

## School of Mathematics & Statistics

### Modules

Normally the pre-requisite(s) for each of the following Honours modules is entry to the Honours Programme(s) for which they are specified, as well as any additional specific pre-requisite(s) given.

General degree students wishing to enter 3000-level modules and non-graduating students wishing to enter 3000-level or 4000 level-modules must consult with the relevant Honours Adviser within the School before making their selection.

The pre-requisite for each of the following 5000-level modules is entry to the M.Phys. or M.Math. Programme(s) for which they are specified, as well as any additional specific pre-requisite(s) given.

### Mathematics & Statistics (MT) Modules

MT3501 Linear Mathematics			
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	12.00 noon Mon (even weeks), Tue and Thu.		
This module aims to show the importance of linearity in many areas of mathematics ranging from linear algebra through to geometric applications to linear operators and special functions. The main topics covered are: linear dependence and independence; change of basis; inner product spaces; inequalities; convergence in Euclidean spaces; Fourier series and adjoint and self-adjoint operators.			
<b>Programme module type:</b>	Compulsory for all M.Math. programmes, B.Sc./M.A. Mathematics, B.Sc. Statistics, B.Sc. joint Honours Statistics programmes, M.Phys. Mathematics and Theoretical Physics and M.Phys. Theoretical Physics. At least two of MT3501, MT3503 and MT3504 are compulsory for all other joint Mathematics programmes (including M.Chem. Chemistry with Mathematics and B.Sc./M.A. Mathematics 'with' degrees)		
<b>Pre-requisite(s):</b>	MT2001		
<b>Required for:</b>	MT4003, MT4111, MT4513, MT4514, MT4516, MT4517, MT4519, MT4521, MT4527, MT4530, MT5827		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 90%, Practical Examinations = 0%, Coursework = 10%		
	<b>As used by St Andrews:</b> Coursework = 10%, Written Examination = 90%		
<b>Module Co-ordinator:</b>	Dr M R Quick		
<b>Lecturer(s)/Tutor(s):</b>	Dr M R Quick		

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT3503 Complex Analysis			
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	12.00 noon Mon (odd weeks), Wed and Fri.		
This module aims to introduce students to analytic function theory and applications. The topics covered include: analytic functions; Cauchy-Riemann equations; harmonic functions; multivalued functions and the cut plane; singularities; Cauchy's theorem; Laurent series; evaluation of contour integrals; fundamental theorem of algebra; Argument Principle; Rouché's Theorem.			
<b>Programme module type:</b>	Compulsory for M.Math. Applied Mathematics, M.Math. Mathematics, M.Math. Pure Mathematics and B.Sc./M.A. Mathematics. At least two of MT3501, MT3503 and MT3504 are compulsory for B.Sc./M.A. joint Honours Mathematics programmes (including Mathematics 'with' degrees) and M.Chem. Chemistry with Mathematics. Optional for all other programmes in the School.		
<b>Pre-requisite(s):</b>	MT2001		
<b>Required for:</b>	MT4005, MT4111, MT4507, MT4513, MT4514, MT4516, MT4519, MT4527, MT4530, MT4551, MT5802		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 90%, Practical Examinations = 0%, Coursework = 10%		
	<b>As used by St Andrews:</b> Coursework = 10%, Written Examination = 90%		
<b>Module Co-ordinator:</b>	Dr M Carr		
<b>Lecturer(s)/Tutor(s):</b>	Dr M Carr		

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT3504 Differential Equations</b>				
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b>	1
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	9.00 am Mon (odd weeks), Wed and Fri.			
<p>The object of this module is to provide a broad introduction to analytical methods for solving ordinary and partial differential equations and to develop students' understanding and technical skills in this area. This module is a prerequisite for several other Honours options. The syllabus includes: existence and uniqueness of solutions to initial-value problems; series solutions of second-order o.d.e.'s; examples including Bessel, Legendre and Airy equations; nonlinear o.d.e.'s; classification of second order linear p.d.e.'s; method of separation of variables; eigenvalues for boundary conditions of mixed type; characteristics and reduction to canonical form.</p>				
<b>Programme module type:</b>	<p>Compulsory for M.Math. Applied Mathematics, M.Math. Mathematics, M.Math. Pure Mathematics, B.Sc./M.A. Mathematics, M.Phys. Mathematics and Theoretical Physics and M.Sci. Applied Quantitative Finance.</p> <p>At least two of MT3501, MT3503 and MT3504 are compulsory for B.Sc./M.A. joint Honours Mathematics programmes (including Mathematics 'with' degrees) and M.Chem. Chemistry with Mathematics.</p> <p>Optional for all other programmes in the School of Mathematics and Statistics.</p>			
<b>Pre-requisite(s):</b>	MT2001			
<b>Required for:</b>	MT4005, MT4111, MT4507, MT4508, MT4511, MT4513, MT4514, MT4516, MT4519, MT4530, MT4551			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 examples class.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100% (class test = 10%, final exam = 90%)			
<b>Module Co-ordinator:</b>	Prof T Neukirch			
<b>Lecturer(s)/Tutor(s):</b>	Prof T Neukirch			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT3600 Fundamentals of Pure Mathematics			
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	10.00 am Mon (even weeks), Tue and Thu.		
The aim of this module is to introduce the fundamental algebraic and analytic concepts in pure mathematics in the context of the number systems.			
<b>Programme module type:</b>	Compulsory for M.Math. Pure Mathematics. At least one of MT3600, MT3601 and MT3606 is compulsory for M.Math. Mathematics and B.Sc./M.A. Mathematics. At least one of MT3600 and MT3601 is compulsory for B.Sc./M.A. joint Honours Mathematics programmes (including Mathematics 'with' degrees) and M.Chem. Chemistry with Mathematics. Optional for all other programmes in the School.		
<b>Pre-requisite(s):</b>	MT2002 or (MT2001 and MT1003)		
<b>Required for:</b>	MT4003, MT4517, MT4521		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Prof N Ruskuc		
<b>Lecturer(s)/Tutor(s):</b>	Prof N Ruskuc		

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT3601 Fundamentals of Applied Mathematics</b>			
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	10.00 am Mon (odd weeks), Wed and Fri.		
<p>This module is designed to introduce students to the mathematical methods which are needed to go on to further study of fluid mechanics, magnetohydrodynamics and electromagnetism. It consists of a revision of the techniques of vector calculus, followed by a discussion of the basic equations of fluid dynamics and electromagnetism. The properties of these equations are then illustrated by considering some basic properties of fluid flow and of magnetohydrodynamics.</p>			
<b>Programme module type:</b>	<p>Compulsory for M.Math. Applied Mathematics. At least one of MT3600, MT3601 and MT3606 compulsory for M.Math. Mathematics and B.Sc./M.A. Mathematics.</p> <p>At least one of MT3600 and MT3601 compulsory for B.Sc./M.A. joint Honours Mathematics programmes (including Mathematics 'with' degrees) and M.Chem. Chemistry with Mathematics.</p> <p>Optional for all other programmes in the School.</p>		
<b>Pre-requisite(s):</b>	MT2001 and (MT2003 or PH3081)	<b>Required for:</b>	MT4509, MT4510
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Dr M Carr		
<b>Lecturer(s)/Tutor(s):</b>	Dr M Carr, Professor C E Parnell		

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT3606 Fundamentals of Statistics			
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	11.00 am Mon (even weeks), Tue and Thu.		
This module provides a bridge between second year and Honours modules in statistics. The module covers a range of fundamental statistical methodology. Topics covered include randomness and goodness-of-fit, discrete data and distributions, continuous distributions, introduction to Bayesian methods, likelihood-based methods.			
<b>Programme module type:</b>	Compulsory for M.Math. Statistics, B.Sc. Statistics and B.Sc./M.A. joint Honours Statistics programmes. At least one of MT3600, MT3601 and MT3606 is compulsory for M.Math. Mathematics and B.Sc./M.A. Mathematics. Optional for all other programmes in the School.		
<b>Pre-requisite(s):</b>	MT2004		
<b>Required for:</b>	MT4516, MT4527, MT4530, MT4531, MT4537, MT4606, MT4609, MT5701, MT5751, MT5831		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 0.5 tutorial.		
	<b>Scheduled learning:</b> 31 hours	<b>Guided independent study:</b> 119 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100% (class test = 10%, final exam = 90%)		
<b>Module Co-ordinator:</b>	Prof S T Buckland		
<b>Lecturer(s)/Tutor(s):</b>	Prof S T Buckland		

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT3607 Computing in Statistics</b>				
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b>	1
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	12.00 noon Mon (odd weeks), Wed and Fri.			
Students will gain experience with the software package SAS and the statistical language and environment R. Statistical computing exercises include using and writing software to (1) extract and organise electronically stored data, (2) search for patterns and meaningful relationships, (3) fit mathematical models to characterise relationships succinctly, (4) produce useful graphical and numerical summaries.				
<b>Programme module type:</b>	Compulsory for M.Math. Statistics and M.Sci. Applied Quantitative Finance. At least one of MT3607, MT4111, MT4112 and MT5611 is compulsory for M.Math. Mathematics. At least one of MT3607, MT4111 and MT4112 is compulsory for B.Sc./M.A. Mathematics and B.Sc. Statistics. Optional for all other programmes in the School of Mathematics and Statistics.			
<b>Pre-requisite(s):</b>	pre- or co-requisite MT2004			
<b>Co-requisite(s):</b>	pre- or co-requisite MT2004			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 practical class.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 40%, Practical Examinations = 0%, Coursework = 60%			
	<b>As used by St Andrews:</b> Coursework = 60%, Written Examination = 40% (four class tests)			
<b>Module Co-ordinator:</b>	Dr L Thomas			
<b>Lecturer(s)/Tutor(s):</b>	Dr L Thomas, Dr E Rexstad			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT3706 Markov Chains and Processes				
SCOTCAT Credits:	15	SCQF Level 9	Semester:	1
Academic year:	2013/4			
Planned timetable:	11.00 am Mon (even weeks), Tue and Thu.			
This module provides an introduction to the theory of stochastic processes and to their use as models, including applications to population processes and queues. The syllabus includes the Markov property, the Chapman-Kolmogorov equations, classification of states of Markov chains, decomposition of chains, stationary distributions, random walks, branching processes, the Poisson process, birth-and-death processes and their transient behaviour, embedded chains, Markovian queues.				
Programme module type:	Compulsory for M.Sci. Applied Quantitative Finance At least two from MT3706, MT4531, MT4606 - MT4609 compulsory for B.Sc./M.A. joint Honours Statistics programmes Optional for all other programmes in the School At least two from MT3706, MT4527, MT4608 compulsory for B.Sc. Management Science (single Honours).			
Pre-requisite(s):	MT2004			
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures per week and 8 tutorials over the semester.			
	Scheduled learning: 33 hours		Guided independent study: 117 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Written Examination = 100%			
Module Co-ordinator:	Dr R King			
Lecturer(s)/Tutor(s):	Dr R King			

MT3802 Numerical Analysis				
SCOTCAT Credits:	15	SCQF Level 9	Semester:	1
Academic year:	2012/3			
Planned timetable:	11.00 am Mon (odd weeks), Wed and Fri.			
The module will introduce students to some topics in numerical analysis, which may include methods of approximation, numerical integration, solution of systems of linear equations by elimination and by iterative methods.				
Programme module type:	Optional for all programmes in the School			
Pre-requisite(s):	MT2001	Required for:	MT5806	
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 1 tutorial			
	Scheduled learning: 35 hours		Guided independent study: 115 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 80%, Practical Examinations = 0%, Coursework = 20%			
	As used by St Andrews: Coursework = 20%, Written Examination = 80%			
Module Co-ordinator:	Dr A P Naughton			
Lecturer(s)/Tutor(s):	Dr A P Naughton, Prof C E Parnell			



## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT3832 Mathematical Programming				
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b>	2
<b>Academic year:</b>	2013/4			
<b>Planned timetable:</b>	12.00 noon Mon (odd weeks), Wed and Fri.			
	The aim of this module is to introduce students to the formulation and solution of various linear programming problems. The subject matter will be illustrated by applying the methods of solution to real examples. The syllabus includes: formulation of linear problems; solution graphically and by simplex algorithm; sensitivity analysis; duality; transportation and transshipment; the assignment problem.			
<b>Programme module type:</b>	Optional for all programmes in the School Compulsory for B.Sc. Management Science (single and joint Honours)			
<b>Pre-requisite(s):</b>	MT2001 (or MT1002 and MN2002)			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 0.5 tutorial			
	<b>Scheduled learning:</b> 30 hours		<b>Guided independent study:</b> 120 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr I B J Goudie			
<b>Lecturer(s)/Tutor(s):</b>	Dr I B J Goudie			

MT3833 Utilities, Decisions and Inventories				
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	12.00 noon Mon (odd weeks), Wed and Fri.			
	This module is intended to provide an introduction to the formulation and solution of problems of decision-taking and problems in the management of inventory systems for a single item, to motivate the need for utility functions, and to explain how they are assessed and employed. The syllabus includes: decision theory; maximin and Bayesian approaches; Bayes theorem; Bellman's optimality principle; utility theory; utility functions; inventory theory.			
<b>Programme module type:</b>	Optional for all programmes in the School. Compulsory for B.Sc. Management Science (single and joint Honours).			
<b>Pre-requisite(s):</b>	MT2004 or (MT2001 and MT1007) -			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 0.5 tutorial.			
	<b>Scheduled learning:</b> 30 hours		<b>Guided independent study:</b> 120 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr I B J Goudie			
<b>Lecturer(s)/Tutor(s):</b>	Dr I B J Goudie			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4003 Groups			
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b> 2
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	9.00 am Mon (even weeks), Tue and Thu.		
<p>This module introduces students to group theory, which is one of the central fields of the 20th century mathematics. The main theme of the module is classifying groups with various additional properties, and the development of tools necessary in this classification. In particular, the students will meet the standard algebraic notions, such as substructures, homomorphisms, quotients and products, and also various concepts peculiar to groups, such as normality, conjugation and Sylow theory. The importance of groups in mathematics, arising from the fact that groups may be used to describe symmetries of any mathematical object, will be emphasised throughout the module.</p>			
<b>Programme module type:</b>	Compulsory for M.Math. Pure Mathematics. At least two from MT4003, MT4004, MT4509, MT4510 and MT4606 are compulsory for M.Math. Mathematics. Optional for all other programmes in the School.		
<b>Pre-requisite(s):</b>	MT3600 or (MT2002 and MT3501)		
<b>Required for:</b>	MT4521, MT5823, MT5824, MT5827, MT5829		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures, 1 tutorial and 1 examples class.		
	<b>Scheduled learning:</b> 45 hours		<b>Guided independent study:</b> 105 hours
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Dr M R Quick		
<b>Lecturer(s)/Tutor(s):</b>	Dr M R Quick		

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4004 Real and Abstract Analysis				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	11.00 am Mon (even weeks), Tue and Thu.			
This module continues the development of real analysis started in MT2002. Topics that will be treated from a rigorous point of view may include: differentiation, Riemann integration, uniform convergence, function spaces.				
<b>Programme module type:</b>	Compulsory for M.Math. Pure Mathematics. At least two from MT4003, MT4004, MT4509, MT4510 and MT4606 are compulsory for M.Math. Mathematics. Optional for all other programmes in the School.			
<b>Pre-requisite(s):</b>	MT2002, unless waived by the module co-ordinator			
<b>Required for:</b>	MT5825, MT5828, MT5830			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures, 1 tutorial and 1 examples class.			
	<b>Scheduled learning:</b> 45 hours		<b>Guided independent study:</b> 105 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Prof L Olsen			
<b>Lecturer(s)/Tutor(s):</b>	Prof L Olsen			

MT4005 Linear and Nonlinear Waves				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	1
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	11.00 am Mon (even weeks), Tue and Thu.			
This module gives an introduction to wave motion and its importance in many areas of applied mathematics. It begins with a discussion of the linear approximation for small amplitude waves and discusses properties of these such as dispersion relations, phase and group velocities, dissipation and dispersion. Some nonlinear effects such as wave steepening are then treated and an introduction given to some of the equations, for example Burger's and Korteweg de Vries, which are used to model nonlinear wave propagation.				
<b>Programme module type:</b>	Compulsory for M.Math. Applied Mathematics. Optional for all other programmes in the School.			
<b>Pre-requisite(s):</b>	(MT2003 or PH3081) and (MT3503 or MT3504)			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr A N Wright			
<b>Lecturer(s)/Tutor(s):</b>	Dr A N Wright			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4111 Symbolic Computation			
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b> 2
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	9.00 am Mon (odd weeks), Wed and Fri.		
<p>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.</p>			
<b>Programme module type:</b>	<p>At least one of MT4111, MT4112 and MT5611 compulsory for M.Math. Applied Mathematics and M.Math. Pure Mathematics</p> <p>At least one of MT3607, MT4111, MT4112 and MT5611 compulsory for M.Math. Mathematics</p> <p>At least one of MT3607, MT4111 and MT4112 compulsory for B.Sc./M.A. Mathematics and B.Sc./M.A. Statistics</p> <p>At least one of MT4111 and MT4112 compulsory for B.Sc./M.A. joint Honours Mathematics programmes (including Mathematics 'with' degrees)</p> <p>Optional for all other programmes in the School</p>		
<b>Pre-requisite(s):</b>	MT3501 or MT3503 or MT3504	<b>Anti-requisite(s):</b>	MT5611
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 practical session		
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours
<b>Assessment pattern:</b>	<b>As defined by QAA:</b>		
	Written Examinations = 70%, Practical Examinations = 0%, Coursework = 30%		
<b>Assessment pattern:</b>	<b>As used by St Andrews:</b>		
	Coursework = 30%, Written Examination = 70%		
<b>Module Co-ordinator:</b>	Dr J D Mitchell		
<b>Lecturer(s)/Tutor(s):</b>	Dr J D Mitchell, Dr M Neunhoeffer, Dr C M Roney-Dougal		

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT4112 Computing in Mathematics</b>			
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b> 1
<b>Academic year:</b>	2013/4		
<b>Planned timetable:</b>	9.00 am Mon (even weeks), Tue and Thu.		
This module is intended to introduce students to FORTRAN and the writing of computer codes to implement mathematical algorithms. The module includes a basic introduction to FORTRAN, and the implementation of mathematical algorithms in a well-documented FORTRAN program. Students are required to complete a project in addition to sitting the examination.			
<b>Programme module type:</b>	At least one of MT4111, MT4112 and MT5611 compulsory for M.Math. Applied Mathematics and M.Math. Pure Mathematics At least one of MT3607, MT4111, MT4112 and MT5611 compulsory for M.Math. Mathematics At least one of MT3607, MT4111 and MT4112 compulsory for B.Sc./M.A. Mathematics and B.Sc./M.A. Statistics At least one of MT4111 and MT4112 compulsory for B.Sc./M.A. joint Honours Mathematics programmes (including Mathematics 'with' degrees) Optional for all other programmes in the School		
<b>Pre-requisite(s):</b>	either pre- or co-requisites MT3501, MT3503 or MT3504	<b>Anti-requisite(s):</b>	MT5612, Honours or Joint Honours Programme in Computer Science.
<b>Co-requisite(s):</b>	either pre- or co-requisites MT3501, MT3503 or MT3504	<b>Required for:</b>	MT5806
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures.		
	<b>Scheduled learning:</b> 25 hours	<b>Guided independent study:</b> 125 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 70%, Practical Examinations = 0%, Coursework = 30%		
	<b>As used by St Andrews:</b> Coursework: Project = 30%, Written Examination = 70%		
<b>Module Co-ordinator:</b>	Dr S J Brooks		
<b>Lecturer(s)/Tutor(s):</b>	Dr S J Brooks		

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4501 Topics in the History of Mathematics				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Academic year:	2013/4			
Planned timetable:	12.00 noon Mon (odd weeks), Wed and Fri.			
The aim of this module is to give students an insight into the historical development of mathematics. Topics to be covered may include some of: the development of algebra, the origins of the calculus, the history of logarithms, the work of some individual mathematicians.				
Programme module type:	Optional for all programmes in the School			
Pre-requisite(s):	either pre- or co-requisites - MT3501, MT3503, MT3504, MT3506	Anti-requisite(s):	MT5613	
Co-requisite(s):	either pre- or co-requisites - MT3501, MT3503, MT3504, MT3506			
Learning and teaching methods and delivery:	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
Assessment pattern:	<b>As defined by QAA:</b> Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%			
	<b>As used by St Andrews:</b> Coursework: Project = 50%, Written Examination = 50% (2 class tests)			
Module Co-ordinator:	Dr C M Roney-Dougal			
Lecturer(s)/Tutor(s):	Dr C M Roney-Dougal, Dr C P Bleak, Prof E F Robertson, Dr J J O'Connor			

MT4507 Classical Mechanics				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Academic year:	2012/3			
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu.			
The object of this module is to introduce students to some of the ideas and mathematical techniques used in understanding the behaviour of dynamical systems that obey Newton's Laws. These notions are arguably the foundations of physics and applied mathematics. The module will include: Newton's laws of motion; conservative forces; central forces; non-inertial/accelerating frames of reference; dynamics of a system of particles; mechanics of a rigid body; Euler's equations; Lagrange's equations; Hamilton's equations.				
Programme module type:	Optional for all programmes in the School			
Pre-requisite(s):	(MT2003 or PH3081) and (MT3503 or MT3504)			
Required for:	PH4032, PH5004			
Learning and teaching methods and delivery:	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
Assessment pattern:	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
Module Co-ordinator:	Prof T Neukirch			
Lecturer(s)/Tutor(s):	Prof T Neukirch			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4508 Dynamical Systems				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2013/4			
<b>Planned timetable:</b>	10.00 am Mon (even weeks), Tue and Thu.			
	This module aims to introduce students to the basic ideas of the modern theory of dynamical systems and to the concepts of chaos and strange attractors. The module will include: period doubling; intermittency and chaos; geometrical approach to differential equations; homoclinic and heteroclinic orbits; Poincaré sections; the Smale horseshoe mapping; centre manifold theory.			
<b>Programme module type:</b>	Optional for all programmes in the School			
<b>Pre-requisite(s):</b>	MT3504			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Prof T Neukirch			
<b>Lecturer(s)/Tutor(s):</b>	Prof T Neukirch			

MT4509 Fluid Dynamics				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	11.00 am Mon (even weeks), Tue and Thu.			
	This module provides an introduction to the theory of incompressible fluid dynamics, which describes the motion of liquids and gases at speeds small compared to the sound speed. Special attention is paid to a precise foundation of the various conservation laws that govern fluid dynamics, as this provides a convenient framework in which to study specific examples as well as extensions of the basic theory.			
<b>Programme module type:</b>	Compulsory for M.Math. Applied Mathematics. At least two from MT4003, MT4004, MT4509, MT4510 and MT4606 compulsory for M.Math. Mathematics. Optional for all other programmes in the School			
<b>Pre-requisite(s):</b>	MT3601	<b>Required for:</b>	MT5809	
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100% (class test = 10%, final exam = 90%)			
<b>Module Co-ordinator:</b>	Prof D G Dritschel			
<b>Lecturer(s)/Tutor(s):</b>	Prof D G Dritschel			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4510 Solar Theory			
SCOTCAT Credits:	15	SCQF Level 10	Semester: 2
Academic year:	2012/3		
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.			
Programme module type:	Compulsory for M.Math. Applied Mathematics. At least two from MT4003, MT4004, MT4509, MT4510 and MT4606 compulsory for M.Math. Mathematics. Optional for all other programmes in the School.		
Pre-requisite(s):	MT3601	Anti-requisite(s):	MT4504, MT5804
Required for:	MT5810		
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 1 tutorial.		
	Scheduled learning: 35 hours		Guided independent study: 115 hours
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	As used by St Andrews: Written Examination = 100%		
Module Co-ordinator:	Dr I De Moortel		
Lecturer(s)/Tutor(s):	Dr I De Moortel		

MT4511 Asymptotic Methods			
SCOTCAT Credits:	15	SCQF Level 10	Semester: 1
Academic year:	2012/3		
Planned timetable:	9.00 am Mon (even weeks), Tue and Thu.		
This module is designed to introduce students to asymptotic methods used in the construction of analytical approximations to integrals and solutions of differential equations.			
Programme module type:	Optional for all programmes in the School		
Pre-requisite(s):	MT3504		
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures and 1 tutorial.		
	Scheduled learning: 35 hours		Guided independent study: 115 hours
Assessment pattern:	As defined by QAA: Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	As used by St Andrews: Written Examination = 100%		
Module Co-ordinator:	Dr S King		
Lecturer(s)/Tutor(s):	Dr S King		



## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4513 Fractal Geometry				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2013/4			
<b>Planned timetable:</b>	12.00 noon Mon (even weeks), Tue and Thu.			
	The aim of this module is to introduce the mathematics used to describe and analyse fractals and to show how the theory may be applied to examples drawn from across mathematics and science. The module discusses the philosophy and scope of fractal geometry; and may include topics such as dimension, representation of fractals by iterated function systems, fractals in other areas of mathematics such as dynamical systems and number theory, Julia sets and the Mandelbrot set.			
<b>Programme module type:</b>	Optional for all programmes in the School			
<b>Pre-requisite(s):</b>	MT3501 or MT3503 or MT3504	<b>Anti-requisite(s):</b>	MT5813	
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Prof K J Falconer			
<b>Lecturer(s)/Tutor(s):</b>	Prof K J Falconer			

MT4514 Graph Theory				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	10.00 am Mon (even weeks), Tue and Thu.			
	The aim of this module is to introduce students to the study of graph theory as a tool for representing connections between data. Topics to be covered may include: basic theory and applications, Eulerian graphs, Hamiltonian graphs, planar graphs, spanning trees and applications, networks, matching problems.			
<b>Programme module type:</b>	Optional for all programmes in the School.			
<b>Pre-requisite(s):</b>	MT3501 or MT3503 or MT3504			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr C P Bleak			
<b>Lecturer(s)/Tutor(s):</b>	Dr C P Bleak			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4515 Functional Analysis				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	12.00 noon Mon (even weeks), Tue and Thu.			
This object of this module is to familiarise students with the basic notions of functional analysis, that is analysis on normed spaces and Hilbert space. The module will cover normed spaces, convergence and completeness, operators, Hilbert spaces and may include topics such as spectral theory and the Hahn-Banach theorem.				
<b>Programme module type:</b>	Optional for all programmes in the School			
<b>Pre-requisite(s):</b>	MT2002, unless waived by the module co-ordinator			
<b>Required for:</b>	MT5830			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Prof K J Falconer			
<b>Lecturer(s)/Tutor(s):</b>	Prof K J Falconer			

MT4516 Finite Mathematics				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	1
<b>Academic year:</b>	2013/4			
<b>Planned timetable:</b>	11.00 am Mon (even weeks), Tue and Thu.			
The aim of this module is to introduce students to some topics in the mathematics of combinatorial structures. This theory has wide applications, both in classical mathematics and in theoretical computer science. Topics to be covered may include: coding theory, finite geometries, Latin squares, designs.				
<b>Programme module type:</b>	Optional for all programmes in the School			
<b>Pre-requisite(s):</b>	either pre- or co-requisites - one of MT3501, MT3503, MT3504, MT3606			
<b>Co-requisite(s):</b>	either pre- or co-requisites - one of MT3501, MT3503, MT3504, MT3606	<b>Required for:</b>	MT5826	
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> 2-hour Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr C M Roney-Dougal			
<b>Lecturer(s)/Tutor(s):</b>	Dr C M Roney-Dougal			

MT4517 Rings and Fields				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	1
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	11.00 am Mon (odd weeks), Wed and Fri.			
	Historically, rings have appeared as generalisations of number systems (integers, in particular) with the intention of gaining deeper insight into number systems themselves. This will be reflected in this module, where students will study familiar concepts, such as factorisation, primeness, divisibility etc., in a new, more general, setting of commutative rings. In addition, the module may include topics from: rings of quotients, finite fields and extensions of fields.			
<b>Programme module type:</b>	Optional for all programmes in the School			
<b>Pre-requisite(s):</b>	MT3600 or (MT2002 and MT3501)			
<b>Required for:</b>	MT5823, MT5826, MT5827, MT5829			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr M Neunhoeffler			
<b>Lecturer(s)/Tutor(s):</b>	Dr M Neunhoeffler, Dr J D Mitchell			

MT4519 Number Theory				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2013/4			
<b>Planned timetable:</b>	10.00 am Mon (even weeks), Tue and Thu.			
	The aim of this module is to introduce students to some important topics in number theory. Topics to be covered may include: prime numbers, cryptography, continued fractions, Pell's equation, the Gaussian integers and writing numbers as sums of squares.			
<b>Programme module type:</b>	Optional for all programmes in the School			
<b>Pre-requisite(s):</b>	one of MT3501, MT3503, MT3504			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr C P Bleak			
<b>Lecturer(s)/Tutor(s):</b>	Dr C P Bleak			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4526 Topology			
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b> 2
<b>Academic year:</b>	2013/4		
<b>Planned timetable:</b>	12.00 noon Mon (odd weeks), Wed and Fri.		
<p>This module introduces the ideas of metric and topological spaces. A metric space is simply a set together with a 'distance' between any two points. This idea is pervasive in mathematics: from situations such as the usual distance in n-dimensional space, to the Hamming distance between words in an error-correcting code and the distance between functions approximating a given function. Metric spaces can be thought of as particular instances of topological spaces, where the fundamental concept is that of points being 'close' to each other rather than the precise distance between points. Topological spaces are a powerful generalisation of metric spaces, and have had a profound influence in the development of mathematics. Many examples of metric spaces and topological spaces will be introduced and fundamental ideas within topology will be discussed, including separation axioms, compactness and connectedness.</p>			
<b>Programme module type:</b>	Optional for all programmes in the School		
<b>Pre-requisite(s):</b>	MT2002 or MT3600 or MT4004	<b>Anti-requisite(s):</b>	MT4521
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Dr J D Mitchell		
<b>Lecturer(s)/Tutor(s):</b>	Dr J D Mitchell		

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4527 Forecasting				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	11.00 am Mon (even weeks), Tue and Thu.			
This module provides an introduction to the forecasting of time series using both 'classical' moving average and exponential smoothing techniques and the Box-Jenkins approach. The syllabus includes: forecasting using moving average and exponential smoothing methods for constant mean and trend models, Holt-Winters method for seasonal models, the ARIMA class of models, fitting and forecasting for Box-Jenkins models.				
<b>Programme module type:</b>	MT4527 or MT4608 is compulsory for M.Math. Statistics. Optional for all other programmes in the School. At least two from MT3706, MT4527, MT4608 compulsory for B.Sc. Management Science (single Honours).			
<b>Pre-requisite(s):</b>	MT2004 together with either (one of MT3501, MT3503, MT3606) or any MN3000 module.			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 0.5 tutorial.			
	<b>Scheduled learning:</b> 30 hours		<b>Guided independent study:</b> 120 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr M Papathomas			
<b>Lecturer(s)/Tutor(s):</b>	Dr M Papathomas			

MT4530 Population Genetics				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	1
<b>Academic year:</b>	2013/4			
<b>Planned timetable:</b>	9.00 am Mon (even weeks), Tue and Thu.			
This module aims to show how the frequencies of characteristics in large natural populations can be explained using mathematical models and how statistical techniques may be used to investigate model validity. The syllabus includes: Mendel's First and Second Laws, random mating and random union of gametes, Hardy-Weinberg equilibrium, linkage, inbreeding, assortative mating, X-linked loci, selection and mutation.				
<b>Programme module type:</b>	Optional for all programmes in the School			
<b>Pre-requisite(s):</b>	MT2004 and one of MT3501, MT3503, MT3504, MT3606			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 0.5 tutorial.			
	<b>Scheduled learning:</b> 30 hours		<b>Guided independent study:</b> 120 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr I B J Goudie			
<b>Lecturer(s)/Tutor(s):</b>	Dr I B J Goudie			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4531 Bayesian Inference				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	1
Academic year:	2012/3			
Planned timetable:	10.00 am Mon (even weeks), Tue and Thu.			
This module is intended to offer a re-examination of standard statistical problems from a Bayesian viewpoint and an introduction to recently developed computational Bayes methods. The syllabus includes Bayes' theorem, inference for Normal samples; univariate Normal linear regression; principles of Bayesian computational, Markov chain Monte Carlo - theory and applications.				
Programme module type:	At least two of MT4531, MT4608 and MT4609 compulsory for B.Sc. Statistics. At least two from MT3706, MT4531, MT4606 - MT4609 compulsory for B.Sc./M.A. joint Honours Statistics programmes. Optional for all other programmes in the School.			
Pre-requisite(s):	MT3606	Anti-requisite(s):	MT5831	
Learning and teaching methods and delivery:	<b>Weekly contact:</b> 2.5 lectures per week and 8 tutorials/practical classes over the semester.			
	<b>Scheduled learning:</b> 33 hours		<b>Guided independent study:</b> 117 hours	
Assessment pattern:	<b>As defined by QAA:</b> Written Examinations = 80%, Practical Examinations = 0%, Coursework = 20%			
	<b>As used by St Andrews:</b> Coursework = 20%, Written Examination = 80%			
Module Co-ordinator:	Dr R King			
Lecturer(s)/Tutor(s):	Dr R King, Dr M Papathomas			

MT4537 Spatial Processes				
SCOTCAT Credits:	15	SCQF Level 10	Semester:	2
Academic year:	2013/4			
Planned timetable:	11.00 am Mon (even weeks), Tue and Thu.			
This module will study probabilistic and inferential problems for spatial processes. It commences with a discussion on different types of spatial data. In the context of spatial point processes functional and non-functional summary characteristics for point patterns are considered. Spatial point process models, including homogeneous and inhomogeneous Poisson processes as well as Gibbs processes and Cox processes along with the approaches to parameter estimation and model evaluation, are introduced. Models in geostatistics based on empirical variograms and kriging approaches and spatial models for lattice data (CAR model, Gauss Markov random fields) are also discussed.				
Programme module type:	Optional for all programmes in the School			
Pre-requisite(s):	MT3606	Anti-requisite(s):	MT4536	
Learning and teaching methods and delivery:	<b>Weekly contact:</b> 2.5 lectures per week and 4 tutorials over the semester.			
	<b>Scheduled learning:</b> 29 hours		<b>Guided independent study:</b> 121 hours	
Assessment pattern:	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
Module Co-ordinator:	Dr J B Illian			
Lecturer(s)/Tutor(s):	Dr J B Illian			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4551 Financial Mathematics				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	10.00 am Mon (odd weeks), Wed and Fri.			
Students are introduced to the application of mathematical models to financial instruments. The course will include an overview of financial markets and the terminology in common usage but the emphasis will be on the mathematical description of risk and return as a means of pricing contracts and options.				
<b>Programme module type:</b>	Compulsory for M.Sci. Applied Quantitative Finance. Optional for all other programmes in the School of Mathematics and Statistics.			
<b>Pre-requisite(s):</b>	<a href="#">MT2001</a> , ( <a href="#">MT1007</a> or <a href="#">MT2004</a> or <a href="#">EC2003</a> ) and ( <a href="#">MT3503</a> or <a href="#">MT3504</a> )			
<b>Required for:</b>	MT5812			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 115 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr D H Mackay			
<b>Lecturer(s)/Tutor(s):</b>	Dr D H Mackay			

MT4599 Project in Mathematics / Statistics				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	Whole Year
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	none			
The student will choose a project from a list published annually although a topic outwith the list may be approved. Students will be required to report regularly to their supervisor and a report of no more than 5,000 words must be submitted by the end of the April.				
<b>Programme module type:</b>	Compulsory for B.Sc./M.A. Mathematics, B.Sc./M.A. Statistics, all B.Sc./M.A. joint Honours Mathematics programmes (including Mathematics 'with' degrees) and all B.Sc./M.A. joint Honours Statistics programmes			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> Typically and on average, 20 mins of project supervisions per week over whole year.			
	<b>Scheduled learning:</b> 8 hours		<b>Guided independent study:</b> 142 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	<b>As used by St Andrews:</b> Coursework: Project = 100%			
<b>Module Co-ordinator:</b>	Prof K J Falconer			

Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4606 Statistical Inference			
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b> 2
<b>Academic year:</b>	2013/4		
<b>Planned timetable:</b>	12.00 noon Mon (even weeks), Tue and Thu.		
<p>This module aims to show how the methods of estimation and hypothesis testing met in MT2004 and MT3606 can be justified and derived; to extend those methods to a wider variety of situations. 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.</p>			
<b>Programme module type:</b>	<p>Compulsory for B.Sc./M.A. Statistics                      At least two from MT4003, MT4004, MT4509, MT4510 and MT4606 compulsory for M.Math. Mathematics                      At least two from MT3706, MT4531, MT4606 - MT4609 compulsory for B.Sc./M.A. joint Honours Statistics programmes                      Optional for all other programmes in the School</p>		
<b>Pre-requisite(s):</b>	MT3606	<b>Anti-requisite(s):</b>	MT3701, MT5701
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 0.5 tutorial.		
	<b>Scheduled learning:</b> 30 hours	<b>Guided independent study:</b> 120 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Dr I B J Goudie		
<b>Lecturer(s)/Tutor(s):</b>	Dr I B J Goudie		



**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT4607 Generalised Linear Models and Data Analysis</b>			
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	9.00 am Mon (even weeks), Tue and Thu.		
This module aims to demonstrate the power and elegance of unifying a large number of simple statistical models within the general framework of the generalised linear model. It will train students in the interpretation, analysis and reporting of data, when a single response measurement is interpreted in terms of one or a number of other variables.			
<b>Programme module type:</b>	Compulsory for B.Sc./M.A. Statistics. At least two from MT3706, MT4531, MT4606 - MT4609 compulsory for B.Sc./M.A. joint Honours Statistics programmes. Optional for all other programmes in the School		
<b>Pre-requisite(s):</b>	MT2004 and either pre- or co-requisite MT3501	<b>Anti-requisite(s):</b>	MT5753
<b>Co-requisite(s):</b>	or pre-requisite MT3501	<b>Required for:</b>	MT5757
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures per week and 8 tutorials over the semester		
	<b>Scheduled learning:</b> 33 hours	<b>Guided independent study:</b> 117 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 80%, Practical Examinations = 0%, Coursework = 20%		
	<b>As used by St Andrews:</b> Coursework: Project = 20%, Written Examination = 80%		
<b>Module Co-ordinator:</b>	Dr A Overstall		
<b>Lecturer(s)/Tutor(s):</b>	Dr A Overstall		

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT4608 Sampling Theory			
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	10.00 am Mon (odd weeks), Wed and Fri.		
<p>The aims of this module are to introduce students to and interest them in the principles and methods of design-based inference, to convince them of the relevance and utility of the methods in a wide variety of real-world problems, and to give them experience in applying the principles and methods themselves. By the end of the module students should be able to recognise good and poor survey design and analysis, to decide upon and implement the main types of survey design in relatively straightforward settings, and analyse the resulting survey data appropriately. The syllabus includes fundamentals of design based vs model-based inference, simple random sampling, sampling with replacement, ratio and regression estimators, stratified sampling, cluster sampling and unequal probability sampling.</p>			
<b>Programme module type:</b>	<p>MT4527 or MT4608 is compulsory for M.Math. Statistics.</p> <p>At least two of MT4531, MT4608 and MT4609 are compulsory for B.Sc. Statistics.</p> <p>At least two from MT3706, MT4531, MT4606 - MT4609 are compulsory for B.Sc./M.A. joint Honours Statistics programmes.</p> <p>Optional for all other programmes in the School.</p> <p>At least two from MT3706, MT4527, MT4608 are compulsory for B.Sc. Management Science (single Honours)</p>		
<b>Pre-requisite(s):</b>	<p>MT2004 and either pre or co-requisite: One of MT3501, MT3503, MT3504, MT3606 or any 3000-level MN module</p> <p>-</p>		
<b>Co-requisite(s):</b>	<p>either pre or co-requisite: One of MT3501, MT3503, MT3504, MT3606 or any 3000-level MN module</p>		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures per week and 8 tutorials over the semester.		
	<b>Scheduled learning:</b> 33 hours	<b>Guided independent study:</b> 117 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b>		
	Written Examinations = 85%, Practical Examinations = 0%, Coursework = 15%		
<b>Assessment pattern:</b>	<b>As used by St Andrews:</b>		
	Coursework: Project = 15%, Written Examination = 85%		
<b>Module Co-ordinator:</b>	Dr J B Illian		
<b>Lecturer(s)/Tutor(s):</b>	Dr J B Illian, Dr L Thomas		

<b>MT4609 Multivariate Analysis</b>				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	10.00 am Mon (odd weeks), Wed and Fri			
This module aims to introduce students to the ideas and techniques of multivariate statistical analysis. The syllabus includes mean vectors, covariance matrices, correlation matrices; basic properties of multivariate normal distributions; checking multivariate normality; the likelihood ratio and union-intersection principles for constructing multivariate tests; the one-sample and two-sample Hotelling's T-squared tests; tests on covariance matrices, tests of independence; linear discriminant analysis; principal components analysis; canonical correlation.				
<b>Programme module type:</b>	At least two of MT4531, MT4608 and MT4609 are compulsory for B.Sc. Statistics. At least two from MT3706, MT4531, MT4606 - MT4609 are compulsory for B.Sc./M.A. joint Honours Statistics programmes. Optional for all other programmes in the School.			
<b>Pre-requisite(s):</b>	MT3606-			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 0.5 tutorial.			
	<b>Scheduled learning:</b> 30 hours		<b>Guided independent study:</b> 120 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr I B J Goudie			
<b>Lecturer(s)/Tutor(s):</b>	Dr I B J Goudie			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5611 Advanced Symbolic Computation			
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b> 2
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	9.00 am Mon (odd weeks), Wed and Fri.		
<p>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.</p>			
<b>Programme module type:</b>	<p>At least one of MT4111, MT4112 and MT5611 compulsory for M.Math. Applied Mathematics and M.Math. Pure Mathematics.</p> <p>At least one of MT3607, MT4111, MT4112 and MT5611 compulsory for M.Math. Mathematics.</p> <p>Optional for all other undergraduate programmes in the School.</p>		
<b>Pre-requisite(s):</b>	at least one MT4000-level module		
<b>Anti-requisite(s):</b>	MT4111		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 practical session.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 165 hours	
<b>Assessment pattern:</b>	<p><b>As defined by QAA:</b> Written Examinations = 55%, Practical Examinations = 0%, Coursework = 45%</p>		
	<p><b>As used by St Andrews:</b> Coursework: Project = 45%, Written Examination = 55%</p>		
<b>Module Co-ordinator:</b>	Dr J D Mitchell		
<b>Lecturer(s)/Tutor(s):</b>	Dr J D Mitchell, Dr M Neunhoeffler, Dr C M Roney-Dougal		

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT5701 Advanced Statistical Inference</b>				
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b>	2
<b>Academic year:</b>	2013/4			
<b>Planned timetable:</b>	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.			
<b>Programme module type:</b>	MT5701 or MT5831 is compulsory for M.Math. Statistics Optional for all other undergraduate programmes in the School.			
<b>Pre-requisite(s):</b>	MT3606 and any MT4000-level module,			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 0.5 tutorial.			
	<b>Scheduled learning:</b> 30 hours		<b>Guided independent study:</b> 170 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 75%, Practical Examinations = 0%, Coursework = 25%			
	<b>As used by St Andrews:</b> Coursework: Project = 25%, Written Examination = 75%			
<b>Module Co-ordinator:</b>	Dr I B J Goudie			
<b>Lecturer(s)/Tutor(s):</b>	Dr I B J Goudie			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5751 Estimating Animal Abundance				
<b>SCOTCAT Credits:</b>	10	SCQF Level 11	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	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>				
<b>Programme module type:</b>	<p>At least two of MT5751, MT5752, MT5757, MT5758 and MT5759 compulsory for M.Math. Statistics.</p> <p>At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.</p> <p>Optional module for all other undergraduate programmes in the School.</p>			
<b>Pre-requisite(s):</b>	MT3606 and any MT4000-level module-			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 7 hours of lectures and 5 hours of practical classes per week for 2 weeks.			
	<b>Scheduled learning:</b> 24 hours		<b>Guided independent study:</b> 76 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 67%, Practical Examinations = 0%, Coursework = 33%			
	<b>As used by St Andrews:</b> Coursework = 33%, Written Examination = 67%			
<b>Module Co-ordinator:</b>	Dr E Rexstad			
<b>Lecturer(s)/Tutor(s):</b>	Dr E Rexstad			

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT5753 Statistical Modelling</b>				
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b>	1
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	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>				
<b>Programme module type:</b>	<p>Compulsory module for M.Math. Statistics.                      At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.                      Optional module for all other undergraduate programmes in the School.</p>			
<b>Pre-requisite(s):</b>	at least one MT4000-level module	<b>Anti-requisite(s):</b>	MT4607	
<b>Required for:</b>	MT5755, MT5757			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 6 hours lectures, 1.5 hours tutorials and 6 hours practicals each week for 4 weeks.			
	<b>Scheduled learning:</b> 54 hours		<b>Guided independent study:</b> 146 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%			
	<b>As used by St Andrews:</b> Coursework = 50%, Written Examination = 50%			
<b>Module Co-ordinator:</b>	Dr M L MacKenzie			
<b>Lecturer(s)/Tutor(s):</b>	Dr M L MacKenzie, Miss L Scott-Hayward			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5757 Advanced Data Analysis			
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b> 2
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	10.00 am Mons (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>			
<b>Programme module type:</b>	<p>At least two of MT5751, MT5752, MT5757, MT5758 and MT5759 compulsory for M.Math. Statistics.</p> <p>At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.</p> <p>Optional for all other undergraduate programmes in the School.</p>		
<b>Pre-requisite(s):</b>	MT4607 or MT5753		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures per week and 8 tutorials over the semester.		
	<b>Scheduled learning:</b> 33 hours	<b>Guided independent study:</b> 167 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%		
	<b>As used by St Andrews:</b> Coursework = 40%, Written Examination = 60%		
<b>Module Co-ordinator:</b>	Dr D L Borchers		
<b>Lecturer(s)/Tutor(s):</b>	Dr D L Borchers, Dr M L MacKenzie		



**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT5758 Applied Multivariate Analysis</b>				
<b>SCOTCAT Credits:</b>	15	SCQF Level 11	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	12.00 noon Mon (even weeks), Tue and Thu.			
<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>				
<b>Programme module type:</b>	<p>At least two of MT5751, MT5752, MT5757, MT5758 and MT5759 compulsory for M.Math. Statistics.</p> <p>At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.</p> <p>Optional for all other undergraduate programmes in the School.</p>			
<b>Pre-requisite(s):</b>	Acceptance on to M.Math. Statistics or M.Math. Mathematics programmes, or taught postgraduate programme.			
<b>Anti-requisite(s):</b>	MT4609			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures per week, and 4 tutorials and 4 project group meetings over the semester.			
	<b>Scheduled learning:</b> 33 hours		<b>Guided independent study:</b> 117 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%			
	<b>As used by St Andrews:</b> Coursework = 50%, Written Examination = 50%			
<b>Module Co-ordinator:</b>	Dr J B Illian			
<b>Lecturer(s)/Tutor(s):</b>	Dr J B Illian			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5802 Advanced Analytical Techniques			
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b> 2
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	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.			
<b>Programme module type:</b>	<p>At least three from MT5802, MT5806, MT5809, MT5810 and MT5990 compulsory for M.Math. Applied Mathematics.</p> <p>At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.</p> <p>Optional for all other undergraduate programmes in the School.</p>		
<b>Pre-requisite(s):</b>	MT3503		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 165 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Dr C V Tran		
<b>Lecturer(s)/Tutor(s):</b>	Dr C V Tran		

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT5806 Advanced Computational Techniques</b>				
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	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.				
<b>Programme module type:</b>	At least three from MT5802, MT5806, MT5809, MT5810 and MT5990 compulsory for M.Math. Applied Mathematics. At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics. Optional for all other undergraduate programmes in the School.			
<b>Pre-requisite(s):</b>	MT3802 and MT4112			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2 lectures and a typical average of 0.5 hours of project supervisions.			
	<b>Scheduled learning:</b> 25 hours		<b>Guided independent study:</b> 175 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	<b>As used by St Andrews:</b> Coursework = 100%			
<b>Module Co-ordinator:</b>	Dr S J Brooks			
<b>Lecturer(s)/Tutor(s):</b>	Dr S J Brooks			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5809 Advanced Fluid Dynamics			
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	11.00 am Mon (odd weeks), Wed and Fri.		
<p>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.</p>			
<b>Programme module type:</b>	<p>At least three from MT5802, MT5806, MT5809, MT5810 and MT5990 compulsory for M.Math. Applied Mathematics.</p> <p>At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.</p> <p>Optional for all other undergraduate programmes in the School.</p>		
<b>Pre-requisite(s):</b>	MT4509		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 165 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Dr J N Reinaud		
<b>Lecturer(s)/Tutor(s):</b>	Dr J N Reinaud		

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT5810 Advanced Solar Theory</b>			
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	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.			
<b>Programme module type:</b>	At least three from MT5802, MT5806, MT5809, MT5810 and MT5990 compulsory for M.Math. Applied Mathematics. At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics. Optional for all other undergraduate programmes in the School.		
<b>Pre-requisite(s):</b>	MT4510	<b>Anti-requisite(s):</b>	MT5804
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 165 hours
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Prof A W Hood		
<b>Lecturer(s)/Tutor(s):</b>	Prof A W Hood		

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5812 Advanced Financial Mathematics				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	1
Academic year:	2012/3			
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 and Statistics.			
Pre-requisite(s):	MT4551			
Learning and teaching methods and delivery:	<b>Weekly contact:</b> 2 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 30 hours		<b>Guided independent study:</b> 170 hours	
Assessment pattern:	<b>As defined by QAA:</b> Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50%			
	<b>As used by St Andrews:</b> Coursework = 50%, Written Examination = 50%			
Module Co-ordinator:	Dr W R Campbell			
Lecturer(s)/Tutor(s):	Dr W R Campbell			

MT5823 Semigroups				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	2
Academic year:	2013/4			
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:	At least three from MT5823 - MT5830 and MT5990 compulsory for M.Math. Pure Mathematics At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics Optional for all other undergraduate programmes in the School			
Pre-requisite(s):	MT4003 or MT4517		Anti-requisite(s):	MT4523
Learning and teaching methods and delivery:	<b>Weekly contact:</b> 2.5 lectures, 1 tutorial and 1 examples class.			
	<b>Scheduled learning:</b> 45 hours		<b>Guided independent study:</b> 155 hours	
Assessment pattern:	<b>As defined by QAA:</b> Written Examinations = 75%, Practical Examinations = 0%, Coursework = 25%			
	<b>As used by St Andrews:</b> Coursework = 25%, Written Examination = 75%			
Module Co-ordinator:	Prof N Ruskuc			
Lecturer(s)/Tutor(s):	Prof N Ruskuc			

**Mathematics & Statistics - Honours Level 2012/13 - September 2012**

<b>MT5824 Topics in Groups</b>				
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b>	1
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	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.				
<b>Programme module type:</b>	At least three from MT5823 - MT5830 and MT5990 compulsory for M.Math. Pure Mathematics. At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics. Optional for all other undergraduate programmes in the School.			
<b>Pre-requisite(s):</b>	MT4003, unless you are on a taught postgraduate programme.			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures, 1 tutorial and 1 examples class.			
	<b>Scheduled learning:</b> 45 hours		<b>Guided independent study:</b> 155 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr C P Bleak			
<b>Lecturer(s)/Tutor(s):</b>	Dr C P Bleak			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5825 Measure and Ergodic Theory			
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b> 1
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	10.00 am Mon (even weeks), Tue and Thu.		
<p>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.</p>			
<b>Programme module type:</b>	<p>At least three from MT5823 - MT5830 and MT5990 compulsory for M.Math. Pure Mathematics.</p> <p>At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.</p> <p>Optional for all other undergraduate programmes in the School.</p>		
<b>Pre-requisite(s):</b>	MT4004, unless you are on a taught postgraduate programme		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 165 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b>		
	Written Examinations = 75%, Practical Examinations = 0%, Coursework = 25%		
<b>Assessment pattern:</b>	<b>As used by St Andrews:</b>		
	Coursework = 25%, Written Examination = 75%		
<b>Module Co-ordinator:</b>	Dr M J Todd		
<b>Lecturer(s)/Tutor(s):</b>	Dr M J Todd		



MT5826 Finite Fields				
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b>	2
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	11.00 am Mon (odd weeks), Wed and Fri.			
<p>Fields are an important part of modern algebra. Introduced as a generalisation of number systems (in particular the rational and the real numbers), fields are the setting for some of the most fascinating results in pure maths, such as the insolubility of the quintic, and ruler and compass constructions. The theory of finite fields came to prominence in the last 50 years due to its applications in combinatorics, coding theory and cryptography. This module will begin by investigating the theory of fields in general, before specialising to finite fields in particular. Applications of field theory, to topics such as geometry and finite mathematics, will also be explored.</p>				
<b>Programme module type:</b>	<p>At least three from MT5823 - MT5830 and MT5990 compulsory for M.Math. Pure Mathematics.</p> <p>At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.</p> <p>Optional for all other undergraduate programmes in the School.</p>			
<b>Pre-requisite(s):</b>	MT4516 or MT4517			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.			
	<b>Scheduled learning:</b> 35 hours		<b>Guided independent study:</b> 165 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%			
	<b>As used by St Andrews:</b> Written Examination = 100%			
<b>Module Co-ordinator:</b>	Dr M Neunhoeffler			
<b>Lecturer(s)/Tutor(s):</b>	Dr M Neunhoeffler			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5827 Lie Algebras			
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b> 2
<b>Academic year:</b>	2013/4		
<b>Planned timetable:</b>	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.			
<b>Programme module type:</b>	At least three from MT5823 - MT5830 and MT5990 compulsory for M.Math. Pure Mathematics At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics Optional for all other undergraduate programmes in the School		
<b>Pre-requisite(s):</b>	MT3501 and (MT4003 or MT4517)		
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 165 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> 2.5-hour Written Examination = 100%		
<b>Module Co-ordinator:</b>	Dr M Neunhoeffler		
<b>Lecturer(s)/Tutor(s):</b>	Dr M Neunhoeffler		

<b>MT5830 Topics in Geometry and Analysis</b>			
<b>SCOTCAT Credits:</b>	20	SCQF Level 11	<b>Semester:</b> 2
<b>Academic year:</b>	2012/3		
<b>Planned timetable:</b>	10.00 am Mon (odd weeks), Wed and Fri.		
<p>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.</p>			
<b>Programme module type:</b>	<p>At least three from MT5823 - MT5830 and MT5990 compulsory for M.Math. Pure Mathematics.</p> <p>At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics.</p> <p>Optional for all other undergraduate programmes in the School.</p>		
<b>Pre-requisite(s):</b>	MT4004 or MT4515	<b>Anti-requisite(s):</b>	MT5828
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2.5 lectures and 1 tutorial.		
	<b>Scheduled learning:</b> 35 hours	<b>Guided independent study:</b> 165 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0%		
	<b>As used by St Andrews:</b> Written Examination = 100%		
<b>Module Co-ordinator:</b>	Prof L Olsen		
<b>Lecturer(s)/Tutor(s):</b>	Prof L Olsen		

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5831 Advanced Bayesian Inference				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	1
Academic year:	2012/3			
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:	MT5701 or MT5831 is compulsory for M.Math. Statistics. Optional for all other undergraduate programmes in the School.			
Pre-requisite(s):	MT3606	Anti-requisite(s):	MT4531	
Learning and teaching methods and delivery:	Weekly contact: 2.5 lectures per week and 8 tutorials/practical classes over semester.			
	Scheduled learning: 33 hours		Guided independent study: 167 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%			
	As used by St Andrews: Coursework = 40%, Written Examination = 60%			
Module Co-ordinator:	Dr R King			
Lecturer(s)/Tutor(s):	Dr R King, Dr M Papathomas			

MT5990 Independent Study Module				
SCOTCAT Credits:	20	SCQF Level 11	Semester:	Either
Academic year:	2012/3			
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:	At least three from MT5802, MT5806, MT5809, MT5810 and MT5990 compulsory for M.Math. Applied Mathematics. At least three from MT5823 - MT5830 and MT5990 compulsory for M.Math. Pure Mathematics. At least 60 credits from MT5751 - MT5753, MT5757 - MT5759, MT5802, MT5806, MT5809, MT5810, MT5823 - MT5830 and MT5990 compulsory for M.Math. Mathematics. Optional for M.Math. Statistics and M.Phys. Mathematics and Theoretical Physics.			
Pre-requisite(s):	Permission from the Head of School			
Learning and teaching methods and delivery:	Weekly contact: Typically 1 hour project supervisions.			
	Scheduled learning: 12 hours		Guided independent study: 188 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr M R Quick			

## Mathematics & Statistics - Honours Level 2012/13 - September 2012

MT5991 Professional Skills for Mathematical Scientists				
<b>SCOTCAT Credits:</b>	30	SCQF Level 11	<b>Semester:</b>	Whole Year
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	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.				
<b>Programme module type:</b>	In exceptional circumstances and with the approval of the Head of School, optional for final year of M.Math. Programme.			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> Varies. Typically 1 project supervision per week over whole year.			
	<b>Scheduled learning:</b> 24 hours		<b>Guided independent study:</b> 276 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	<b>As used by St Andrews:</b> Coursework = 100%			
<b>Module Co-ordinator:</b>	Prof T Neukirch			

MT5999 Advanced Project in Mathematics / Statistics				
<b>SCOTCAT Credits:</b>	40	SCQF Level 11	<b>Semester:</b>	Whole Year
<b>Academic year:</b>	2012/3			
<b>Planned timetable:</b>	To be arranged.			
This is a more substantial project which, for M.Math. students, will replace the existing Honours project. The project will be chosen from an approved list of topics. The student will be required to investigate a topic in some depth, submit a report by the end of April and give a presentation.				
<b>Programme module type:</b>	Compulsory for M.Math. Applied Mathematics, M.Math. Mathematics, M.Math. Pure Mathematics and M.Math. Statistics. Either MT5999 or PH5102 is compulsory for M.Phys. Mathematics and Theoretical Physics.			
<b>Pre-requisite(s):</b>	Entry to an M.Phys. or M.Math. programme			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> Typically and on average, 40 mins of project supervisions per week over whole year			
	<b>Scheduled learning:</b> 16 hours		<b>Guided independent study:</b> 384 hours	
<b>Assessment pattern:</b>	<b>As defined by QAA:</b> Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	<b>As used by St Andrews:</b> Project = 100%			
<b>Module Co-ordinator:</b>	Prof K J Falconer			