School of Mathematics & Statistics

Head of School   Professor N Ruskuc

Taught Programmes

MSc:
Applied Statistics and Datamining
Mathematics
Statistics

For all Masters degrees there are exit awards available that allow suitably-qualified candidates to receive a Postgraduate Certificate or Postgraduate Diploma.

Programme Requirements

Applied Statistics and Datamining

Taught Element:

90 credits: MT5753, MT5756, MT5757, MT5758, and ID5059

30 credits: from MT modules in the range MT3000 - MT4598 or MT4600 - MT5998.

Programmes of study are subject to approval by the Head of School.

MSc:

120 credits as for Taught Element together with a 60-credit dissertation (MT5099) comprising three months' full-time study.

Mathematics

Taught Element:

90 credits: 5000-level modules listed in this section of the Postgraduate Course Catalogue.

30 credits: from MT modules in the range MT3000 - MT4598 or MT4600 - MT5998.

Programmes of study are subject to approval by the Head of School.

MSc:

120 credits as for Taught Element together with a 60-credit dissertation (MT5099) comprising three months' full-time study.

Statistics

Taught Element:

90 credits: 5000-level modules listed in this section of the Postgraduate Course Catalogue.

30 credits: from MT modules in the range MT3000 - MT4598 or MT4600 - MT5998.

Programmes of study are subject to approval by the Head of School.

MSc:

120 credits as for Taught Element together with a 60-credit dissertation (MT5099) comprising three months' full-time study.

Modules

The Pre-requisites for each module may be replaced by equivalent material from other institutions.

InterDisciplinary (ID) modules

ID5059 Knowledge Discovery and Datamining

SCOTCAT Credits:	15	SCQF Level 11	**Semester:**	2
Planned timetable:	11.00 am Mon (odd weeks), Wed and Fri			

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 the commercial packages SAS and SPSS.

Programme module type:	Optional for Advanced Computer Science, Artificial Intelligence, Networks and Distributed Systems, Software Engineering and Erasmus Mundus Dependable Software Systems MSc Programmes.
	Compulsory for Applied Statistics and Datamining MSc Programme.
	Optional for Statistics MSc Programme.
Anti-requisite(s):	MT5759
Learning and teaching methods and delivery:	**Weekly contact**: Lectures, seminars, tutorials and practical classes.
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%
Module Co-ordinator:	masters-coord-cs@st-andrews.ac.uk

Mathematics & Statistics (MT) modules

MT5099 Dissertation for MSc Programme/s

SCOTCAT Credits:	60	SCQF Level 11	**Semester:**	Whole Year
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 of not more than 15,000 words must be submitted by the end of August.

Programme module type:	Compulsory for MSc Programmes in Mathematics and in Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: Individual supervision
Assessment pattern:	Dissertation = 100%
Module Co-ordinator:	Prof T Neukirch

MT5611 Advanced Symbolic Computation

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
Planned timetable:	9.00 am Mon (odd weeks), Wed and Fri			

This module aims to enable students to use Maple as a tool in their other modules and to turn naturally to such a package when solving mathematical problems. The module aims to illustrate the following points: a symbolic computation package allows one to conduct mathematical experiments; a symbolic computation package 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 machine is stupid. 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.

Programme module type:	Optional for Mathematics and Statistics MSc Postgraduate Programmes		
Pre-requisite(s):	at least one MT4000-level module unless you are on a taught postgraduate programme	**Anti-requisite(s):**	MT4111
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 1 practical session (weeks 2 - 11).		
Assessment pattern:	2-hour Written Examination = 55%, Coursework: Project = 45%		
Module Co-ordinator:	Dr J D Mitchell		
Lecturer(s)/Tutor(s):	Dr J McDermott, Dr J D Mitchell, Dr C M Roney-Dougal		

MT5751 Estimating Animal Abundance

SCOTCAT Credits:	15	SCQF Level 11	**Semester:**	2
Planned timetable:	12.00 noon Mon(odd), Wed, 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. 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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics, also for some Postgraduate programmes outwith the School.
Learning and teaching methods and delivery:	**Weekly contact**: 1.5 hrs lecture, 1 hr practical, 0.5 hr tutorial (weeks 1 - 10)
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%
Module Co-ordinator:	Prof D L Borchers
Lecturer(s)/Tutor(s):	Prof D L Borchers

MT5753 Statistical Modelling

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
Planned timetable:	2.00 pm			

This module will introduce the main ideas of linear and generalised linear statistical modelling and will provide training in applied statistical modelling. The module structure is as follows: what statistical models are and what they are for; distributions, point and interval estimation and hypothesis testing; simple linear regression models for normal data; multiple regression; multiple regression with qualitative explanatory variables; less linear models for non-normal data; generalised linear models. Lectures will be built around the book 'An Introduction to Statistical Modelling' (Krzanowski, 1998), which closely matches what we believe to be an ideal course structure.

Programme module type:	Compulsory for Applied Statistics and Datamining MSc Programme.
	Compulsory for MRes in Environmental Biology and MRes in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences and MRes in Marine Mammal Science Postgraduate Programmes.
	Optional for MRes in Ecosystem-Based Management of Marine Systems
	Optional for Statistics MSc Programme.

Anti-requisite(s):	MT4607	**Required for:**	MT5755, MT5757
Learning and teaching methods and delivery:	**Weekly contact**: 6 hours lectures, 1.5 hours tutorials and 6 hours practicals (x 4 weeks).		
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%		
Module Co-ordinator:	Dr M L MacKenzie		
Lecturer(s)/Tutor(s):	Dr M L MacKenzie, Dr S DeRuiter		

MT5756 Data Analysis

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
Planned timetable:	2.00 pm			

This module provides coverage of essential statistical concepts, data manipulation and analysis methods, and software skills in commercial analysis packages. Specifically: the different types of data and their numerical/graphical treatment; data entry/import/export, basic probability theory and concepts of inference; fundamental statistical concepts with particular emphasis on sampling issues; basic statistical models and tests; introductory computer-intensive inference. The widespread commercial statistical packages SAS, SPSS are introduced and utilised with Excel for most analyses. The statistical programming language R is also given brief attention. 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.

Programme module type:	Compulsory for Applied Statistics and Datamining MSc Programme. An exemption may be granted to an appropriately qualified entrant.
Learning and teaching methods and delivery:	**Weekly contact**: Lectures, tutorials and practicals for 4 weeks.
Assessment pattern:	Coursework = 40%, 2-hour Examination = 60%
Module Co-ordinator:	Dr C R Donovan
Lecturer(s)/Tutor(s):	Dr C R Donovan

MT5757 Advanced Data Analysis

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu			

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; Ridge Regression and Principal Components Regression; 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 the commercial packages SAS.

Programme module type:	Compulsory for Applied Statistics and Datamining MSc Programme. Optional for Statistics MSc Programme.
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10)and 8 tutorials over the semester.
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%
Module Co-ordinator:	Dr M L MacKenzie
Lecturer(s)/Tutor(s):	Dr M L MacKenzie

MT5758 Applied Multivariate Analysis

SCOTCAT Credits:	15	SCQF Level 11	**Semester:**	2
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.

Programme module type:	Compulsory for Applied Statistics and Datamining MSc Programme. Optional for Statistics MSc Programme.		
Pre-requisite(s):	Acceptance on taught postgraduate programme.	**Anti-requisite(s):**	MT4609
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10), and 4 tutorials and 4 project group meetings over the semester.		
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%		
Module Co-ordinator:	Dr J B Illian		
Lecturer(s)/Tutor(s):	Dr J B Illian		

MT5802 Advanced Analytical Techniques

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).
Assessment pattern:	2-hour Written Examination = 75%, Coursework = 25%
Module Co-ordinator:	Dr C V Tran
Lecturer(s)/Tutor(s):	Dr C V Tran

MT5806 Advanced Computational Techniques

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: 2 lectures (weeks 1 - 10) and a typical average of 0.5 hours of project supervisions (weeks 2 - 11)
Assessment pattern:	Coursework = 100%
Module Co-ordinator:	Dr S J Brooks
Lecturer(s)/Tutor(s):	Dr S J Brooks

MT5809 Advanced Fluid Dynamics

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).
Assessment pattern:	2.5-hour Written Examination = 100%
Module Co-ordinator:	Prof D G Dritschel
Lecturer(s)/Tutor(s):	Prof D G Dritschel

MT5810 Advanced Solar Theory

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).
Assessment pattern:	2.5-hour Written Examination = 100%
Module Co-ordinator:	Prof T Neukirch
Lecturer(s)/Tutor(s):	Prof T Neukirch

MT5812 Advanced Financial Mathematics

SCOTCAT Credits:	20	SCQF Level 11	Semester:	1
Planned timetable:	2.00 pm Tue and Fri			

This module builds on the theory that has been taught in MT4551 by introducing further analytical and practical techniques that are used in the valuation and risk-management of all the mainstream vanilla and exotic derivatives in the Equity, Foreign Exchange, Fixed Income and Credit Markets. The focus will be on both understanding the theory as well as how it is applied in the real world environment of a derivatives trading desk. By means of lectures and practical assignments, students will also be introduced to Excel and the Visual Basic Programming language (as a working knowledge of these will be invaluable to anyone seeking a career in the areas of finance or business).

Programme module type:	Optional for all programmes in the School of Mathematics & Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: 2 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%
Module Co-ordinator:	Dr W R Campbell
Lecturer(s)/Tutor(s):	Dr W R Campbell

MT5821 Advanced Combinatorics

SCOTCAT Credits:	20	SCQF Level 11	Semester:	2
Planned timetable:	12.00 noon Mon (odd weeks), Wed & 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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Pre-requisite(s):	MT4514 or MT4516
Learning and teaching methods and delivery:	**Weekly contact**: 2.5-hour lectures (weeks 1 - 10) and 1-hour tutorial (weeks 2 - 11).
Assessment pattern:	2.5-hour Written Examination = 100%
Module Co-ordinator:	Prof P J Cameron
Lecturer(s)/Tutor(s):	Prof P J Cameron

MT5824 Topics in Groups

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
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/MT4603, 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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10), 1 tutorial and 1 examples class (weeks 2 - 11).
Assessment pattern:	2.5-hour Written Examination = 100%
Module Co-ordinator:	Dr C P Bleak
Lecturer(s)/Tutor(s):	Dr C P Bleak

MT5825 Measure and Ergodic Theory

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu			

This module introduces some of the powerful techniques and ideas of modern mathematical analysis 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 ergodic theorem, martingale theory. Analysis is one of the active research areas within the School, and the choice of topics will reflect current activity.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).
Assessment pattern:	2-hour Written Examination = 75%, Coursework = 25%
Module Co-ordinator:	Prof L Olsen
Lecturer(s)/Tutor(s):	Prof L Olsen

MT5830 Topics in Geometry and Analysis

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
Planned timetable:	10.00 am Mon (odd weeks), Wed and Fri			

The module will present new developments in geometry and analysis that relate to research interests in St Andrews. Building on 4000-level modules in analysis, it will introduce students to advanced results in this beautiful and important area of mathematics. The choice of specific topics may vary from year to year but will be chosen from Geometric Measure Theory, Non-commutative Geometry, Fuchsian Groups, Harmonic Analysis, and Measurable Dynamics.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Anti-requisite(s):	MT5828
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 1 tutorial (weeks 2 - 11).
Assessment pattern:	2.5-hour Written Examination = 100%
Module Co-ordinator:	Dr M Todd
Lecturer(s)/Tutor(s):	Dr M Todd

MT5831 Advanced Bayesian Inference

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.
Anti-requisite(s):	MT4531
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 8 tutorials/practical classes over semester.
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%
Module Co-ordinator:	Dr M Papathomas
Lecturer(s)/Tutor(s):	Dr M Papathomas, Dr L Thomas

MT5836 Galois Theory

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
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.

Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.		
Pre-requisite(s):	MT4517	**Anti-requisite(s):**	MT5826
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 10 tutorials/practical classes over semester.		
Assessment pattern:	2.5-hour Written Examination = 100%		
Module Co-ordinator:	Dr S Huczynska		
Lecturer(s)/Tutor(s):	Dr S Huczynska, Dr C Roney-Dougal		

MT5990 Independent Study Module

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	Either
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.

Programme module type:	Optional for all Postgraduate Programmes within the School.
Pre-requisite(s):	Permission from the Head of School
Learning and teaching methods and delivery:	**Weekly contact**: Typically 1 hour project supervisions.
Assessment pattern:	Coursework = 100%
Module Co-ordinator:	Dr M R Quick

MT5991 Professional Skills for Mathematical Scientists

SCOTCAT Credits:	30	SCQF Level 11	**Semester:**	Whole Year

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.

Programme module type:	Optional for all MSc programmes within the School of Mathematics & Statistics.
Learning and teaching methods and delivery:	**Weekly contact**: Varies. Typically 1 project supervision per week over whole year.
Assessment pattern:	Coursework = 100%
Module Co-ordinator:	Prof T Neukirch