Master of Science Statistics

Programme Requirements

Statistics - MSc
90 credits from List: MT5611, MT5751, MT5753, MT5757-MT5758, MT5802, MT5806, MT5809-MT5810, MT5812, MT5821, MT5824, MT5830-MT5831, MT5836, MT5852. **and** 30 credits from Module List: MT3000 - MT4598, MT4600 - MT5998 **and** MT5099 (60 credits)

Modules

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

Compulsory module - Whole Year:

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 21st of August.				
Programme module type:	Compulsory for MSc Programmes in Mathematics and in Statistics. Optional for Data-Intensive Analysis MSc Programme.			
Learning and teaching methods and delivery:	**Weekly contact**: Individual supervision			
Assessment pattern:	Dissertation = 100%			
Module coordinator:	Dr J D Mitchell			

90 credits from optional modules:

MT5753 Statistical Modelling

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
Planned timetable:	2.00 pm - 5.00 pm Mon - Thu and 2.00 pm - 3.00 pm Fri (Weeks 5 - 9)			
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.				
Programme module type:	Compulsory for Applied Statistics and Datamining MSc Programme. Compulsory for Data-Intensive Analysis MSc programme. Optional for Statistics MSc Programme.			
Anti-requisite(s):	MT4607		**Required for:**	MT5757
Learning and teaching methods and delivery:	**Weekly contact**: 6 hours lectures, 1.5 hours tutorials and 6 hours practicals (x 5 weeks).			
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%			
Module coordinator:	Dr L A Scott-Hayward			

MT5757 Advanced Data Analysis

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
Planned timetable:	12.00 noon 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; 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.				
Programme module type:	Compulsory for Applied Statistics and Datamining MSc Programme. Compulsory for Data-Intensive Analysis 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 coordinator:	Dr L Scott-Hayward			

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 coordinator:	Prof L Thomas			
Module teaching staff:	Prof L Thomas, Dr V M Popov			

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 coordinator:	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 coordinator:	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 coordinator:	Dr J Reinaud			

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 coordinator:	Prof C E Parnell			

MT5821 Advanced Combinatorics

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
Availability restrictions:	Availability subject to confirmation			
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.				
Programme module type:	Optional for all Postgraduate Programmes within the School of Mathematics & Statistics.			
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 coordinator:	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 coordinator:	Dr C P Bleak			

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**: 24 lectures and 7 practical classes over semester.			
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%			
Module coordinator:	Dr M Papathomas			

MT5852 Mathematical Biology 2

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
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.				
Programme module type:	Optional for all MSc postgraduate programmes in 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 = 90%, Coursework (Class Test) = 10%			
Module coordinator:	Dr T Lorenzi			

30 credits from modules listed above or the following:

MT5613 Advanced Topics in the History of Mathematics

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
Planned timetable:	12.00 noon Mon (odd), Wed & 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			
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 coordinator:	Dr I J Falconer			

MT5701 Advanced Statistical Inference

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	2
Planned timetable:	10.00 am Mon (odd weeks), Wed and Fri			
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 Programmes within the School of Mathematics & Statistics			
Anti-requisite(s):	MT4606			
Learning and teaching methods and delivery:	**Weekly contact**: 2.5 lectures (weeks 1 - 10) and 0.5 tutorial (weeks 2 - 11).			
Assessment pattern:	2-hour Written Examination = 75%, Coursework: Project = 25%			
Module coordinator:	Prof A G Lynch			

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. Compulsory for Data-Intensive Analysis MSc Programme.			
Learning and teaching methods and delivery:	**Weekly contact**: Lectures, tutorials and practicals for 4 weeks.			
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%			
Module coordinator:	Dr V Popov			

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 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-hour Written Examination = 75%, Coursework = 25%			
Module coordinator:	Dr J D Mitchell			

MT5825 Measure and Probability Theory

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
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.				
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 coordinator:	Prof L Olsen			

MT5827 Lie Algebras

SCOTCAT Credits:	20	SCQF Level 11	**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 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 coordinator:	Dr A Detinko			

MT5990 Independent Study Module				
SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1 or 2
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 of Mathematics & Statistics.			
Learning and teaching methods and delivery:	**Weekly contact**: Typically 1 hour project supervisions.			
Assessment pattern:	Coursework = 100%			
Module coordinator:	Dr A L Wilmot-Smith			

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 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 coordinator:	Dr J D Mitchell			

For further Mathematics and Statistics modules in the range MT3000 - MT4598 or MT4600 - MT5998 see: 2017/8 Honours Mathematics & Statistics