

School of Mathematics & Statistics

Mathematics & Statistics (MT) modules

MT3501 Linear Mathematics 2			
SCOTCAT Credits:	15	SCQF Level 9	Semester 1
Academic year:	2018/9		
Planned timetable:	12.00 noon Mon (even weeks), Tue and Thu		
This module continues the study of vector spaces and linear transformations begun in MT2501. It aims to show the importance of linearity in many areas of mathematics ranging from linear algebra through to geometric applications to linear operators and special functions. The main topics covered include: diagonalisation and the minimum polynomial; Jordan normal form; inner product spaces; orthonormal sets and the Gram-Schmidt process; adjoint and self-adjoint operators.			
Pre-requisite(s):	Before taking this module you must pass MT2501		
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).		
	Scheduled learning: 35 hours	Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 90%, Practical Examinations = 0%, Coursework = 10%		
	As used by St Andrews: 2-hour Written Examination = 90%, Coursework = 10%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Dr J D Mitchell		
Module teaching staff:	Dr J Mitchell		

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MT3502 Real Analysis				
SCOTCAT Credits:	15	SCQF Level 9	Semester	1
Academic year:	2018/9			
Planned timetable:	11.00 am Mon (even weeks), Tue & Thu			
This module continues the study of analysis begun in the 2000-level module MT2502 Analysis. It considers further important topics in the study of real analysis including: integration theory, the analytic properties of power series and the convergence of functions. Emphasis will be placed on rigorous development of the material, giving precise definitions of the concepts involved and exploring the proofs of important theorems. The language of metric spaces will be introduced to give a framework in which to discuss these concepts.				
Pre-requisite(s):	Before taking this module you must pass MT2502			
Learning and teaching methods of delivery:	Weekly contact: 2.5-hours of lectures and 1 tutorial.			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 90%, Class Test = 10%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr J M Fraser			
Module teaching staff:	Dr J Fraser			

MT3503 Complex Analysis				
SCOTCAT Credits:	15	SCQF Level 9	Semester	1
Academic year:	2018/9			
Planned timetable:	12.00 noon Mon (odd weeks), Wed and Fri			
This module aims to introduce students to analytic function theory and applications. The topics covered include: analytic functions; Cauchy-Riemann equations; harmonic functions; multivalued functions and the cut plane; singularities; Cauchy's theorem; Laurent series; evaluation of contour integrals; fundamental theorem of algebra; Argument Principle; Rouche's Theorem.				
Pre-requisite(s):	Before taking this module you must pass MT2502 or pass MT2503			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 34 hours		Guided independent study: 116 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 90%, Practical Examinations = 0%, Coursework = 10%			
	As used by St Andrews: 2-hour Written Examination = 90%, Coursework = 10%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr M Quick			

MT3504 Differential Equations				
SCOTCAT Credits:	15	SCQF Level 9	Semester	1
Academic year:	2018/9			
Planned timetable:	9.00 am Mon (odd weeks), Wed and Fri			
The object of this module is to provide a broad introduction to analytical methods for solving ordinary and partial differential equations and to develop students' understanding and technical skills in this area. This module is a prerequisite for several other Honours options. The syllabus includes: existence and uniqueness of solutions to initial-value problems; non-linear ODEs; phase-plane analysis; Green's functions for ODEs; Sturm-Liouville problems; first order PDE's; method of characteristics; classification of second order linear PDEs; method of separation of variables; characteristics and reduction to canonical form.				
Pre-requisite(s):	Before taking this module you must pass MT2503			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 examples class (week 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: Written Examination = 100% (2-hour final exam = 90%, class test = 10%)			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof A W Hood			
Module teaching staff:	Prof A Hood, Prof D Dritschel			

MT3505 Algebra: Rings and Fields				
SCOTCAT Credits:	15	SCQF Level 9	Semester	2
Academic year:	2018/9			
Planned timetable:	11.00 am Mon (odd weeks), Wed & Fri			
This module continues the study of algebra begun in the 2000-level module MT2505 Abstract Algebra. It places emphasis on the concept of a ring and their properties, which give insight into concepts of factorisation and divisibility. Important examples such as polynomial rings will be used to motivate and illustrate the theory developed.				
Pre-requisite(s):	Before taking this module you must pass MT2505			
Learning and teaching methods of delivery:	Weekly contact: 2.5 hours of lectures and 1 tutorial.			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 90%, Practical Examinations = 0%, Coursework = 10%			
	As used by St Andrews: 2-hour Written Examination = 90%, Coursework = 10%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr S Huczynska			

MT3506 Techniques of Applied Mathematics			
SCOTCAT Credits:	15	SCQF Level 9	Semester 2
Academic year:	2018/9		
Planned timetable:	12.00 noon Mon (odd weeks), Wed & Fri		
Differential equations are of fundamental significance in applied mathematics. This module will cover important and common techniques used to solve the partial differential equations that arise in typical applications. The module will be useful to students who wish to specialise in Applied Mathematics in their degree programme.			
Pre-requisite(s):	Before taking this module you must pass MT2506 and pass MT3504		
Anti-requisite(s)	You cannot take this module if you take PH3081		
Learning and teaching methods of delivery:	Weekly contact: 2.5 hours of lectures and 1 tutorial.		
	Scheduled learning: 35 hours	Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 90%, Practical Examinations = 0%, Coursework = 10%		
	As used by St Andrews: 2-hour Written Examination = 90%, Coursework = 10%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Dr R K Scott		
Module teaching staff:	Dr R Scott		

MT3507 Mathematical Statistics			
SCOTCAT Credits:	15	SCQF Level 9	Semester 1
Academic year:	2018/9		
Planned timetable:	11.00 am Mon (odd weeks), Wed & Fri		
Together with MT3508, this module provides a bridge between second year and Honours modules in statistics. It will provide students with a solid theoretical foundation on which much of more advanced statistical theory and methods are built. This includes probability generating functions and moment generating functions, as well as widely used discrete distributions (binomial, Poisson, negative binomial and multinomial) and continuous distributions (gamma, exponential, chi-squared, beta, t-distribution, F-distribution, and multivariate normal). It will also provide a foundation in methods of statistical inference (maximum likelihood and Bayesian) and model selection methods based on information theory (AIC and BIC).			
Pre-requisite(s):	Before taking this module you must pass MT2508		
Learning and teaching methods of delivery:	Weekly contact: 2.5 hours of lectures and 1 tutorial.		
	Scheduled learning: 35 hours	Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	As used by St Andrews: 2-hour Written Examination = 90%, Class Test = 10%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Prof S T Buckland		
Module teaching staff:	Prof S Buckland		

MT3508 Applied Statistics			
SCOTCAT Credits:	15	SCQF Level 9	Semester 2
Academic year:	2018/9		
Planned timetable:	12.00 noon Mon (even weeks), Tue & Thu		
Together with MT3507, this module provides a bridge between second year and Honours modules in statistics. It deals with the application of statistical methods to test hypotheses and draw inferences from data. This includes a number of nonparametric methods and statistical tests (goodness-of-fit tests and tests of independence). Inference methods include model fitting by least squares and maximum likelihood, and variance estimation by means of the information matrix and by bootstrap. Applications include multiple regression, analysis of variance, the general (normal) linear model and an introduction to generalized linear models.			
Pre-requisite(s):	Before taking this module you must pass MT2508		
Learning and teaching methods of delivery:	Weekly contact: 2.5 hours of lectures and 1 tutorial.		
	Scheduled learning: 35 hours	Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 90%, Practical Examinations = 0%, Coursework = 10%		
	As used by St Andrews: 2-hour Written Examination = 90%, Coursework (Project) = 10%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Dr V M Popov Prof L J Thomas		
Module teaching staff:	Dr Valentin Popov Prof L Thomas		

MT3802 Numerical Analysis			
SCOTCAT Credits:	15	SCQF Level 9	Semester 1
Academic year:	2018/9		
Planned timetable:	10.00 am Mon (odd weeks), Wed and Fri		
The module will introduce students to some topics in numerical analysis, which may include methods of approximation, iterative methods for solving systems of linear equations, numerical techniques for differential equations.			
Pre-requisite(s):	Before taking this module you must pass MT2501		
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).		
	Scheduled learning: 35 hours	Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 70%, Practical Examinations = 0%, Coursework = 30%		
	As used by St Andrews: 2-hour Written Examination = 70%, Coursework = 30%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Dr A Naughton		

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MT3852 Automata, Languages and Complexity				
SCOTCAT Credits:	15	SCQF Level 9	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not available to Joint Honours Mathematics and Computer Science students.			
Planned timetable:	10.00 am Mon (even weeks), Tue, Thu.			
This module begins with finite state machines, context-free grammars and big-O notation. Turing machines, non-determinism and pushdown automata are introduced, followed by studies on decidability, simulation and the Halting problem. The complexity classes P, NP, co-NP, NP-hard, etc., are described via analysis of SAT and graph isomorphism. Strengths and limitations of the abstract approach to complexity are discussed, followed by an introduction to practical complexity.				
Pre-requisite(s):	Before taking this module you must pass MT2504 or ((pass CS2001 or pass cs2101) and pass CS2002)			
Anti-requisite(s)	You cannot take this module if you take CS3052			
Learning and teaching methods of delivery:	Weekly contact: 2 hours of lectures (x 11 weeks), .5-hour tutorial (x 10 weeks)			
	Scheduled learning: 27 hours		Guided independent study: 123 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%			
	As used by St Andrews: 2-hour Written Examination = 60%, Coursework = 40%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof C M Roney-Dougal			
Module teaching staff:	Prof C Roney-Dougal, Dr S Sarkar, Prof Ian Gent, Prof S Linton			

MT4003 Groups				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	9.00 am Mon (even weeks), Tue and Thu			
This module introduces students to group theory, which is one of the central fields of the 20th century mathematics. The main theme of the module is classifying groups with various additional properties, and the development of tools necessary in this classification. In particular, the students will meet the standard algebraic notions, such as substructures, homomorphisms, quotients and products, and also various concepts peculiar to groups, such as normality, conjugation and Sylow theory. The importance of groups in mathematics, arising from the fact that groups may be used to describe symmetries of any mathematical object, will be emphasised throughout the module.				
Pre-requisite(s):	Before taking this module you must pass MT2505			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10), 1 tutorial and 1 examples class (weeks 2 - 11).			
	Scheduled learning: 45 hours		Guided independent study: 105 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof N Ruskuc			

MT4004 Real and Abstract Analysis				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	11.00 am Mon (even weeks), Tue and Thu			
This module continues the development of real analysis that was begun in MT2502 and continued through MT3502. Topics covered will include limits and continuity in metric spaces, differentiation in higher dimensions and the theoretical underpinning of Fourier series. This module will present some of the highlights of the study of analysis, such as Baire's Category Theorem, the Contraction Mapping Theorem, the Weierstrass Approximation Theorem, and the Inverse Function Theorem.				
Pre-requisite(s):	Before taking this module you must pass MT3502			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10), 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof L O R Olsen			
Module teaching staff:	Prof L Olsen			

MT4005 Linear and Nonlinear Waves				
SCOTCAT Credits:	15	SCQF Level 10	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	11.00 am Mon (even weeks), Tue and Thu			
This module gives an introduction to wave motion and its importance in many areas of applied mathematics. It begins with a discussion of the linear approximation for small amplitude waves and discusses properties of these such as dispersion relations, phase and group velocities, dissipation and dispersion. Some nonlinear effects such as wave steepening are then treated and an introduction given to some of the equations, for example Burger's and Korteweg de Vries, which are used to model nonlinear wave propagation.				
Pre-requisite(s):	Before taking this module you must (pass MT2506 or pass PH3081) and (pass MT3503 or pass MT3504)			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr A N Wright			
Module teaching staff:	Dr A Wright			

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MT4111 Symbolic Computation				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	9.00 am Mon (odd weeks), Wed and Fri			
This module aims to enable students to use a computer as a tool in their other modules and to turn naturally to a computer when solving mathematical problems. The module aims to illustrate the following points: computation allows one to conduct mathematical experiments; computation allows one to collect data about a problem being studied. This is similar to the way other scientists work. It is easier to try several different approaches to a problem and see which works. The computer is not intelligent; intelligence comes from the user. The user thinks, the user interprets, the computer calculates.				
Pre-requisite(s):	Before taking this module you must pass one module from MT3501, MT3502, MT3503, MT3504, MT3505 or MT3506			
Anti-requisite(s)	You cannot take this module if you take MT5611			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 practical session (weeks 2 - 11)			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 70%, Practical Examinations = 0%, Coursework = 30%			
	As used by St Andrews: 2-hour Written Examination = 70%, Coursework = 30%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr L S Theran			
Module teaching staff:	Dr L Theran			

MT4113 Computing in Statistics				
SCOTCAT Credits:	15	SCQF Level 10	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	12.00 noon Mon (odd weeks) and Wed, 12.00 noon - 2.00 pm Fri			
The aim of this module is to teach computer programming skills, including principles of good programming practice, with an emphasis on statistical computing. Practical work focusses on the widely-used statistical language and environment R. Practical skills are developed through a series of computing exercises that include (1) modular programming; (2) manipulating data; (3) simulating data with specific statistical properties, (4) investigating behaviour of statistical procedures under failure of statistical assumptions.				
Pre-requisite(s):	Before taking this module you must pass MT2508			
Learning and teaching methods of delivery:	Weekly contact: 1.5-hour lectures (x 10 weeks), 2-hour practical classes (x 10 weeks)			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 40%, Practical Examinations = 0%, Coursework = 60%			
	As used by St Andrews: 2-hour Written Examination = 40%, Coursework = 60%			
Re-assessment pattern:	1-hour 40 minute Written Examination = 40%, Coursework (4 new programming assignments) = 60%			
Module coordinator:	Prof L J Thomas			
Module teaching staff:	Prof L Thomas			

MT4507 Classical Mechanics				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu			
The object of this module is to introduce students to some of the ideas and mathematical techniques used in understanding the behaviour of dynamical systems that obey Newton's Laws. These notions are arguably the foundations of physics and applied mathematics. The module will include: Newton's laws of motion; conservative forces; central forces; non-inertial/accelerating frames of reference; dynamics of a system of particles; mechanics of a rigid body; Euler's equations; Lagrange's equations; Hamilton's equations.				
Pre-requisite(s):	Before taking this module you must (pass MT2506 or pass PH3081) and pass MT3504			
Anti-requisite(s)	You cannot take this module if you take PH4038			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr V Archontis			

MT4509 Fluid Dynamics				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	11.00 am Mon (even weeks), Tue and Thu			
This module provides an introduction to the theory of incompressible fluid dynamics, which describes the motion of liquids and gases at speeds small compared to the sound speed. Special attention is paid to a precise foundation of the various conservation laws that govern fluid dynamics, as this provides a convenient framework in which to study specific examples as well as extensions of the basic theory.				
Pre-requisite(s):	Before taking this module you must pass MT2506 and pass MT3504			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: Written Examination = 100% (2-hour final exam = 90%, class test = 10%)			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr J N Reinaud			
Module teaching staff:	Dr J Reinaud, Dr H Burgess			

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MT4510 Solar Theory				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	11.00 am Mon (odd weeks), Wed and Fri			
The object of this module is to describe the basic dynamic processes at work in the Sun, a subject which is being enlivened by dramatic new results from space missions.				
Pre-requisite(s):	Before taking this module you must pass MT2506 and pass MT3504			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof A W Hood			
Module teaching staff:	Prof A Hood, Dr P Antolin			

MT4511 Asymptotic Methods				
SCOTCAT Credits:	15	SCQF Level 10	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	9.00 am Mon (even weeks), Tue and Thu			
This module is designed to introduce students to asymptotic methods used in the construction of analytical approximations to integrals and solutions of differential equations.				
Pre-requisite(s):	Before taking this module you must pass MT3504			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr A L Wilmot-Smith			
Module teaching staff:	Dr A Wilmot-Smith			

MT4514 Graph Theory				
SCOTCAT Credits:	15	SCQF Level 10	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu			
The aim of this module is to introduce students to the study of graph theory as a tool for representing connections between data. Topics to be covered may include: basic theory and applications, Eulerian graphs, Hamiltonian graphs, planar graphs, spanning trees and applications, networks, matching problems.				
Pre-requisite(s):	Before taking this module you must pass MT1003 or pass MT2504			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr S Huczynska			

MT4515 Functional Analysis				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	12.00 noon Mon (even weeks), Tue and Thu			
This object of this module is to familiarise students with the basic notions of functional analysis, that is analysis on normed spaces and Hilbert space. The module will cover normed spaces, convergence and completeness, operators, Hilbert spaces and may include topics such as spectral theory and the Hahn-Banach theorem.				
Pre-requisite(s):	Before taking this module you must pass MT2501 and pass MT3502			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof K J Falconer			
Module teaching staff:	Prof K Falconer			

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MT4527 Time Series Analysis				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu			
This module provides an introduction to univariate linear times series models (ARIMA processes) and univariate non-linear times-series models (ARCH and GARCH). The syllabus includes: forecasting methods for constant mean and trend models, the ARIMA class of models (including seasonal ARIMA models), fitting and forecasting ARIMA models, ARCH and GARCH processes.				
Pre-requisite(s):	Before taking this module you must pass MT2508			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 0.5 tutorial (weeks 2 - 11).			
	Scheduled learning: 30 hours		Guided independent study: 120 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr M Papathomas			

MT4531 Bayesian Inference				
SCOTCAT Credits:	15	SCQF Level 10	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu			
This module is intended to offer a re-examination of standard statistical problems from a Bayesian viewpoint and an introduction to recently developed computational Bayes methods. The syllabus includes Bayes' theorem, inference for Normal samples; univariate Normal linear regression; principles of Bayesian computational, Markov chain Monte Carlo - theory and applications.				
Pre-requisite(s):	Before taking this module you must pass MT3507 or pass MT3508			
Anti-requisite(s)	You cannot take this module if you take MT5831			
Learning and teaching methods of delivery:	Weekly contact: 24 lectures and 7 practical classes over the semester.			
	Scheduled learning: 31 hours		Guided independent study: 119 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 80%, Practical Examinations = 0%, Coursework = 20%			
	As used by St Andrews: 2-hour Written Examination = 80%, Coursework = 20%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr M Papathomas			

MT4539 Quantitative Risk Management				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	12.00 noon Mon (odd), Wed, Fri, and 2.00 pm Fri			
The module introduces the concept of financial risk and discusses the importance of its regulation. The emphasis is laid on the popular risk measure Value at Risk (VaR). After a brief discussion on asset returns, various modelling techniques - ranging from the simple Historical Simulation to the more advanced ARMA and GARCH models - are presented and applied for the calculation of VaR using real financial data. The aim of this module is to provide a solid basis in risk management for those students considering a career in finance.				
Pre-requisite(s):	Before taking this module you must pass MT2504 and pass MT2508			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 5 tutorials and 5 practical sessions.			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 80%, Practical Examinations = 0%, Coursework = 20%			
	As used by St Andrews: 2-hour Written Examination = 80%, Coursework = 20%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr V M Popov			
Module teaching staff:	Dr V Popov			

MT4552 Mathematical Biology 1				
SCOTCAT Credits:	15	SCQF Level 10	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	9.00 am Mon (even weeks), Tue and Thu			
This module will explore real world applications of mathematics to biological problems e.g. harvesting of fish stocks, host-parasitoid systems, predator-prey dynamics, molecular interactions. The mathematical techniques used in the modelling will be nonlinear difference equations and ordinary differential equations. The module will be useful to students who wish to specialise in Applied Mathematics in their degree programme.				
Pre-requisite(s):	Before taking this module you must pass MT3504			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 90%, Coursework (Class Test) = 10%			
Re-assessment pattern:	Take-Home Examination = 100%			
Module coordinator:	Prof M A J Chaplain			
Module teaching staff:	Prof M Chaplain, Dr T Lorenzi			

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MT4553 Theory of Electric and Magnetic Fields			
SCOTCAT Credits:	15	SCQF Level 10	Semester 2
Academic year:	2018/9		
Availability restrictions:	Not automatically available to General Degree students		
Planned timetable:	10.00 am Mon (odd weeks), Wed, Fri		
The module will consider the mathematical and physical principles that describe the theory of electric and magnetic fields. It will first describe the basic principles of electrostatics and magneto-statics and following this electrodynamics. Next Maxwell's equations are described along with the properties of electro-magnetic waves in a variety of media. Finally an application to the area of plasma physics is carried out through considering the orbits of charged particles in a variety of spatially and time varying magnetic fields.			
Pre-requisite(s):	Before taking this module you must pass MT2503 and pass MT2506 and pass MT3504		
Anti-requisite(s)	You cannot take this module if you take PH3007		
Learning and teaching methods of delivery:	Weekly contact: 2.5 hours of lectures (x 10 weeks), 1-hour tutorial (x 10 weeks) Scheduled learning: 35 hours Guided independent study: 120 hours		
Assessment pattern:	As defined by QAA: Written Examinations = 90%, Practical Examinations = 0%, Coursework = 10% As used by St Andrews: 2-hour Written Examination = 90%, Coursework (class test) = 10%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Prof D H Mackay		
Module teaching staff:	Prof D Mackay		

MT4599 Project in Mathematics / Statistics			
SCOTCAT Credits:	15	SCQF Level 10	Semester Full Year
Academic year:	2018/9		
Availability restrictions:	Available only to students in the final year of a BSc/MA Honours degree programme in the School		
Planned timetable:	none		
The student will choose a project from a list published annually although a topic outwith the list may be approved. Students will be required to report regularly to their supervisor, produce a substantial written report, submitted by the end of April, and give a presentation.			
Learning and teaching methods of delivery:	Weekly contact: Typically and on average, 20 mins of project supervisions per week over whole year. Scheduled learning: 8 hours Guided independent study: 142 hours		
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80% As used by St Andrews: Coursework = 100%: Project = 80%, Presentation = 20%		
Re-assessment pattern:	Resubmission of project = 100%		
Module coordinator:	Prof N Ruskuc		
Module teaching staff:	Team Taught		

MT4607 Generalised Linear Models and Data Analysis			
SCOTCAT Credits:	15	SCQF Level 10	Semester 1
Academic year:	2018/9		
Availability restrictions:	Not automatically available to General Degree students		
Planned timetable:	9.00 am Mon (even weeks), Tue and Thu		
This module aims to demonstrate the power and elegance of unifying a large number of simple statistical models within the general framework of the generalised linear model. It will train students in the interpretation, analysis and reporting of data, when a single response measurement is interpreted in terms of one or a number of other variables.			
Pre-requisite(s):	Before taking this module you must pass MT2503 and pass MT2508		
Anti-requisite(s)	You cannot take this module if you take MT5753 or take MT5761		
Co-requisite(s):	You must also take MT3501		
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 8 tutorials over the semester		
	Scheduled learning: 33 hours	Guided independent study: 117 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 80%, Practical Examinations = 0%, Coursework = 20%		
	As used by St Andrews: 2-hour Written Examination = 80%, Coursework: Project = 20%		
Re-assessment pattern:	2-hour Written Examination = 80%, Coursework: Project = 20%		
Module coordinator:	Dr L A S Scott-Hayward		
Module teaching staff:	Dr L Scott-Hayward		

MT4608 Sampling Theory			
SCOTCAT Credits:	15	SCQF Level 10	Semester 1
Academic year:	2018/9		
Availability restrictions:	Not automatically available to General Degree students		
Planned timetable:	10.00 am Mon (odd weeks), Wed and Fri		
The aims of this module are to introduce students to and interest them in the principles and methods of design-based inference, to convince them of the relevance and utility of the methods in a wide variety of real-world problems, and to give them experience in applying the principles and methods themselves. By the end of the module students should be able to recognise good and poor survey design and analysis, to decide upon and implement the main types of survey design in relatively straightforward settings, and analyse the resulting survey data appropriately. The syllabus includes fundamentals of design based vs model-based inference, simple random sampling, sampling with replacement, ratio and regression estimators, stratified sampling, cluster sampling and unequal probability sampling.			
Pre-requisite(s):	Before taking this module you must pass MT2508		
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 8 tutorials over the semester.		
	Scheduled learning: 33 hours	Guided independent study: 117 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 85%, Practical Examinations = 0%, Coursework = 15%		
	As used by St Andrews: 2-hour Written Examination = 85%, Coursework: Project = 15%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Dr J B Illian		
Module teaching staff:	Dr J Illian		

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MT4609 Multivariate Analysis			
SCOTCAT Credits:	15	SCQF Level 10	Semester 2
Academic year:	2018/9		
Availability restrictions:	Not automatically available to General Degree students		
Planned timetable:	10.00 am Mon (odd weeks), Wed and Fri		
This module aims to introduce students to the ideas and techniques of multivariate statistical analysis. The syllabus includes mean vectors, covariance matrices, correlation matrices; basic properties of multivariate normal distributions; checking multivariate normality; the likelihood ratio and union-intersection principles for constructing multivariate tests; the one-sample and two-sample Hotelling's T-squared tests; tests on covariance matrices, tests of independence; linear discriminant analysis; principal components analysis; canonical correlation.			
Pre-requisite(s):	Before taking this module you must pass MT3507		
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 0.5 tutorial (weeks 2 - 11).		
	Scheduled learning: 30 hours	Guided independent study: 120 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	As used by St Andrews: 2-hour Written Examination = 100%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module teaching staff:	Dr G Minas		

MT4614 Design of Experiments			
SCOTCAT Credits:	15	SCQF Level 10	Semester 2
Academic year:	2018/9		
Availability restrictions:	Not automatically available to General Degree students		
Planned timetable:	9.00 am Mon (odd weeks), Wed and Fri		
This module introduces a wide range of features that occur in real comparative experiments, such as choice of blocks and replication as well as type of design. It includes enough about the analysis of data from experiments to show what has to be considered at the design stage. It includes consultation with the scientist and interpretation of the results.			
Pre-requisite(s):	Before taking this module you must pass MT2508 and pass MT3501		
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and either tutorial or practical (weeks 2 - 11).		
	Scheduled learning: 35 hours	Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 80%, Practical Examinations = 10%, Coursework = 10%		
	As used by St Andrews: 2-hour Written Examination = 80%, Presentation = 10%, Coursework = 10%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Prof R A Bailey		
Module teaching staff:	Prof R Bailey		

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MT4794 Joint Dissertation (30cr)				
SCOTCAT Credits:	30	SCQF Level 10	Semester	Full Year
Academic year:	2018/9			
Availability restrictions:	Available only to students in the Second year of the Honours Programme, who have completed the Letter of Agreement, downloadable from https://www.st-andrews.ac.uk/coursecatalogue). No student may do more than 60 credits in Dissertation or Project modules.			
Planned timetable:	To be arranged.			
The dissertation must consist of approximately 6,000 words of English prose on a topic agreed between the student and two appropriate members of staff (who act as supervisors). The topic does not have to relate to work covered in previous Honours modules, though it may be helpful to the student if it builds on previous work. The topic and range of sources should be chosen in consultation with the supervisors in order to determine that the student has access to sources as well as a clear plan of preparation. (Guidelines for printing and binding dissertations can be found at: http://www.st-andrews.ac.uk/printanddesign/dissertation/)				
Pre-requisite(s):	The student requires a letter of agreement			
Anti-requisite(s)	Cannot take more than 30 credits in other dissertation/project modules			
Learning and teaching methods of delivery:	Weekly contact: As per Letter of Agreement.			
	Scheduled learning: 0 hours		Guided independent study: 0 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: As per Letter of Agreement.			
Re-assessment pattern:	As per Letter of Agreement.			
Module teaching staff:	As per Letter of Agreement			

MT4796 Joint Project (30cr)				
SCOTCAT Credits:	30	SCQF Level 10	Semester	Full Year
Academic year:	2018/9			
Availability restrictions:	Available only to students in the Second year of the Honours Programme, who have completed the Letter of Agreement, downloadable from https://www.st-andrews.ac.uk/coursecatalogue). No student may do more than 60 credits in Dissertation or Project modules.			
Planned timetable:	To be arranged.			
The aim of the project is to develop and foster the skills of experimental design, appropriate research management and analysis. The topic and area of research should be chosen in consultation with the supervisors in order to determine that the student has access to sources as well as a clear plan of preparation.				
Pre-requisite(s):	The student requires a letter of agreement			
Anti-requisite(s)	May not take more than 30 credits in other dissertation / project modules			
Learning and teaching methods of delivery:	Weekly contact: As per Letter of Agreement.			
	Scheduled learning: 0 hours		Guided independent study: 0 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: As per Letter of Agreement.			
Re-assessment pattern:	As per Letter of Agreement.			
Module teaching staff:	As per Letter of Agreement			

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MT5611 Advanced Symbolic Computation			
SCOTCAT Credits:	20	SCQF Level 11	Semester 2
Academic year:	2018/9		
Availability restrictions:	Not automatically available to General Degree students		
Planned timetable:	9.00 am Mon (odd weeks), Wed and Fri		
<p>This module aims to enable students to use a computer as a tool in their other modules and to turn naturally to a computer when solving mathematical problems. The module aims to illustrate the following points: computation allows one to conduct mathematical experiments; computation allows one to collect data about a problem being studied. This is similar to the way other scientists work. It is easier to try several different approaches to a problem and see which works. The computer is not intelligent; intelligence comes from the user. The user thinks, the user interprets, the computer calculates. Students will undertake a more substantial project than that required for MT4111.</p>			
Pre-requisite(s):	Before taking this module you must pass at least 4000-level mt module		
Anti-requisite(s)	You cannot take this module if you take MT4111		
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 practical session (weeks 2 - 11).		
	Scheduled learning: 35 hours	Guided independent study: 165 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 55%, Practical Examinations = 0%, Coursework = 45%		
	As used by St Andrews: 2-hour Written Examination = 55%, Coursework: Project = 45%		
Re-assessment pattern:	2-hour Written Examination = 55%, Coursework: Project = 45%		
Module coordinator:	Dr L S Theran		

MT5751 Estimating Animal Abundance			
SCOTCAT Credits:	15	SCQF Level 11	Semester 2
Academic year:	2018/9		
Availability restrictions:	Not automatically available to General Degree students		
Planned timetable:	12.00 noon Mon (odd), Wed and Fri		
<p>The module will introduce students to the main types of survey method for wildlife populations. It will cover simple methods in some detail and provide students with a conceptual framework for building understanding of more advanced methods. By the end of the course, students will be able to identify an appropriate assessment method for a given population, be able to design a simple survey to assess the population, and perform simple analyses of survey data. Students will get experience in using the methods via computer practical sessions involving design and analyses of surveys conducted by computer simulation.</p>			
Pre-requisite(s):	Before taking this module you must (pass MT3507 or pass MT3508) and pass one 4000-level mt module		
Learning and teaching methods of delivery:	Weekly contact: 1.5 hrs lecture, 1 hr practical, 0.5 hr tutorial (weeks 1 - 10)		
	Scheduled learning: 30 hours	Guided independent study: 120 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%		
	As used by St Andrews: 2-hour Written Examination = 50%, Coursework = 50%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module coordinator:	Mr R Glennie		

MT5758 Applied Multivariate Analysis				
SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	11.00 am Mon (even weeks), Tue and Thu			
This module provides introductory and advanced training in the applied analysis of multivariate data. The module emphasis is upon practical analysis of data and the extraction of answers from real-life data. Basic theory is given covering matrix algebra, metrics and general measures of similarity. The most common and fundamental methods including dimension reduction and classification are covered e.g. Multivariate Analysis of Variance, Principal Components Analysis, multidimensional scaling, Factor Analysis, clustering methods. The practical component of the module focuses on analysis of real data using the commercial software tools Excel, SAS and SPSS.				
Pre-requisite(s):	The student must have been accepted on to mmath statistics or mmath mathematics programmes			
Anti-requisite(s)	You cannot take this module if you take MT4609			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10), and 4 tutorials and 4 project group meetings over the semester.			
	Scheduled learning: 33 hours		Guided independent study: 117 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%			
	As used by St Andrews: 2-hour Written Examination = 50%, Coursework = 50%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr J B Illian			
Module teaching staff:	Dr J Illian			

MT5761 Statistical Modelling				
SCOTCAT Credits:	15	SCQF Level 11	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	Mon, Tues, Thur, Fri 3:00 - 4:00 (lectures), Tues, Thur 4:00 - 5:00 (practicals)			
This applied statistics module covers the main aspects of linear models (LMs) and generalized linear models (GLMs). In each case the course describes model specification, various options for model selection, model assessment and tools for diagnosing model faults. Common modelling issues such as collinearity and residual correlation are also addressed, and as a consequence of the latter the Generalized Least squares (GLS) method is described. The GLM component has emphasis on models for count data and presence/absence data while GLMs for multinomial (sometimes called choice-based models) are also covered for nominal and ordinal response outcomes. The largest part of the course material is taught inside an environmental impact assessment case study with reality-based research objectives. Political and medical examples are used to illustrate the multinomial models.				
Pre-requisite(s):	Undergraduates must have passed at least one of MT4113, MT4527, MT4528, MT4530, MT4531, MT4537, MT4539, MT4606, MT4608, MT4609, MT4614.			
Anti-requisite(s)	You cannot take this module if you take MT4607 or take MT5753			
Learning and teaching methods of delivery:	Weekly contact: 4 lectures (x 5 weeks), 2 practicals (x 5 weeks)			
	Scheduled learning: 30 hours		Guided independent study: 117 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%			
	As used by St Andrews: 2-hour Written Examination = 50%, Coursework = 50%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr V M Popov			
Module teaching staff:	Dr V Popov			

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MT5763 Software for Data Analysis			
SCOTCAT Credits:	15	SCQF Level 11	Semester 1
Academic year:	2018/9		
Planned timetable:	Mon, Tues, Fri 3:30 - 4:30 (lectures). Mon, Tues, Fri 4:30 - 5:30 (Practicals)		
This module covers the practical computing aspects of statistical data analysis, focussing on packages most widely used in the commercial sector (R, SAS, SPSS & Excel). We cover the accessing, manipulation, checking and presentation of data (visual and numerical). We fit various statistical models to data, with subsequent assessment, interpretation and presentation. Good practice and 'reproducible research' is covered, as is computer intensive inference and big data considerations. This module is a short intensive course and is a core, preliminary, requirement for the MSc in Applied Statistics and Datamining and the MSc in Data Intensive Analysis. It covers material essential for study of the more advanced statistical methods encountered in subsequent modules.			
Pre-requisite(s):	Pass in MT1007 or MT3507 or MT3508 or be taking MT5762		
Anti-requisite(s)	You cannot take this module if you take MT5756		
Learning and teaching methods of delivery:	Weekly contact: Three 2-hour lecture/practical classes (x 5 weeks)		
	Scheduled learning: 30 hours	Guided independent study: 120 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%		
	As used by St Andrews: Coursework = 100%		
Re-assessment pattern:	Coursework = 100%		
Module coordinator:	Dr C R Donovan		
Module teaching staff:	Dr C Donovan		

MT5764 Advanced Data Analysis			
SCOTCAT Credits:	15	SCQF Level 11	Semester 2
Academic year:	2018/9		
Availability restrictions:	Not automatically available to General Degree students		
Planned timetable:	Mon 12:00-1:00 Weeks 2, 4, 5, 8, 10 Tues, Thur 12:00-2:00, Weeks 1-10 (lectures) Tues 2:00 - 3:00 Weeks 2-9 (practicals)		
This module covers modern modelling methods for situations where the data fails to meet the assumptions of common statistical models and simple remedies do not suffice. This represents a lot of real world data. Methods covered include: nonlinear models; basic splines and Generalised Additive Models; LASSO and the Elastic Net; models for non-independent errors and random effects. Pragmatic data imputation is covered with associated issues. Computer intensive inference is considered throughout. Practical applications build sought-after skills in R and the commercial packages SAS.			
Pre-requisite(s):	Undergraduates must pass MT4607 or MT5753 or MT5761		
Anti-requisite(s)	You cannot take this module if you take MT5757		
Learning and teaching methods of delivery:	Weekly contact: 2.5 hours of lectures lectures (Weeks 1 - 10) and 8 practicals over the semester.		
	Scheduled learning: 33 hours	Guided independent study: 116 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%		
	As used by St Andrews: 2-hour Written Examination = 60%, Coursework = 40%		
Re-assessment pattern:	2-hour Written Examination = 100%		
Module teaching staff:	TBC		

MT5765 Medical Statistics				
SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	10:00 - Mon (odd weeks), Wed, Fri			
This module will cover a number of topics in medical statistics, that are important areas both in terms of methodological development and application. The main topic covered will be Survival Analysis, with others selected from Meta-analysis, Power calculations, Prospective vs Observational studies, Sequential analyses, Clinical trials.				
Pre-requisite(s):	Before taking this module you must pass MT3507 or pass MT3508			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 1 tutorial (x 10 weeks)			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 65%, Practical Examinations = 0%, Coursework = 35%			
	As used by St Andrews: Coursework = 35%, 2-hour Written Examination = 65%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof A G Lynch			
Module teaching staff:	Prof A Lynch			

MT5802 Advanced Analytical Techniques				
SCOTCAT Credits:	20	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	12.00 noon Mon (odd weeks), Wed and Fri			
This module introduces students to some further important applied analytic techniques such as Variational Calculus, Integral equations and transforms, and the theory of Steepest Descent.				
Pre-requisite(s):	Before taking this module you must pass MT3503			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 165 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 75%, Practical Examinations = 0%, Coursework = 25%			
	As used by St Andrews: 2-hour Written Examination = 75%, Coursework = 25%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr C V Tran			
Module teaching staff:	Dr C Tran			

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MT5806 Advanced Computational Techniques				
SCOTCAT Credits:	20	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	12.00 noon Mon (even weeks), Tue and Thu			
This module introduces students to some of the ideas, techniques and constraints that underpin modern approaches to the numerical modeling of physical processes that may be described by partial differential equations. Students will gain expertise in implementing standard methods and will submit a short dissertation together with a portfolio of computational work.				
Pre-requisite(s):	Before taking this module you must pass MT3802 and pass MT4112			
Learning and teaching methods of delivery:	Weekly contact: 2 lectures (weeks 1 - 10) and a typical average of 0.5 hours of project supervisions (weeks 2 - 11)			
	Scheduled learning: 25 hours		Guided independent study: 175 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%			
Re-assessment pattern:	Resubmission of projects = 100%			
Module coordinator:	Dr S J Brooks			
Module teaching staff:	Dr S Brooks			

MT5809 Advanced Fluid Dynamics				
SCOTCAT Credits:	20	SCQF Level 11	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	11.00 am Mon (odd weeks), Wed and Fri			
This module will examine current research in fluid dynamics, with a particular focus on meteorology and oceanography. The large-scale atmosphere and oceans behave quite unlike a 'classical' fluid owing to the presence of stable density stratification and rotation. As a result, the fluid motion is dominated by slow, 'vortical' or eddying motions (like cyclones) which generally spin slower than the Earth. Superimposed on this slow motion are relatively fast wave-like motions analogous to surface waves on a pond. These lectures describe the mathematical basis of these fundamentally different types of motion, and furthermore illustrate the increasingly important role of computer modelling in this research.				
Pre-requisite(s):	Before taking this module you must pass MT4509			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 165 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2.5-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr J N Reinaud			
Module teaching staff:	Dr Jn Reinaud			

MT5810 Advanced Solar Theory				
SCOTCAT Credits:	20	SCQF Level 11	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	12.00 noon Mon (even weeks), Tue and Thu			
The object of this module is to describe the magnetohydrodynamic processes at work in the Sun, using modern techniques of applied mathematics, and to discuss the latest theories in relation to aspects of current research within the School.				
Pre-requisite(s):	Before taking this module you must pass MT4510			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 165 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2.5-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof A W Hood			
Module teaching staff:	Prof Alan Hood			

MT5821 Advanced Combinatorics				
SCOTCAT Credits:	20	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	12.00 noon Mon (odd weeks), Wed and Fri			
Combinatorics underlies and interacts many topics in discrete mathematics including group theory, statistical design, and statistical mechanics, as well as being a lively subject in its own right. The module will give students a good grounding in the techniques and will engage students with research-level problems. It is designed to make a wide area of combinatorics available to students.				
Pre-requisite(s):	Before taking this module you must pass MT4514 or pass MT4516			
Learning and teaching methods of delivery:	Weekly contact: 2.5-hour lectures (weeks 1 - 10) and 1-hour tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 165 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2.5-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Prof P J Cameron			
Module teaching staff:	Prof P Cameron			

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MT5824 Topics in Groups				
SCOTCAT Credits:	20	SCQF Level 11	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	10.00 am Mon (odd weeks), Wed and Fri			
The overall aim of this module is to build on the foundations established in MT4003, and take the students further into this important and beautiful branch of mathematics. More specifically, through a selection of topics, some of which will be of current research interest in St Andrews, it will introduce students to advanced techniques of handling groups and classifying them.				
Pre-requisite(s):	Before taking this module you must pass MT4003			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10), 1 tutorial and 1 examples class (weeks 2 - 11).			
	Scheduled learning: 45 hours		Guided independent study: 155 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2.5-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr C P Bleak			
Module teaching staff:	Dr C Bleak			

MT5825 Measure and Probability Theory				
SCOTCAT Credits:	20	SCQF Level 11	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	11.00 am Mon (odd weeks), Wed and Fri			
This module introduces some of the powerful techniques and ideas of modern mathematical analysis and mathematical probability theory that are important both in analysis in its own right and in its many applications in mathematics and science. The module will include topics such as: measure theory, the mathematical foundations for probability theory, law of large numbers. Mathematical analysis and the use of probabilistic methods in analysis is one of the active research areas within the School, and the choice of topics will reflect current activity.				
Pre-requisite(s):	Before taking this module you must pass MT3502 or pass MT4004			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 165 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 75%, Practical Examinations = 0%, Coursework = 25%			
	As used by St Andrews: 2-hour Written Examination = 75%, Coursework = 25%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr M J Todd			
Module teaching staff:	Dr M Todd			

MT5830 Hyperbolic Geometry				
SCOTCAT Credits:	20	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	10.00 am Mon (odd weeks), Wed and Fri			
We study two dimensional hyperbolic space, which is a fundamental example of a non-Euclidean metric space. Hyperbolic space has a rich structure and many counter intuitive properties and this module will focus on the geometry of this space, including a detailed study of the geodesic structure, the group of isometries, and the actions of Fuchsian groups which lead to beautiful tilings and fractal limit sets. We will combine ideas from analysis, geometry and group theory, with a strong emphasis on visual intuition.				
Pre-requisite(s):	Before taking this module you must pass MT2505 and pass MT3502 and pass MT3503			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 165 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2.5-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr J M Fraser			
Module teaching staff:	Dr J Fraser			

MT5831 Advanced Bayesian Inference				
SCOTCAT Credits:	20	SCQF Level 11	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu			
This module consists of MT4531 with an additional project which will give consideration to some more advanced aspects of the theory or to the application of Bayesian techniques. This may involve either directed reading or the use of the computer for simulation or data-based analyses. The syllabus includes Bayes' theorem, inference for Normal samples; univariate Normal linear regression; principles of Bayesian computational, Markov chain Monte Carlo - theory and applications.				
Pre-requisite(s):	Before taking this module you must pass MT3507 or pass MT3508			
Anti-requisite(s)	You cannot take this module if you take MT4531			
Learning and teaching methods of delivery:	Weekly contact: 24 lectures and 7 practical classes over semester.			
	Scheduled learning: 31 hours		Guided independent study: 169 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%			
	As used by St Andrews: 2-hour Written Examination = 60%, Coursework = 40%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr M Papathomas			

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MT5836 Galois Theory				
SCOTCAT Credits:	20	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	11.00 am Mon (odd weeks), Wed and Fri			
Galois theory is one of the most beautiful areas of mathematics, establishing a remarkable connection between the theory of polynomial equations and their roots and group theory. The subject brings together ideas from the theory of groups and fields in a powerful way, culminating in Galois' fundamental theorem. There are many applications of the work, for example demonstrating that certain ruler and compass constructions are impossible, and that there is no general formula for the solution of quintic equations.				
Pre-requisite(s):	Before taking this module you must pass MT3505 or pass MT4517			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 10 tutorials/practical classes over semester.			
	Scheduled learning: 35 hours		Guided independent study: 165 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2.5-hour Written Examination = 100%			
Re-assessment pattern:	2.5-hour Written Examination = 100%			
Module coordinator:	Dr M Quick			

MT5852 Mathematical Biology 2				
SCOTCAT Credits:	20	SCQF Level 11	Semester	1
Academic year:	2018/9			
Availability restrictions:	Not automatically available to General Degree students			
Planned timetable:	9.00 am Mon (odd weeks), Wed and Fri			
This module will explore real world applications of mathematics to biological and medical problems e.g. cell movement, pattern formation in animal coat markings, spread of diseases (AIDS, measles). The mathematical techniques used in the modelling will be nonlinear partial differential equations. The module will be useful to students who wish to specialise in Applied Mathematics in their degree programme.				
Pre-requisite(s):	Undergraduate - before taking this module you must pass MT3504			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	As used by St Andrews: 2-hour Written Examination = 90%, Coursework (Class Test) = 10%			
Re-assessment pattern:	Take-Home Examination = 100%			
Module coordinator:	Dr T Lorenzi			

MT5990 Independent Study Module				
SCOTCAT Credits:	20	SCQF Level 11	Semester	Both
Academic year:	2018/9			
Availability restrictions:	Available only to students on an MMath, MPhys or MSc degree programme in the School			
Planned timetable:	To be arranged.			
This module provides the opportunity for a student to study an Advanced topic as a reading course under the supervision of a member of staff. The topic will be disjoint from those available in other modules.				
Pre-requisite(s):	In taking this module undergraduate students must have permission of head of school.			
Learning and teaching methods of delivery:	Weekly contact: Typically 1 hour project supervisions.			
	Scheduled learning: 12 hours		Guided independent study: 188 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%			
Re-assessment pattern:	Resubmission of coursework = 100%			
Module coordinator:	Dr A L Wilmot-Smith			
Module teaching staff:	Dr A Wilmot-Smith			

MT5991 Professional Skills for Mathematical Scientists				
SCOTCAT Credits:	30	SCQF Level 11	Semester	Full Year
Academic year:	2018/9			
Availability restrictions:	Available only to students on an MSc Postgraduate programme or, exceptionally, on an MMath or MPhys Honours degree programme in the School			
Planned timetable:	To be arranged.			
This module encompasses a range of skills, both generic and topic specific, together with taught components aimed at providing an appreciation of both breadth and depth of research areas in Pure or Applied Mathematics. The precise programme of study, together with the identification of the relevant software expertise required, will be determined in consultation with the student's supervisor.				
Learning and teaching methods of delivery:	Weekly contact: Varies. Typically 1 project supervision per week over whole year.			
	Scheduled learning: 24 hours		Guided independent study: 276 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%			
Re-assessment pattern:	Resubmission of coursework = 100%			
Module coordinator:	Dr J D Mitchell			
Module teaching staff:	Dr J Mitchell			

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MT5999 Advanced Project in Mathematics / Statistics				
SCOTCAT Credits:	40	SCQF Level 11	Semester	Full Year
Academic year:	2018/9			
Availability restrictions:	Available only to students in the final year of an MMath or MPhys Honours programme in the School			
Planned timetable:	To be arranged.			
This is a more substantial project which, for MMath students, will replace the existing Honours project. The project will be chosen from an approved list of topics. The student will be required to investigate a topic in some depth, submit a report by the end of April and give a presentation.				
Pre-requisite(s):	The student must have been accepted to an mphys or mmath programme			
Learning and teaching methods of delivery:	Weekly contact: Typically and on average, 40 mins of project supervisions per week over whole year			
	Scheduled learning: 16 hours		Guided independent study: 384 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%: Project = 80%, Presentation = 20%			
Re-assessment pattern:	Resubmission of project = 100%			
Module coordinator:	Prof N Ruskuc			
Module teaching staff:	Team taught			