy of continuous improvement and development. Every effort will be made to notify you of any such changes.