

School of Mathematics & Statistics

Head of School

Professor N Ruskuc

Taught Programmes

M.Sc.:

**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.

M.Sc.:

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.

M.Sc.:

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.

M.Sc.:

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

ID5011 Geographic Information Systems for Environmental Management				
SCOTCAT Credits:	15	SCQF Level 11	Semester:	1
Planned timetable:	To be arranged.			
<p>This module provides an introduction to Geographic Information systems and their use in environmental problem solving. The module will be taught through a series of lectures, tutorials, laboratory classes and individual projects. The module will be assessed through class exercises and the final, short individual project. Students will be introduced to methods of acquiring, storing, analysing and displaying (2D and 3D) spatial digital data using the ArcGIS data package. An introduction to data manipulation and statistical techniques on a variety of environmental examples will be given. The module is taught within the School of Geography & Geosciences but incorporates datasets and analysis techniques used in earth and environmental science, biology, archaeology, and mathematics.</p>				
Programme module type:	Optional for Ecosystem-Based Management of Marine Systems, Environmental Biology, Mathematics, Statistics, Management and Environmental History Taught Postgraduate Programmes.			
Pre-requisite(s):	A basic ability in computer skills (Basic word processing, spread sheet analysis)			
Anti-requisite(s):	GE5005, ID5010, ID5012			
Learning and teaching methods and delivery:	Lectures, practicals and occasional tutorials.			
Assessment pattern:	Coursework = 50%, Short Project = 50%			
Module Co-ordinator:	Dr C R Bates			
Lecturer(s)/Tutor(s):	Dr R A J Robinson, Dr C R Bates			

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ID5059 Knowledge Discovery and Datamining				
SCOTCAT Credits:	15	SCQF Level 11	Semester:	2
Planned timetable:	To be arranged.			
<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 the commercial packages SAS and SPSS.</p>				
Programme module type:	Compulsory for Applied Statistics and Datamining Taught Postgraduate Programme. Optional for Statistics Taught Postgraduate Programme.			
Anti-requisite(s):	MT5759			
Learning and teaching methods and delivery:	Lectures, seminars, tutorials and practical classes.			
Assessment pattern:	Coursework = 40%, Written Examination = 60%			
Module Co-ordinator:	Dr C R Donovan and Dr T Kelsey			
Lecturer(s)/Tutor(s):	Dr C R Donovan and Dr T Kelsey			

Mathematics & Statistics (MT) modules

MT5099 Dissertation for M.Sc. Programme/s				
SCOTCAT Credits:	60	SCQF Level 11	Semester:	Whole Year
Planned timetable:	At times to be arranged with the supervisor.			
<p>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.</p>				
Programme module type:	Compulsory for Mathematics and Statistics M.Sc. Postgraduate Programmes			
Learning and teaching methods and delivery:	Individual supervision			
Assessment pattern:	Dissertation = 100%			
Module Co-ordinator:	Prof T Neukirch			

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MT5613 Advanced Topics in the History of Mathematics				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	1
Planned timetable:	12.00 noon Mon (odd weeks), Wed and Fri.			
The overall aim of the module is to give students an insight into the historical development of mathematics and an opportunity to research into one particular topic in some depth. This module is taught in parallel with MT4501.				
Programme module type:	Optional for all Postgraduate Taught Programmes within the School of Mathematics & Statistics			
Pre-requisite(s):	Entry to a Postgraduate Taught Programme within the School of Mathematics & Statistics			
Anti-requisite(s):	MT4501			
Learning and teaching methods and delivery:	Weekly contact: 2 lectures and 1 tutorial.			
Assessment pattern:	2 Class Tests = 34%, Coursework: Project = 66%			
Module Co-ordinator:	Dr C Roney-Dougal			
Lecturer(s)/Tutor(s):	Dr C Roney-Dougal, Dr C Bleak, Dr J J O'Connor, Prof E F Robertson			

MT5701 Advanced Statistical Inference				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	2
Planned timetable:	12.00 noon Mon (even weeks), Tue and Thu.			
This module consists of MT4606 with the addition of directed reading on more advanced aspects of the subject and a requirement to write a review essay on an aspect of the subject. The syllabus includes: comparison of point estimators; the Rao-Blackwell Theorem; distribution theory; Fisher information and the Cramer-Rao lower bound; maximum likelihood estimation; hypothesis-testing; confidence sets.				
Programme module type:	Optional for all Postgraduate Taught Programmes within the School of Mathematics & Statistics			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 0.5 tutorial.			
Assessment pattern:	2-hour Written Examination = 75%, Coursework: Project = 25%			
Module Co-ordinator:	Dr I B J Goudie			
Lecturer(s)/Tutor(s):	Dr I B J Goudie			

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MT5751 Estimating Animal Abundance				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
Planned timetable:	2.00 pm			
<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>				
Programme module type:	Optional for all Postgraduate Taught Programmes within the School of Mathematics & Statistics, also for some Postgraduate programmes outwith the School.			
Learning and teaching methods and delivery:	Weekly contact: 7 hours of lectures and 5 hours of practical classes per week for 2 weeks.			
Assessment pattern:	2-hour Written Examination = 67%, Coursework = 33%			
Module Co-ordinator:	Dr E Rexstad			
Lecturer(s)/Tutor(s):	Dr E Rexstad			

MT5753 Statistical Modelling				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	1
Planned timetable:	2.00 pm			
<p>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.</p>				
Programme module type:	<p>Compulsory for Applied Statistics and Datamining Taught Postgraduate Programme.</p> <p>Compulsory for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences and M.Res. in Marine Mammal Science Postgraduate Taught Programmes.</p> <p>Optional for M.Res. in Ecosystem-Based Management of Marine Systems</p> <p>Optional for Statistics Taught Postgraduate Programme.</p>			
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 each week for 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, Miss L Scott-Hayward			

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MT5756 Data Analysis				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	1
Planned timetable:	To be arranged.			
<p>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.</p>				
Programme module type:	Compulsory for Applied Statistics and Datamining Taught Postgraduate Programme. An exemption may be granted to an appropriately qualified entrant.			
Learning and teaching methods and delivery:	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.			
<p>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.</p>				
Programme module type:	Compulsory for Applied Statistics and Datamining Taught Postgraduate Programme. Optional for Statistics Taught Postgraduate Programme.			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures per week and 8 tutorials over the semester.			
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%			
Module Co-ordinator:	Dr D L Borchers			
Lecturer(s)/Tutor(s):	Dr D L Borchers, Dr M L MacKenzie			

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MT5758 Applied Multivariate Analysis				
SCOTCAT Credits:	15	SCQF Level 11	Semester:	2
Planned timetable:	10.00 am Mon (odd weeks), Wed and Fri.			
<p>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.</p>				
Programme module type:	Compulsory for Applied Statistics and Datamining Taught Postgraduate Programme. Optional for Statistics Taught Postgraduate Programme.			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures per week, 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.			
<p>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.</p>				
Programme module type:	Optional for all Postgraduate Taught Programmes within the School of Mathematics & Statistics.			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 1 tutorial.			
Assessment pattern:	2.5-hour Written Examination = 75 100%, Coursework = 25%			
Module Co-ordinator:	Dr C V Tran			
Lecturer(s)/Tutor(s):	Dr C V Tran			

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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 Taught Programmes within the School of Mathematics & Statistics.			
Learning and teaching methods and delivery:	Weekly contact: 2 lectures and a typical average of 0.5 hours of project supervisions.			
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 Taught Programmes within the School of Mathematics & Statistics.			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 1 tutorial.			
Assessment pattern:	2.5-hour Written Examination = 100%			
Module Co-ordinator:	Dr J N Reinaud			
Lecturer(s)/Tutor(s):	Dr J N Reinaud			

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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 Taught Programmes within the School of Mathematics & Statistics.			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 1 tutorial.			
Assessment pattern:	2.5-hour Written Examination = 100%			
Module Co-ordinator:	Prof A W Hood			
Lecturer(s)/Tutor(s):	Prof A W Hood			

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 and 1 tutorial.			
Assessment pattern:	2-hour Written Examination = 50% , Coursework = 50%			
Module Co-ordinator:	Dr W R Campbell			
Lecturer(s)/Tutor(s):	Dr W R Campbell			

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MT5821 Advanced Combinatorics				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	2
Planned timetable:	10.00 am 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.				
Programme module type:	Optional for all Postgraduate Taught Programmes within the School of Mathematics & Statistics.			
Learning and teaching methods and delivery:	Weekly contact: 2.5-hour lectures and 1-hour tutorial.			
Assessment pattern:	2.5-hour Written Examination = 100%			
Module Co-ordinator:	Prof P J Cameron			
Lecturer(s)/Tutor(s):	Prof P J Cameron			

MT5823 Semigroups				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	2
Planned timetable:	9.00 am Mon (odd weeks), Wed and Fri.			
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.				
Programme module type:	Optional for all Postgraduate Taught Programmes within the School of Mathematics & Statistics			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures, 1 tutorial and 1 examples class.			
Assessment pattern:	2-hour Written Examination = 75%, Coursework = 25%			
Module Co-ordinator:	Prof N Ruskuc			
Lecturer(s)/Tutor(s):	Prof N Ruskuc			

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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 Taught Programmes within the School of Mathematics & Statistics.			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures, 1 tutorial and 1 examples class.			
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 Taught Programmes within the School of Mathematics & Statistics.			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 1 tutorial.			
Assessment pattern:	2-hour Written Examination = 75%, Coursework = 25%			
Module Co-ordinator:	Dr M J Todd			
Lecturer(s)/Tutor(s):	Dr M J Todd			

MT5827 Lie Algebras				
SCOTCAT Credits:	20	SCQF Level 10	Semester:	2
Planned timetable:	11.00 am Mon (odd weeks), Wed and Fri.			
The aim of this module is to classify the semi-simple Lie algebras over an algebraically closed field. Lie algebra has important applications to theoretical physics and is used in the classification of finite simple groups.				
Programme module type:	Optional for all Postgraduate Taught Programmes within the School of Mathematics & Statistics			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 1 tutorial.			
Assessment pattern:	2.5-hour Written Examination = 100%			
Module Co-ordinator:	Dr M Neunhoeffler			
Lecturer(s)/Tutor(s):	Dr M Neunhoeffler			

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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 Taught Programmes within the School of Mathematics & Statistics.			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures per week and 8 tutorials/practical classes over semester.			
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%			
Module Co-ordinator:	Dr R King			
Lecturer(s)/Tutor(s):	Dr R King, Dr M Papatomas			

MT5991 Professional Skills for Mathematical Scientists				
SCOTCAT Credits:	30	SCQF Level 11	Semester:	Whole Year
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 taught postgraduate 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			