

ID5059 Knowledge Discovery and Datamining

SCOTCAT Credits:	15	SCQF level 11	Semester	Both
Academic year:	2021-2022			
Planned timetable:	11.00 am Mon (odd weeks), Wed and Fri			
<p>Contemporary data collection can be automated and on a massive scale e.g. credit card transaction databases. Large databases potentially carry a wealth of important information that could inform business strategy, identify criminal activities, characterise network faults etc. These large scale problems may preclude the standard carefully constructed statistical models, necessitating highly automated approaches. This module covers many of the methods found under the banner of Datamining, building from a theoretical perspective but ultimately teaching practical application. Topics covered include: historical/philosophical perspectives, model selection algorithms and optimality measures, tree methods, bagging and boosting, neural nets, and classification in general. Practical applications build sought-after skills in programming (typically R, SAS or python).</p>				
Anti-requisite(s)	You cannot take this module if you take CS5014			
Learning and teaching methods of delivery:	Weekly contact: Lectures, seminars, tutorials and practical classes.			
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%			
Re-assessment pattern:	2-hour Written Examination = 60%, Existing Coursework = 40%			
Module coordinator:	Dr S C Drasco			
Module teaching staff:	Team Taught			

MT4113 Computing in Statistics

SCOTCAT Credits:	15	SCQF level 10	Semester	1
Academic year:	2021-2022			
Planned timetable:	12.00 noon Mon (odd weeks) and Wed, 12.00 noon - 2.00 pm Fri			
<p>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.</p>				
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 1 x practical (x 10 weeks), 1 optional Q&A session (x 5 weeks)			
Assessment pattern:	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:	Dr R Glennie			
Module teaching staff:	Dr Richard Glennie			

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MT4510 Solar Theory				
SCOTCAT Credits:	15	SCQF level 10	Semester	2
Academic year:	2021-2022			
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 (x 10 weeks) and 1 tutorial (x 10 weeks).			
Assessment pattern:	2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr A L Wilmot-Smith			
Module teaching staff:	Dr Antonia Wilmot-Smith and Dr Tom Howson			

MT4539 Quantitative Risk Management				
SCOTCAT Credits:	15	SCQF level 10	Semester	2
Academic year:	2021-2022			
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.			
Assessment pattern:	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 Valentin Popov			

MT5095 Dissertation for MSc Mathematical Biology				
SCOTCAT Credits:	60	SCQF level 11	Semester	Full Year
Academic year:	2021-2022			
Availability restrictions:	This module is only available for students on the MSc Mathematical Biology			
Planned timetable:	To be arranged			
This module is an individual dissertation where Mathematical Biology students are supervised by a member of the teaching staff who will advise on the choice of subject and provide guidance throughout the progress of the dissertation. The submission consists of a written report (not exceeding 15,000 words) alongside an oral presentation.				
Learning and teaching methods of delivery:	Weekly contact: Project meetings with supervisor, by arrangement			
Assessment pattern:	Written report = 80%, Oral Presentation = 20%			
Re-assessment pattern:	N/A			
Module coordinator:	Dr N Sfakianakis			
Module teaching staff:	Team Taught			

MT5097 Portfolio Dissertation for Statistical Ecology MSc Programme				
SCOTCAT Credits:	60	SCQF level 11	Semester	Full Year
Academic year:	2021-2022			
Planned timetable:	Individual supervision by arrangement with supervisor			
<p>Students will submit a portfolio comprising a range of outputs based on a single research topic. The submission will consist of a compulsory element (50% of the module grade) alongside a free choice element (50% of the module grade). The compulsory component comprises a report (maximum 4000 words, 30% of the module grade) alongside a reflective element (maximum 1000 words, 10% of the module grade), and an oral presentation (maximum 15 minutes, 10% of the module grade) summarising the project topic. For the free choice elements students can optionally choose either a 15-30 minute short film (modern essay, 50% of the module grade) or two of the following elements (25% each): podcast, webpage, poster, field report, training materials. The reflective element contained in the compulsory component describes (in part) why each portfolio element was chosen and describes the audience each element is intended to reach.</p>				
Learning and teaching methods of delivery:	Weekly contact: Project meetings with supervisor, by arrangement			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	Not available			
Module coordinator:	Dr C S Sutherland			
Module teaching staff:	Team Taught			

MT5098 Group Dissertation for MSc Programme/s				
SCOTCAT Credits:	60	SCQF level 11	Semester	Full Year
Academic year:	2021-2022			
Availability restrictions:	Available only to students enrolled on the MSc in Applied Statistics and Datamining			
Planned timetable:	To be arranged.			
<p>This module is a group-based dissertation which is supervised by members of the teaching staff who will advise on the choice of subject and provide guidance and structure throughout the progress of the dissertation. This module results in an individually written and submitted dissertation of not more than 15,000 words. This dissertation may also include an agreed collaboratively written group report, but this report will constitute no more than 30% of the module grade. Each student is assessed taking into account both individual and group submissions.</p>				
Pre-requisite(s):	Students must be enrolled on the MSc programme in the Applied Statistics and Data Mining.			
Anti-requisite(s)	You cannot take this module if you take MT5099			
Learning and teaching methods of delivery:	Weekly contact: 1-hour supervision (x 13 weeks)			
Assessment pattern:	Dissertation = 100%			
Re-assessment pattern:	Resubmission of dissertation = 100%			
Module coordinator:	Dr V M Popov			
Module teaching staff:	Team Taught			

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MT5099 Dissertation for MSc Programme/s				
SCOTCAT Credits:	60	SCQF level 11	Semester	Full Year
Academic year:	2021-2022			
Planned timetable:	At times to be arranged with the supervisor.			
Student dissertations will be supervised by members of the teaching staff who will advise on the choice of subject and provide guidance throughout the progress of the dissertation. The completed dissertation must be no more than 15,000 words.				
Learning and teaching methods of delivery:	Weekly contact: Individual supervision			
Assessment pattern:	Dissertation = 100%			
Re-assessment pattern:	No Re-Assessment Available			
Module coordinator:	Professor J D Mitchell			
Module teaching staff:	Team Taught			

MT5590 Independent Study Module				
SCOTCAT Credits:	15	SCQF level 11	Semester	Both
Academic year:	2021-2022			
Availability restrictions:	Available only to students on an MMath, MPhys or MSc degree programme in the School			
Planned timetable:	Weekly supervision as arranged with supervisor.			
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 that of other taught modules, broadening the selection of advanced material available. Students will meet regularly with their supervisor and follow a planned programme of independent study, with associated assessment, as specified in the Letter of Agreement.				
Pre-requisite(s):	The student requires a letter of agreement			
Anti-requisite(s)	You cannot take this module if you take MT5990			
Learning and teaching methods of delivery:	Weekly contact: Typically 1 hour supervision each week.			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	2-hour written examination = 100%			
Module coordinator:	Dr A L Wilmot-Smith			
Module teaching staff:	Dr Antonia Wilmot-Smith			

MT5599 Advanced Project in Mathematics / Statistics				
SCOTCAT Credits:	30	SCQF level 11	Semester	Full Year
Academic year:	2021-2022			
Availability restrictions:	Available only to students in the final year of a MMath/MPhys Honours degree programme in the School.			
Planned timetable:	Regular supervision as arranged with supervisor.			
This is a substantial project for final year students on integrated Masters degrees. The project will be chosen from a list published annually in the project booklet. It is also possible for students to nominate their own project, by agreement with a supervisor. Students will be required to investigate a topic in some depth, reporting regularly to their supervisor, submit a report by the end of April and give a presentation.				
Pre-requisite(s):	Available only to students in the final year of a MMath/MPhys Honours degree programme in the School.			
Learning and teaching methods of delivery:	Weekly contact: Typically and on average, 40 mins of project supervisions per week over whole year			
Assessment pattern:	Coursework = 100% (Project = 80%, Presentation = 20%)			
Re-assessment pattern:	Resubmission of project = 100%			
Module coordinator:	Professor N Ruskuc			
Module teaching staff:	Team Taught			

MT5751 Estimating Animal Abundance and Biodiversity				
SCOTCAT Credits:	15	SCQF level 11	Semester	2
Academic year:	2021-2022			
Planned timetable:	12.00 noon Mon (odd), Wed and Fri			
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. In the case of multi-species surveys, it will also show how abundance estimates may be combined into biodiversity measures. By the end of the course, students will be able to identify an appropriate assessment method for a given population, design a simple survey to assess the population, perform simple analyses of survey data, and estimate biodiversity trends in a community. Students will get experience in using the methods via computer practical sessions involving design and analyses of surveys.				
Pre-requisite(s):	Before taking this module you must pass MT3507 or pass MT3508 or pass MT5761			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x10 weeks), 1 computer practical or tutorial (x10 weeks)			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	Coursework = 100%			
Module coordinator:	Dr C S Sutherland			
Module teaching staff:	Dr Christopher Sutherland and Dr David Borchers			

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MT5758 Multivariate Analysis				
SCOTCAT Credits:	15	SCQF level 11	Semester	2
Academic year:	2021-2022			
Planned timetable:	11.00 am Mon (even weeks), Tue and Thu			
This module provides theory and application for the analysis of multivariate data. Fundamental matrix material is presented including mean vectors, covariance matrices, correlation matrices and basic properties of multivariate normal distributions. Multivariate extensions to common univariate tests are subsequently covered. Distance metrics and general measures of similarity are explored, leading to the broader utility of multivariate methods in real-world problems, particularly for classification and dimension reduction. The most common and fundamental methods are covered, including Principal Components Analysis, multidimensional scaling, clustering and discriminant analyses. The practical component of the module focuses on analysis of real data using widespread software.				
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 MT4609			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), and 4 tutorials and 4 project group meetings over the semester.			
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module teaching staff:	Dr Alison Johnston			

MT5761 Applied Statistical Modelling using GLMs				
SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
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)			
Assessment pattern:	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 Valentin Popov			

MT5762 Introductory Data Analysis			
SCOTCAT Credits:	15	SCQF level 11	Semester 1
Academic year:	2021-2022		
Availability restrictions:	Not available to Undergraduate students.		
Planned timetable:	Monday, Thursday, Friday 3:30pm-5pm and Tuesday 4pm-5:30pm		
This module provides coverage of essential statistical concepts and analysis methods relevant to commercial analysis. Specifically: the different types of data and their numerical/graphical treatment; basic probability theory and concepts of inference; fundamental statistical concepts with particular emphasis on sampling issues; basic statistical models and tests; linear models; introductory computer-intensive inference. This module is a short intensive course and is a core, preliminary, requirement for the MSc in Applied Statistics and Datamining. It covers material essential for study of the more advanced statistical methods encountered in subsequent modules.			
Pre-requisite(s):	Students must have gained admission onto an MSc programme		
Anti-requisite(s)	You cannot take this module if you take MT5756		
Learning and teaching methods of delivery:	Weekly contact: Four 1.5-hour lectures (x 5 weeks), 1 tutorial (x 5 weeks)		
Assessment pattern:	Coursework = 100%		
Module coordinator:	Professor D L Borchers		
Module teaching staff:	Dr David Borchers		

MT5763 Software for Data Analysis			
SCOTCAT Credits:	15	SCQF level 11	Semester 1
Academic year:	2021-2022		
Planned timetable:	Tuesday, Wednesday, Thursday, Friday 2-3:30pm.		
This module covers the practical computing aspects of statistical data analysis, focussing on packages most widely used in the commercial sector (R, SAS, SPSS and 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):	Before taking this module you must pass MT1007 or pass MT3507 or pass MT3508 or take 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)		
Assessment pattern:	Coursework = 100%		
Re-assessment pattern:	Coursework = 100%		
Module coordinator:	Dr C R Donovan		
Module teaching staff:	Dr Carl Donovan and Dr Charles Paxton		

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MT5764 Advanced Data Analysis				
SCOTCAT Credits:	15	SCQF level 11	Semester	2
Academic year:	2021-2022			
Planned timetable:	Mon 12:00-1:00 Weeks 2, 4, 6, 8, 10 Tues; Thur 12:00-1:00, Weeks 1-10 (lectures); Mon 2:00 - 4:00 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):	Before taking this module you must pass MT3508 and (pass MT4606 or pass 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 (x 10 weeks) and 8 practicals over the semester.			
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%			
Re-assessment pattern:	2-hour Written Examination = 100%			

MT5765 Medical Statistics				
SCOTCAT Credits:	15	SCQF level 11	Semester	2
Academic year:	2021-2022			
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)			
Assessment pattern:	Coursework = 35%, 2-hour Written Examination = 65%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Professor A G Lynch			
Module teaching staff:	Dr Andy Lynch			

MT5766 Statistical Problem Solving

SCOTCAT Credits:	15	SCQF level 11	Semester	Full Year
Academic year:	2021-2022			
Planned timetable:	Lecture/Practical (Thursday 2pm)			
<p>The module will focus on problem formulation and scientific reporting to different audiences. The module will consist of a set of case studies covering a range of application areas, for example, ecology, economics and medicine. The case studies will take the form of a key research question posed in a non-statistical way with an associated data set where appropriate. Students will be required to formulate the posed questions as a statistical problem and decide upon appropriate techniques to apply in each case. The coursework produced will be targeted at audiences ranging from readers of statistical journals to the general public. The form of the coursework will be different for each case study offering students the opportunity to improve their scientific writing and presentation skills. The module will also cover the importance of data protection and ethics approval alongside the promotion of science and statistics to wider audiences.</p>				
Pre-requisite(s):	Before taking this module you must pass MT3507 or pass MT3508			
Co-requisite(s):	You must also take MT4113			
Learning and teaching methods of delivery:	Weekly contact: 1 Lecture (x6 weeks), 1 practical (x16 weeks), 1 seminar (x2 weeks)			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	Coursework = 100%			
Module coordinator:	Dr H Worthington			
Module teaching staff:	Dr Hannah Worthington			

MT5767 Modelling Wildlife Population Dynamics

SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
Planned timetable:	10.00 am Mon (odd weeks), Wed, Fri			
<p>This module will introduce students to methods for constructing mathematical models of wildlife population dynamics and of fitting these models to diverse data from wildlife surveys. It will begin with an introduction to the key demographic processes that govern population dynamics, and how these can be represented within discrete-time age- and stage-structured models. Types of relevant wildlife survey data will then be considered, before turning to the approaches for fitting these data to the population models. Both classical and Bayesian approaches will be considered. Practical experience will be gained through tutorials and through two assignments.</p>				
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 practical (x 10 weeks)			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	Coursework = 100%			
Module coordinator:	Dr C S Sutherland			
Module teaching staff:	Dr Chris Sutherland			

MT5846 Advanced Computational Techniques				
SCOTCAT Credits:	15	SCQF level 11	Semester	2
Academic year:	2021-2022			
Planned timetable:	12 noon Monday (even weeks), Tuesday, Thursday.			
This module introduces students to some of the ideas, techniques and constraints that underpin modern approaches to the numerical modelling of physical processes that may be described by partial differential equations. Students will gain experience in implementing a variety of standard numerical methods where they will carry out three projects involving code development, testing and analysis/interpretation of results.				
Pre-requisite(s):	Before taking this module you must pass MT3802 and pass MT4112			
Anti-requisite(s)	You cannot take this module if you take MT5806			
Learning and teaching methods of delivery:	Weekly contact: 2 lectures (x 10 weeks), 1 practical (x 11 weeks)			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	Oral examination = 100%			
Module coordinator:	Dr A J Stewart			
Module teaching staff:	Dr Alexander Stewart			

MT5849 Geophysical Fluid Dynamics				
SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
Planned timetable:	11am Monday (odd weeks), Wednesday, Friday			
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			
Anti-requisite(s)	You cannot take this module if you take MT5809			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 1 tutorial (x 10 weeks)			
Assessment pattern:	2-hour written examination = 100%			
Re-assessment pattern:	2-hour written examination = 100%			
Module coordinator:	Dr R K Scott			
Module teaching staff:	Dr Richard Scott			

MT5850 Advanced Solar Theory				
SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
Planned timetable:	12 noon Monday (even weeks), Tuesday, Thursday			
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			
Anti-requisite(s)	You cannot take this module if you take MT5810			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lecture (x 10 weeks), 1 tutorial (x 10 weeks)			
Assessment pattern:	2-hour written examination = 100%			
Re-assessment pattern:	2-hour written examination = 100%			
Module coordinator:	Professor T Neukirch			
Module teaching staff:	Prof Thomas Neukirch			

MT5853 Spatial Models and Pattern Formation in Mathematical Biology				
SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
Planned timetable:	9am, Monday (odd weeks), Wednesday, Friday			
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 infectious diseases). The mathematical models that will be considered are mostly formulated in terms of nonlinear partial differential equations whose solutions can exhibit a range of interesting behaviour. 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			
Anti-requisite(s)	You cannot take this module if you take MT5852			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 10 tutorials (x 10 weeks)			
Assessment pattern:	50 minute class test = 10%, 2-hour written examination = 90%			
Re-assessment pattern:	2-hour written examination = 100%			
Module coordinator:	Dr A J Stewart			
Module teaching staff:	Dr Alexander Stewart			

MT5854 Mathematical Oncology				
SCOTCAT Credits:	15	SCQF level 11	Semester	2
Academic year:	2021-2022			
Planned timetable:	9am, Monday (odd weeks), Wednesday, Friday			
Cancer is a complex disease, the second largest cause of death throughout the world (after cardiovascular diseases). Beginning with genetic mutations in a single cell, cancer progresses through several key growth phases - the avascular growth phase (nutrient delivered by diffusion of oxygen), tumour-induced angiogenesis (blood vessel growth), invasion and metastasis (spread to secondary parts of the body). Because of its complexity and multiscale nature (temporal and spatial), treatment of cancer is challenging. This module will introduce students to the mathematical modelling of the key phases of cancer growth and treatment via immunotherapy, chemotherapy and radiotherapy. The mathematical techniques used in the modelling will be nonlinear partial differential equations, and students will be exposed to current research taking place within the Mathematical Biology research group in the School of Mathematics and Statistics.				
Pre-requisite(s):	Before taking this module you must pass MT3504			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 1 tutorial (x 10 weeks)			
Assessment pattern:	50 minute class test = 10%, 2-hour written examination = 90%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr N Sfakianakis			
Module teaching staff:	Dr Nikolaos Sfakianakis			

MT5855 Stochastic Dynamics in Biology				
SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
Planned timetable:	10am Monday (even weeks), Tuesday, Thursday			
This module will provide an introduction to stochastic modelling with a focus on applications in biology. It will introduce and explain key biological phenomena where stochastic effects are important, such as stochastic amplification (the emergence of stochastically-enabled oscillations) and stochastic resonance and focussing, where stochastic dynamics can change systems behaviour due to non-linear interactions. The module will include Bayesian techniques that may be used to infer parameters of stochastic models. Stochastic methods are increasingly used in applied maths and in mathematical biology in particular, both in research and in industrial settings. This module aims to equip students with the skills to understand stochastic dynamical systems and complements other modules in the School where dynamical systems are widely discussed using deterministic descriptions such as ODEs or PDEs. Here students learn how to extend such systems to take stochastic effects into account.				
Pre-requisite(s):	Before taking this module you must pass MT2508 and pass MT3504			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 1 tutorial (x 10 weeks)			
Assessment pattern:	Coursework (computing project) = 20%, 2-hour Written Examination = 80%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr J Kursawe			
Module teaching staff:	Dr Jochen Kursawe			

MT5856 Calculus of Variations in Biological Modelling				
SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
Planned timetable:	10am Monday (odd weeks), Wednesday, Friday			
This module introduces students to the mathematical modelling of biological processes using the Calculus of Variations as its main tool. It starts with an introduction to the Calculus of Variations and its historical applications and continues to modern applications in Mathematical Biology. Students will gain first-hand experience in confronting research-level modelling questions as well as in applying advanced mathematical techniques in the biological setting.				
Pre-requisite(s):	Before taking this module you must pass MT3504 and pass MT3802			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 1 tutorial (x 10 weeks)			
Assessment pattern:	Coursework (2 x 25% projects) = 50%, 2-hour Written Examination = 50%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr N Sfakianakis			
Module teaching staff:	Dr Nikolaos Sfakianakis			

MT5861 Advanced Combinatorics				
SCOTCAT Credits:	15	SCQF level 11	Semester	2
Academic year:	2021-2022			
Planned timetable:	12 noon Monday (odd weeks), Wednesday, Friday.			
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			
Anti-requisite(s)	You cannot take this module if you take MT5821			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x10 weeks), 1 tutorial (x10 weeks)			
Assessment pattern:	2-hour written examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Professor P J Cameron			
Module teaching staff:	Prof Peter Cameron			
Additional information from Schools:	A selection from the following will be covered. It is envisaged that the module in a given year will cover one of the following areas. The Intended Learning Outcomes differ by area. 1. Enumerative combinatorics: basic counting, formal power series and their calculus, recurrence relations, q-analogues, group action and cycle index, species, asymptotic results. 2. Graphs, codes and designs: strongly regular graphs, t-designs, optimality for block designs, codes and weight enumerators, matroids and Tutte polynomial, MacWilliams relations. 3. Projective and polar spaces: geometry of vector spaces, combinatorics of projective planes, sesquilinear and quadratic forms and their classification, diagram geometry, classical groups.			

Mathematics & Statistics - Postgraduate - 2021/2 - August – 2021

MT5862 Discrete Geometry				
SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
Availability restrictions:	Module runs in alternating odd years			
Planned timetable:	Lectures - Monday (odd weeks), Wednesday, Friday - 12 noon			
Discrete geometry is concerned with combinatorial properties of geometric objects such as point sets, arrangements of affine and projective subspaces, convex polytopes, and geometric graphs. This module introduces the area, covering the basic objects and selected key results.				
Pre-requisite(s):	Before taking this module you must pass MT2504 and pass MT3501 and (pass MT3502 or pass MT3505 or pass MT3852 or pass MT4003 or pass MT4514 or pass MT4516 or pass MT4512)			
Learning and teaching methods of delivery:	Weekly contact: 2.5 hour lectures (9 weeks), 1 hour tutorial (10 weeks)			
Assessment pattern:	2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr L S Theran			
Module coordinator Email:	lst6@st-andrews.ac.uk			
Module teaching staff:	Dr Louis Theran			

MT5863 Semigroups				
SCOTCAT Credits:	15	SCQF level 11	Semester	2
Academic year:	2021-2022			
Planned timetable:	1pm Monday, Thursday, Friday			
The general aim of this module is to introduce students to semigroup theory, which is the study of sets with one associative binary operation defined on them. In the process, the common aims and concerns of abstract algebra will be emphasised and illustrated by drawing comparisons between semigroups, groups and rings				
Pre-requisite(s):	Before taking this module you must pass MT3505 or pass MT4003			
Anti-requisite(s)	You cannot take this module if you take MT5823			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 1 tutorial (x 10 weeks)			
Assessment pattern:	2-hour written examination = 100%			
Re-assessment pattern:	2-hour written examination = 100%			
Module coordinator:	Professor J D Mitchell			
Module teaching staff:	Prof James Mitchell and Prof Nik Ruskuc			

MT5864 Topics in Groups				
SCOTCAT Credits:	15	SCQF level 11	Semester	1
Academic year:	2021-2022			
Planned timetable:	10am, Monday (odd weeks), Wednesday, Friday			
Groups are important mathematical objects that arise in many contexts since they encode the symmetry appearing within any particular setting. This is an area of current research interest in the School and this expertise determines the choice of topics covered in this module. The overall aim of the module is to build on the foundations established in MT4003 and to take students deeper into this important and beautiful branch of mathematics. It will introduce students to advanced techniques used to handle and classify groups.				
Pre-requisite(s):	Before taking this module you must pass MT4003			
Anti-requisite(s)	You cannot take this module if you take MT5824			
Learning and teaching methods of delivery:	Weekly contact: 2.5 lectures (x 10 weeks), 1 tutorial (x 9 weeks), 1 examples class (x 9 weeks)			
Assessment pattern:	2-hour Written Examination = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr M Quick			
Module teaching staff:	Dr Martyn Quick			

MT5991 Professional Skills for Mathematical Scientists				
SCOTCAT Credits:	30	SCQF level 11	Semester	Full Year
Academic year:	2021-2022			
Availability restrictions:	Available only to students studying MSc Mathematics			
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.			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	Resubmission of coursework = 100%			
Module coordinator:	Professor J D Mitchell			
Module teaching staff:	Team Taught			