

School of Mathematics & Statistics

Important Degree Information:

B.Sc./M.A. Honours

The general requirements are 480 credits over a period of normally 4 years (and not more than 5 years) or part-time equivalent; the final two years being an approved Honours programme of 240 credits, of which 90 credits are at 4000 level and at least a further 120 credits at 3000 and/or 4000 (H) levels. Refer to the appropriate Faculty regulations for lists of subjects recognised as qualifying towards either a B.Sc. or M.A. degree.

B.Sc./M.A. Honours with Integrated Year Abroad

The general requirements are 540 credits over a period of normally 5 years (and not more than 6 years) or part-time equivalent; the final three years being an approved Honours programme of 300 credits, of which 60 credits are gained during the integrated year abroad, 90 credits are at 4000 level and at least a further 120 credits at 3000 and/or 4000 (H) levels. Refer to the appropriate Faculty regulations for lists of subjects recognised as qualifying towards either a B.Sc. or M.A. degree.

M.Math. Honours

General requirements are 600 credits over a period of normally 5 years or 4 years with Advanced Standing (and in no circumstances more than 6 years) or part-time equivalent; an approved Honours programme of at least 330 credits of which 120 credits are at 5000 level and at least a further 210 are at 3000 level and above.

Other Information: In the case of students who spend part of the BSc/MA Honours programme abroad on a recognised Exchange Scheme, the Programme Requirements will be amended to take into account courses taken while abroad.

Degree Programmes	Programme Requirements at:
(M.Math. Honours): Applied Mathematics	<p>Single Honours M.Math. Applied Mathematics Degree:</p> <p>Level 1: At least 20 credits comprising MT1002</p> <p>Level 2: At least 60 credits comprising at least grade 15 in MT2001 and MT2003</p> <p>Level 3: At least 60 credits comprising MT3501, MT3503, MT3504, MT3601</p> <p>Level 4: At least 45 credits comprising MT4005, MT4509 and MT4510. In addition at least one of MT4111, MT4112, MT5611 and MT5612</p> <p>Level 5: At least 120 credits overall which must include MT5999 and at least 60 credits from MT5802, MT5806, MT5809, MT5810, MT5990</p>

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Degree Programmes	Programme Requirements at:
<p>(M.Chem. Honours): Chemistry with Mathematics (M. Chem.) 5 years</p>	<p>Chemistry with Mathematics (M.Chem. Honours) (5 year degree) : Level 1: 60 credits comprising passes in CH1401, CH1402 and CH1601 and 20 credits from MT1002</p> <p>Level 2: 60 credits comprising passes at 15 or better in CH2501, CH2701, MT2001 and either (MT2002 or MT2003).</p> <p>Level 3: 125 credits comprising CH3441, and 60 credits from (CH3431, CH3511, CH3512, CH3521, CH3615, CH3621, CH3712, CH3715, CH3717, CH3721), two of (MT3501, MT3503, MT3504), MT3600 or MT3601)</p> <p>Level 4: 115 credits comprising CH4442, 3 of (CH4511, CH4513, CH4611, CH4612, CH4613, CH4711, CH4712, CH4713) and 3 further 3000- or 4000-level MT modules.</p> <p>Level 5: 120 credits comprising CH5441, CH5461, CH5711, CH5712, CH5713, CH5714, 3 from (CH5511, CH5513-5, CH5611-6, CH5717-8).</p> <p>Other Information: This course is recognised by the Royal Society of Chemistry (RSC) for professional membership.</p>
<p>(M.Math. Honours): Mathematics</p>	<p>Single Honours M.Math Mathematics Degree: Level 1: At least 20 credits including MT1002. In addition credit in one of MT1007, MT1008, MT2004 must normally be gained at some stage.</p> <p>Level 2: At least 90 credits including MT2001 (at grade 15 or better), and two of MT2002, MT2003, MT2004 and MT2005 (with one at grade 15, or better, and another at grade 11 or better)</p> <p>Level 3: At least 60 credits including MT3501, MT3503, MT3504 and at least one of MT3600, MT3601 and MT3606</p> <p>Level 4: At least 30 credits including at least 2 of MT4003, MT4004, MT4509, MT4510, MT4606.</p> <p>Level 5: At least 120 credits overall which must include MT5999 and at least 60 credits from MT5751-MT5753, MT5757-MT5759, MT5802, MT5806, MT5809, MT5810, MT5823-MT5830, MT5990.</p> <p>In addition at least one of MT3607, MT4111, MT4112, MT5611 and MT5612.</p>
<p>(M.Math. Honours): Pure Mathematics</p>	<p>Single Honours M.Math Pure Mathematics Degree: Level 1: At least 20 credits including MT1002</p> <p>Level 2: At least 60 credits including a pass at 15 or better in MT2001 and MT2002</p> <p>Level 3: At least 60 credits including MT3501, MT3503, MT3504 and MT3600</p> <p>Level 4: At least 30 credits including MT4003 and MT4004. In addition at least one of MT4111, MT4112, MT5611 and MT5612.</p> <p>Level 5: At least 120 credits overall which must include MT5999 and at least 60 credits from MT5823- MT5830,, MT5990</p>

Degree Programmes	Programme Requirements at:
<p>(M.Math. Honours): Statistics</p>	<p>Single Honours Statistics M.Math. Degree: Level 1: At least 20 credits including MT1002 Level 2: At least 60 credits including a pass at 15 or better in MT2001 and MT2004 Level 3: At least 45 credits including MT3501, MT3606 and MT3607 Level 4 & Level 5: The programme must include:</p> <ul style="list-style-type: none"> - at least one of MT4527 and MT4608; - at least one of MT5701 and MT5831; - at least two of MT5751, MT5752, MT5757, MT5758, MT5759; - MT5753; - A project MT5999 on a statistical topic; - At least 120 credits at level 5.
<p>(B.Sc. Honours or M.A. Honours): Mathematics</p>	<p>Single Honours Mathematics Degrees: Level 1: At least 20 credits comprising MT1002 In addition credit in one of MT1007, MT1008 or MT2004 must normally be gained at some stage. Level 2: At least 60 credits comprising passes at 11, or better, in MT2001 and at least one of MT2002, MT2003, MT2004 and MT2005 Level 3 and 4:</p> <ul style="list-style-type: none"> - 45 credits comprising MT3501, MT3503 and MT3504; - at least one of MT3600, MT3601 and MT3606 - MT4599; - at least one of MT3607, MT4111, MT4112.
<p>(B.Sc. Honours): Mathematics and one of: Biology, Chemistry, Computer Science, Economics, Geography, Internet Computer Science^N, Logic & Philosophy of Science, Management Science, Physics, Psychology.</p> <p>^N Not available to entrants from 2011-12</p> <p>(M.A. Honours): Mathematics and one of: Ancient History, Arabic^W, Art History, Biblical Studies, Classical Studies, Economics, Hebrew, International Relations, Italian^W, Latin, Mediaeval History, Modern History, Philosophy, Psychology, Russian^W, Scottish History, Spanish^W, Theological Studies.</p> <p>^W available also as 'With Integrated Year Abroad Degrees'</p>	<p>Mathematics element of Joint Honours Degrees: Level 1: 20 credits comprising MT1002 Level 2: 60 credits comprising passes at 11 or better in MT2001 and one of MT2002 or MT2003 Level 3 and level 4: Normally a total of 120 credits which must include:</p> <ul style="list-style-type: none"> - at least two of MT3501, MT3503 and MT3504; - at least one of MT3600 and MT3601; - at least one of MT4111, MT4112; - MT4599. <p>Note The total number of MT 3000-level and 4000-level credits may be reduced to no less than 90 with the permission of the Director of Teaching.</p> <p>Other Information: In total (between the two Schools) 240 credits are normally required at Level 3 and Level 4 of which at least 90 credits must be achieved at Level 4.</p>

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Degree Programmes	Programme Requirements at:
<p>(B.Sc. Honours): Mathematics with one of: French^{W N}, German^{W N}</p> <p>^N Not available to entrants from 2008-09</p> <p>(M.A. Honours) Mathematics with one of: Russian^W or Spanish^W</p> <p>^W available also as 'With Integrated Year Abroad Degrees'</p>	<p>Mathematics major element of B.Sc. or M.A. Honours Degree with a Modern Language: Level 1: 20 credits comprising MT1002 Level 2: 60 credits comprising passes at 11, or better, in MT2001 and one of MT2002 or MT2003 Level 3 and level 4: Normally a total of 180 credits which must include:-</p> <ul style="list-style-type: none"> - at least two of MT3501, MT3503, MT3504; - at least one of MT3600 and MT3601; - at least one of MT4111, MT4112; - MT4599. <p>Other Information: In total (between the two Schools) 240 credits are normally required at Level 3 and Level 4 of which at least 90 credits must be achieved at Level 4.</p>
<p>(B.Sc. Honours): Mathematics with Geography</p>	<p>Mathematics major element of B.Sc. Honours Degree with Geography: Level 1: 20 credits comprising MT1002 Level 2: 60 credits comprising passes at 11, or better, in MT2001 and one of MT2002 or MT2003 Level 3 and level 4: Normally a total of 180 credits which must include:-</p> <ul style="list-style-type: none"> - at least two of MT3501, MT3503, MT3504; - at least one of MT3600 and MT3601; - at least one of MT4111, MT4112; - MT4599. <p>Other Information: In total (between the two Schools) 240 credits are normally required at Level 3 and Level 4 of which at least 90 credits must be achieved at Level 4.</p>
<p>(M.Phys. Honours): Mathematics and Theoretical Physics</p>	<p>Mathematics element of Joint M.Phys. Honours Degree: Level 1: 20 credits comprising MT1002 Level 2: 60 credits comprising MT2001, at grade 15 or better, and one of MT2002 or MT2003 (Direct entry students to this programme who take MT1002 and MT2001 in their first year of study should normally take one of MT2002 and MT2003 in their second year of study.) Level 3: 30 credits comprising MT3501 and MT3504 Level 4: At least 45 credits comprising at least three 4000-level MT modules. Level 5: A project (either MT5999 or PH5102) together with a further 40 credits in 5000-level MT modules. Note Normally the Honours programme will comprise either 180 credits in MT modules at 3000 level and above, or 150 credits in MT modules at 3000 level and above together with a 30 credit MT module at 2000 level.</p>

Degree Programmes	Programme Requirements at:
(B.Sc. or M.A. Honours): Statistics	Single Honours Statistics Degrees: Level 1: At least 20 credits including MT1002 Level 2: At least 60 credits including passes at 11, or better, in MT2001 and MT2004 Level 3 and level 4: <ul style="list-style-type: none"> - MT3501 - MT3606 - At least one of MT3607, MT4111, MT4112 - MT4606 - MT4607 - At least two of MT4531, MT4608, MT4609 - MT4599
(B.Sc. Honours): Statistics and one of: Biology, Computer Science, Economics, Geography, Internet Computer Science^N, Logic & Philosophy of Science, Management Science. ^N Not available to entrants from 2011-12 (M.A. Honours): Statistics and one of: Economics, Philosophy	Statistics element of Joint Honours Degrees: Level 1: At least 20 credits including MT1002 Level 2: At least 60 credits comprising passes at 11, or better, in MT2001 and MT2004 Level 3 and level 4: Normally 120 credits which must include <ul style="list-style-type: none"> - 30 credits comprising MT3501, MT3606; - at least two from MT3706, MT4531, MT4606 - MT4609; - MT4599. Other Information: In total (between the two Schools) 240 credits are normally required at Level 3 and Level 4 of which at least 90 credits must be achieved at Level 4.

Students still completing degree programmes as defined in previous Course Catalogues should discuss their module selections with their Honours Adviser(s).

Modules

Normally the prerequisite 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 prerequisite(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 prerequisite for each of the following 5000-level modules is entry to the MPhys or MMath Programme(s) for which they are specified, as well as any additional specific prerequisite(s) given.

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InterDisciplinary (ID) Modules

There is a module to which this School contributes – **ID4001 Communications and Teaching in Science** which also appears in the InterDisciplinary Section of the Catalogue (Section 23)

ID4001 Communication and Teaching in Science

Credits: 15 Semester: 1
Availability: Available only to final year students who have been accepted following application and interview in the preceding semester.

Description: This module is based on the Undergraduate Ambassador Scheme launched in 2002. It provides final year students within the Faculty of Science with the opportunity to gain first hand experience of science education through a mentoring scheme with science teachers in local schools. Students will act initially as observers in the classroom and later as classroom assistants. With permission of the teacher-in-charge, students may also be given the opportunity to lead at least one lesson, or activity within a lesson, during their placement. This module will enable students to gain substantial experience of working in a challenging and unpredictable working environment, and of communicating scientific ideas at various different levels; and to gain a broad understanding of many of the key aspects of teaching science in schools. While of particular value to students aiming for a career in education, these core skills are equally important for any career that requires good communication. Entry to this module is by selection following application and interview during the preceding semester.

Class Hour: Flexible
Teaching: Occasional tutorials and a half-day training session.
Assessment: Continuous Assessment = 100%

Mathematics & Statistics (MT) Modules

MT3501 Linear Mathematics

Credits: 15 Semester: 1
Prerequisite: MT2001
Description: 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.
Class Hour: 12.00 noon
Teaching: 2 lectures and 1 tutorial.
Assessment: Continuous Assessment = 10%, 2-hour Examination = 90%

MT3503 Complex Analysis

Credits: 15 Semester: 1
Prerequisite: MT2001
Description: 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; Rouche's Theorem.
Class Hour: 12.00 noon
Teaching: 2 lectures and 1 tutorial.
Assessment: Continuous Assessment = 10%, 2-hour Examination = 90%

MT3504 Differential Equations

Credits: 15 Semester: 1

Prerequisite: MT2001

Description: 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.

Class Hour: 9.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: Continuous Assessment = 10%, 2-hour Examination = 90%

MT3600 Fundamentals of Pure Mathematics

Credits: 15 Semester: 1

Prerequisite: MT2002 or (MT2001 and MT1003)

Description: The aim of this module is to introduce the fundamental algebraic and analytic concepts in pure mathematics in the context of the number systems.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT3601 Fundamentals of Applied Mathematics

Credits: 15 Semester: 1

Prerequisites: MT2001 and MT2003

Anti-requisite: MT4601

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT3606 Fundamentals of Statistics

Credits: 15 Semester: 1

Prerequisite: MT2004

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: Continuous Assessment = 10%, 2-hour Examination = 90%

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MT3607 Computing in Statistics

Credits: 15 Semester: 2
Co-(Pre)requisite: MT2004

Description: 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 organize electronically stored data, (2) search for patterns and meaningful relationships, (3) fit mathematical models to characterize relationships succinctly, (4) produce useful graphical and numerical summaries.

Class Hour: 9.00 am
Teaching: 2 lectures and 1 practical class.
Assessment: Continuous Assessment = 100%

MT3706 Markov Chains and Processes

Credits: 15 Semester: 1
Availability: 2011-12
Prerequisites: MT2004

Description: 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.

Class Hour: 11.00 am
Teaching: 2 lectures and 1 tutorial.
Assessment: 2-hour Examination = 100%

MT3802 Numerical Analysis

Credits: 15 Semester: 1
Prerequisites: MT2001
Anti-requisite: MT4502

Description: 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.

Class Hours: 11.00 am
Teaching: 2 lectures and 1 tutorial.
Assessment: Continuous Assessment = 20%, 2-hour Examination = 80%

MT3832 Mathematical Programming

Credits: 15 Semester: 2
Availability: 2011-12
Prerequisites: MT2001 (or MT1002 and MN2002)
Anti-requisite: MT4532

Description: 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.

Class Hour: 12.00 noon
Teaching: 2 lectures and 1 tutorial.
Assessment: 2-hour Examination = 100%

MT3833 Utilities, Decisions & Inventories

Credits: 15 Semester: 2

Availability: 2012-13

Prerequisite: MT2004 or (MT2001 and MT1007)

Anti-requisite: MT4533

Description: 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.

Class Hour: 12.00 noon

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4003 Groups

Credits: 15 Semester: 2

Prerequisite: MT3600 or (MT2002 and MT3501)

Anti-requisites: MT3603, MT4603

Description: 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.

Class Hour: 9.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4004 Real & Abstract Analysis

Credits: 15 Semester: 2

Prerequisite: MT2002 or with the approval of the module coordinator

Anti-requisites: MT3604, MT4604

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

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MT4005 Linear & Nonlinear Waves

Credits: 15 Semester: 1

Prerequisites: MT2003 and (MT3503 or MT3504)

Anti-requisites: MT3605, MT4605

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4111 Symbolic Computation

Credits: 15 Semester: 2

Availability: 2012-13

Prerequisite: MT3501 or MT3503 or MT3504

Anti-requisite: MT3611, MT5611

Description: 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.

Class Hour: 9.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: Continuous Assessment = 30%, 2-hour Examination = 70%

MT4112 Computing in Mathematics

Credits: 15 Semester: 1

Availability: 2011-12

Co-(Pre)requisites: MT3501, MT3503 or MT3504

Anti-requisites: MT3612, MT5612, Honours or Joint Honours Programme in Computer Science.

Description: 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.

Class Hour: 9.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: Project = 30%, 2-hour Examination = 70%

MT4501 Topics in the History of Mathematics

Credits: 15 Semester: 1

Availability: 2011-12

Pre (co)requisite: one of MT3501, MT3503, MT3504, MT3606

Anti-requisite: MT3801, MT5613

Description: 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.

Class Hour: 12.00 noon

Teaching: 2 lectures and 1 tutorial.

Assessment: Continuous Assessment: Project = 50%, 2 Class Tests = 50%

MT4507 Classical Mechanics

Credits: 15 Semester: 2

Availability: 2012-13

Prerequisite: MT2003 and (MT3503 or MT3504)

Anti-requisite: MT3807

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4508 Dynamical Systems

Credits: 15 Semester: 2

Availability: 2011-12

Prerequisite: MT3504

Anti-requisite: MT3808

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4509 Fluid Dynamics

Credits: 15 Semester: 2

Prerequisite: MT3601 (or MT4601)

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 50-minute Class Test in Week 5 = 10%, 2-hour Examination = 90%

MT4510 Solar Theory

Credits: 15 Semester: 2

Prerequisite: MT3601

Anti-requisites: MT4504, MT5804

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

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MT4511 Asymptotic Methods

Credits: 15 Semester: 1
Availability: 2012-13
Prerequisite: MT3504
Anti-requisite: MT3811
Description: This module is designed to introduce students to asymptotic methods used in the construction of analytical approximations to integrals and solutions of differential equations.
Class Hour: 9.00 am
Teaching: 2 lectures and 1 tutorial.
Assessment: 2-hour Examination = 100%

MT4513 Fractal Geometry

Credits: 15 Semester: 2
Availability: 2011-12
Prerequisite: MT3501 or MT3503 or MT3504
Anti-requisite: MT3813, MT5813
Description: 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.
Class Hour: 12.00 noon
Teaching: 2 lectures and 1 tutorial.
Assessment: 2-hour Examination = 100%

MT4514 Graph Theory

Credits: 15 Semester: 2
Availability: 2012-13
Prerequisite: MT3501 or MT3503 or MT3504
Anti-requisite: MT3814
Description: 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.
Class Hour: 10.00 am
Teaching: 2 lectures and 1 tutorial.
Assessment: 2-hour Examination = 100%

MT4515 Functional Analysis

Credits: 15 Semester: 2
Availability: 2012-13
Prerequisite: MT2002 or with the approval of the module coordinator
Anti-requisite: MT3815
Description: 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.
Class Hour: 12.00 noon
Teaching: 2 lectures and 1 tutorial.
Assessment: 2-hour Examination = 100%

MT4516 Finite Mathematics

Credits: 15 Semester: 1

Availability: 2011-12

Pre(co)requisites: one of MT3501, MT3503, MT3504, MT3606

Anti-requisite: MT3816

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4517 Rings & Fields

Credits: 15 Semester: 1

Availability: 2012-13

Prerequisite: MT3600 or (MT2002 and MT3501)

Anti-requisite: MT3817

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4519 Number Theory

Credits: 15 Semester: 2

Availability: 2011-12

Prerequisite: one of MT3501, MT3503, MT3504

Anti-requisite: MT3819

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

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MT4526 Topology

Credits: 15 Semester: 2

Availability: 2011-12

Prerequisites: MT2002 or MT3600 or MT4004

Anti-requisite: MT4521

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4527 Forecasting

Credits: 15 Semester: 1

Availability: 2012-13

Prerequisites: MT2004 together with either (one of MT3501, MT3503, MT3606) or any MN3000 module.

Anti-requisite: MT3827

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4530 Population Genetics

Credits: 15 Semester: 1

Availability: 2011-12

Prerequisites: MT2004 and one of MT3501, MT3503, MT3504, MT3606

Anti-requisite: MT3830

Description: 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.

Class Hour: 9.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

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MT4531 Bayesian Inference

Credits: 15 Semester: 2

Availability: 2011-12

Prerequisite: MT3606

Anti-requisite: MT3831, MT5831

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial and practical classes.

Assessment: Continuous Assessment = 20%, 2-hour Examination = 80%

MT4537 Spatial Processes

Credits: 15 Semester: 2

Availability: 2011-12

Prerequisite: MT3606

Anti-requisite: MT4536

Description: 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.

Class Hour: 11.00 am Tuesdays, Thursdays and even Mondays

Teaching: 5 lectures, 1 practical class and 1 tutorial per fortnight.

Assessment: 2-hour Examination = 100%

MT4551 Financial Mathematics

Credits: 15 Semester: 2

Prerequisites: MT2001 and (MT3503 or MT3504)

Anti-requisite: MT3851

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4599 Project in Mathematics/Statistics

Credits: 15 Semester: Whole Year

Anti-requisite: MT3999

Description: 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.

Assessment: Project = 100%

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MT4606 Statistical Inference

Credits: 15 Semester: 2

Availability: 2011-12

Prerequisites: MT3606

Anti-requisite: MT3701, MT5701

Description: 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 Cramér-Rao lower bound; maximum likelihood estimation; hypothesis-testing; confidence sets.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2-hour Examination = 100%

MT4607 Generalized Linear Models & Data Analysis

Credits: 15 Semester: 1

Availability: 2012-13

Prerequisite: MT2004

Anti-requisite: MT5753

Co-(or pre-)requisite: MT3501

Description: This module aims to demonstrate the power and elegance of unifying a large number of simple statistical models within the general framework of the generalized 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.

Class Hour: 9.00 am

Teaching: 2 lectures and 1 tutorial and practical classes.

Assessment: Project = 20%, 2-hour Examination = 80%

MT4608 Sampling Theory

Credits: 15 Semester: 1

Availability: 2012-13

Prerequisite: MT2004

Anti-requisite: MT3704

Co-(or pre-)requisite: one of MT3501, MT3503, MT3504, MT3606 or any 3000-level MN module

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures, 1 tutorial and practical classes.

Assessment: Project = 15%, 2-hour Examination = 85%

MT4609 Multivariate Analysis

Credits: 15 Semester: 2

Availability: 2012-13

Prerequisite: MT3606

Anti-requisite: MT3705, MT5705

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures, 1 tutorial and practical classes.

Assessment: 2-hour Examination = 100%

MT4613 Statistical Research in Practice

Credits: 15 Semester: Whole Year

Availability: 2012-13

Prerequisite: MT2004

Co-requisite: MT3606

Description: Many university statistics courses provide students with a set of tools and skills for solving well-formulated statistical problems but give them limited practice in solving unformulated real-world problems.

This module aims to develop students' ability and to solve real-world statistical problems and at the same time expose them to, and interest them in some of the real-world statistical problems currently being addressed within the Statistics Division. This will be achieved by considering a series of case-studies selected from current applied statistics problems in the Division and by using real data in at least some of these. Each case-study will present a real-world scenario and problem description together with relevant background material. With guidance from lecturers, students will work through the problems, from problem formulation, through solution for the formulated problem, to interpretation and presentation of the solution.

Class Hour: 10.00 am

Teaching: 1 lecture and 1 practical class.

Assessment: Continuous Assessment = 100%

MT5611 Advanced Symbolic Computation

Credits: 20 Semester: 2

Availability: 2012-13

Prerequisite: at least one MT4000-level module

Anti-requisite: MT4111

Description: 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.

Class Hour: 9.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: Project = 45%, 2-hour Examination = 55%

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MT5701 Advanced Statistical Inference

Credits: 20 Semester: 2
Availability: 2011-12
Prerequisites: MT3606 and any MT4000-level module
Anti-requisite: MT4606

Description: 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 Cramér-Rao lower bound; maximum likelihood estimation; hypothesis-testing; confidence sets.

Class Hour: 10.00 am
Teaching: 2 lectures and 1 tutorial.
Assessment: Project = 25%, 2-hour Examination = 75%

MT5751 Estimating Animal Abundance

Credits: 10 Semester: 2 (2 weeks)
Prerequisites: MT3606 and any MT4000-level module
Antirequisite: MT4535, MT5835

Description: 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.

Class Hour: 2.00 pm
Teaching: 4 lectures, 1 tutorial and 2 practical classes each week for 2 weeks.
Assessment: Continuous Assessment = 33%, 2-hour Examination = 67%

MT5752 Modelling Ecological Dynamics

Credits: 20 Semester: 2 (4 weeks)
Prerequisites: at least one MT4000-level module
Anti-requisites: MT4534, MT5834

Description: This module is designed to provide practical training in the construction and use of mathematical models of ecological dynamic systems. The module will start by covering basic dynamical concepts and mathematical tools, and will then cover modelling of individuals, single species populations, interacting populations and ecosystems. At all stages students will be expected to build and analyse models, with a combination of pencil and paper and computer software.

Class Hour: 2.00 pm
Teaching: 4 lectures, 1 tutorial and 3 practicals each week for 4 weeks.
Assessment: Continuous Assessment = 33%, 2-hour Examination = 67%

MT5753 Statistical Modelling

Credits: 20 Semester: 1 (4 weeks)
Prerequisites: at least one MT4000-level module
Anti-requisite: MT4607

Description: This course will introduce the main ideas of linear and generalised linear statistical modelling and will provide training in applied statistical modelling. The course 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; generalized 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.

Class Hour: 2.00 pm
Teaching: 4 lectures, 1 tutorial and 3 practicals each week for 4 weeks.
Assessment: Continuous Assessment = 50%, 2-hour Examination = 50%

MT5757 Advanced Data Analysis

Credits: 20 Semester: 1 (4 weeks)

Prerequisites: MT4607 or MT5753

Description: This module covers modern modeling methods for situations where the data fails to meet the assumptions of common statistical models and simple remedies do not suffice. The represents a lot of real world data. Methods covered include: nonlinear models; basic splines & Generalized Additive Models; Ridge Regression and Principal Components Regression; models for non-independent errors. 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 and SPSS.

Class Hour: 2.00 pm

Teaching: Lectures, tutorials and practicals.

Assessment: Continuous Assessment = 40%, 2-hour Examination = 60%

MT5758 Applied Multivariate Analysis

Credits: 15 Semester: 2

Anti-requisites: MT4609, MT5705

Prerequisites: Acceptance on to MMath Statistics or MMath Mathematics programmes.

Description: 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.

Class Hour: 10.00 am

Teaching: Lectures, tutorials and practicals.

Assessment: Continuous Assessment = 60%, 2-hour Examination = 40%

MT5759 Knowledge Discovery and Datamining

Credits: 15 Semester: 2

Prerequisites: Acceptance on to MMath Statistics or MMath Mathematics programmes.

Description: Contemporary data collection can be automated and on a massive scale e.g. credit card transaction databases. Large databases potentially carry a wealth of important information that could inform business strategy, identify criminal activities, characterize network faults etc. These large scale problems may preclude the standard carefully constructed statistical models, necessitating highly automated approaches.

This module covers many of the methods found under the banner of "Datamining", building from a theoretical perspective but ultimately teaching practical application. Topics covered include: historical/philosophical perspectives, model selection algorithms & optimality measures, tree methods, bagging and boosting, neural nets, and classification in general. Practical applications build sought-after skills in the commercial packages SAS and SPSS.

Class Hour: 11.00 am

Teaching: Lectures, tutorials and practicals.

Assessment: Continuous Assessment = 60%, 2-hour Examination = 40%

MT5802 Advanced Analytical Techniques

Credits: 20 Semester: 2

Prerequisite: MT3503

Description: 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.

Class Hour: 12.00 noon

Teaching: 2 lectures and 1 tutorial.

Assessment: 2.5-hour Examination = 100%

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MT5806 Advanced Computational Techniques

Credits: 20 Semester: 2
Prerequisite: MT3802 and MT4112
Anti-requisite: MT4506

Description: This module introduces students to some of the ideas, techniques and constraints that underpin modern approaches to the numerical modelling of physical processes that may be described by partial differential equations. Students will gain expertise in implementing standard methods and will submit a short dissertation together with a portfolio of computational work.

Class Hour: 12.00 noon
Teaching: 2 lectures and 1 tutorial.
Assessment: Continuous Assessment = 100%

MT5809 Advanced Fluid Dynamics

Credits: 20 Semester: 1
Prerequisite: MT4509

Description: 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.

Class Hour: 11.00 am
Teaching: 2 lectures and 1 tutorial.
Assessment: 2.5-hour Examination = 100%

MT5810 Advanced Solar Theory

Credits: 20 Semester: 1
Prerequisite: MT4510
Anti-requisites: MT4504, MT5804

Description: 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.

Class Hour: 12.00 noon
Teaching: 2 lectures and 1 tutorial.
Assessment: 2.5-hour Examination = 100%

MT5812 Global Capital Markets - Structured Derivatives, Analytics and Applications

Credits: 20 Semester: 2
Prerequisite: MT4551
Co-requisite: EC5705

Description: The Global Capital Markets divisions of Investment Banks are now a significant employer of highly numerate graduates who have a rigorous training in both Economics and Mathematics. This module will provide a practical introduction to the theory and applications of the various different types of structured derivatives that currently exist across all the asset classes that constitute Capital Markets. Detailed examples of both the applications as well as the dynamics, valuation and risk-management of 'vanilla' and 'exotic' Interest Rate, Equity, Credit, FX and Commodity structured derivatives will be discussed and analysed.

The focus will be practical and there will be a bias towards developing a strong intuition through discussing and analyzing such questions as 'Why do structured derivatives exist?', 'Who are the participants (e.g. Asset Managers, Pension Funds, Hedge Funds, etc) in this market?', 'How are these structured derivatives valued, risk-managed and traded?', 'What type of models are used in their valuation?', 'What assumptions underlie the models and when do the assumptions break down?' to finally 'How do Banks make money from structured derivatives?' and 'How are the models actually used on the trading desks of Investment Banks?'

Class Hour: 12.00 noon
Teaching: 2 lectures and 1 tutorial.
Assessment: Continuous Assessment = 60%, 2-hour Examination = 40%

MT5823 Semigroups

Credits: 20 Semester: 2

Availability: 2011-12

Prerequisites: MT4003 (or MT4603) or MT4517

Anti-requisite: MT4523

Description: 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.

Class Hour: 9.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: Continuous Assessment = 25%, 2-hour Examination = 75%

MT5824 Topics in Groups

Credits: 20 Semester: 1

Prerequisite: MT4003 (or MT4603)

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2.5-hour Examination = 100%

MT5825 Measure & Ergodic Theory

Credits: 20 Semester: 1

Prerequisite: MT4004 (or MT4604)

Anti-requisite: MT4525

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: Project = 25%, 2-hour Examination = 75%

MT5826 Finite Fields

Credits: 20 Semester: 2

Availability: 2011-12

Prerequisite: MT4516 or MT4517

Description: 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 specializing to finite fields in particular. Applications of field theory, to topics such as geometry and finite mathematics, will also be explored.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2.5-hour Examination = 100%

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MT5827 Lie Algebras

Credits: 20 Semester: 2

Availability: 2013-14

Prerequisite: MT3501 and (MT4003/MT4603 or MT4517)

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2.5-hour Examination = 100%

MT5829 Group Rings

Credits: 20 Semester: 2

Availability: Not available 2011-12

Prerequisite: MT2002 and at least one of (MT4003 and MT4517)

Description: Group rings were introduced as a tool in the representation theory of groups, and then they became objects of independent study. A group ring combines a group and a ring, so it is natural to ask how the properties of the ring and the group determine the properties of the group ring, and vice versa. The main directions of current researches in group ring theory are their ring and Lie properties, the structure of the unit group and the isomorphism problem. After a revision of necessary facts from group theory and ring theory, we will give classical results in each of these four areas; we will also point out some very recent results and open questions.

Class Hour: 2.00 pm

Teaching: 2 or 3 lectures and 1 tutorial.

Assessment: 2.5-hour Examination = 100%

MT5830 Topics in Geometry & Analysis

Credits: 20 Semester: 2

Availability: 2012-13

Prerequisite: MT4004 or MT4515

Anti-requisite: MT5828

Description: 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.

Class Hour: 10.00 am

Teaching: 2 lectures and 1 tutorial.

Assessment: 2.5-hour Examination = 100%

MT5831 Advanced Bayesian Inference

Credits: 20 Semester: 2

Availability: 2011-12

Prerequisite: MT3606

Anti-requisite: MT4531

Description: 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.

Class Hour: 11.00 am

Teaching: 2 lectures and 1 tutorial and practical classes.

Assessment: Project = 40%, 2-hour Examination = 60%

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MT5990 Independent Study module

Credits: 20 Semester: Either

Prerequisite: Permission of the Head of School

Description: 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.

Assessment: 2.5-hour Examination = 100%

MT5991 Professional Skills for Mathematical Scientists

Credits: 30 Semester: Whole Year

Programme(s): M.Sc. in Mathematics or, exceptionally, final year of M.Math. programme with the approval of the Head of School.

Description: 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.

Class Hour: To be arranged.

Teaching: Lectures, tutorials and practical classes.

Assessment: Continuous Assessment = 100%

MT5999 Advanced Project in Mathematics/Statistics

Credits: 40 Semester: Whole Year

Prerequisite: Entry to an M.Phys. or M.Math. programme

Description: 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.

Assessment: Project = 100%

