SCHOOL of ENGINEERING

PHYSICS & MATHEMATICS

Undergraduate Degree Programmes in Mathematics

Session 2014-2015

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FOREWORD

I would like to extend a very warm welcome to you as a student on a degree programme in Mathematics at the University of Dundee.

The Mathematics Division is located in the Fulton Building. You will find us to be a small and friendly Division, and we hope that you should soon find your way about and get to know us.

The Handbook is intended for all students who intend to complete a degree that involves Mathematics. The objective of this document is to give you some basic information about the Mathematics Division and how it operates. In addition to the material contained in this booklet, you can find a lot of extra information, including detailed syllabuses of modules, starting from

http://www.maths.dundee.ac.uk

and linking to “Information for Current Students”. You will also be given information by your Adviser, and then by your lecturers. Do not worry if you feel a little overwhelmed with information overload – you will get necessary information again, mostly as and when you need it! I suggest that for now you browse through this booklet, note a few things that seem to you to be important, and then put it aside for future reference.

I hope that you will enjoy your time studying here with us, and if you need any advice or help, and you think it appropriate to approach me, please do not hesitate to do so.

Dr Dyce Davidson, Head of Division

1 ORGANISATION OF THE DIVISION

1.1 Staff in the Division

Name	Room (Fulton Building)	Phone (3xxxxx)	Email xx@maths.dundee.ac.uk
Teaching Staff			
Professor Mark Chaplain	J26	85369	chaplain
Professor Gunnar Hornig	G1E	88315	gunnar
Professor Ping Lin	J16	84473	plin
Dr Fordyce Davidson	J27	84692	fdavidso
Dr Niall Dodds	G5	84470	ndodds
Dr Raluca Eftimie	G10	84488	reftimie
Dr Hiroko Kamei	G6	84476	hiroko
Dr Irene Kyza	G12	84469	ikyza
Dr Philip Murray	G11	84478	pmurray
Dr Mariya Ptashnyk	G9	84467	mptashnyk
Dr David Pontin	G1G	84466	dpontin
Dr Gibin Powathil		84897	gibin
Dr Alan Terry		84475	aterry
Dr Dumitru Trucu	G7	84462	trucu
Dr Antonia Wilmot-Smith	G1E	84482	antonia
Dr Miho Janvier	G14	85721	mjanvier
Technical Staff			
Mr Nick Dawes		84839	ndawes
Mr Mahamadou Niakate		84839	mniakate

1.2 Modules available in the Division

The Mathematics Division teaches the modules listed in the table on the next page. The module leaders and lecturers are also shown. The modules coded EG are mainly available to Engineering students as service courses.

The Level 1 modules are a consolidation and extension of school Higher grade mathematics, and in Levels 2 and 3 the subject is developed with some specialisation in particular areas at Level 3. The Level 4 modules reflect the research strength of the Division in Applied Mathematics. We have particular strengths in Numerical Analysis, Mathematical Biology and Magnetohydrodynamics, with research work of international excellence being carried out in these areas.

Every module in your degree programme is Scotcat credit rated; for example, each of our modules at Level 1 or Level 2 is rated at 20 Scotcat credits. This means that the total time spent by you in studying and being examined in each of these modules should be 10 x 20 = **200 hours**. The 200 hours is known as the 'notional student effort', and comprises all formal classes, private study, and preparation for and sitting any examinations. You should be prepared to spend this amount of time on these modules.

LEVEL 1

MA11001 Mathematics 1A; Dr H Kamei, Dr M Ptashnyk
20 credits. Assessment: 100% coursework.
Aims: In this module you will be introduced to basic ideas of Calculus and Algebra. The module will consolidate and extend the mathematics covered in school leaving certificate mathematics and provide a secure base on which to develop later mathematics courses.

MA12001 Mathematics 1B; Dr H Kamei, Dr P Murray
20 credits. Assessment: 50% exam, 50% coursework.
Aims: In this module you will be introduced to the basic ideas of Calculus, Algebra and Geometry. The module, consisting of a Calculus component and an Algebra and Geometry component, will extend the mathematics covered in module MA11001 and will provide a secure base on which to develop later mathematics modules.

MA12002 Topics in Pure Mathematics; Dr N Dodds
20 credits. Assesment 50% exam, 50% coursework.
Aims: To develop the ability to think in a logical manner, and construct well structured mathematical arguments.

MA12003 Probability and Statistics; Dr M Janvier, Dr N Dodds
20 credits. Assesment 50% exam, 50% coursework.
Aims: The module gives an introduction to statistics and probability, laying the foundation for a broad range of applications of mathematics to modelling real-world problems.

EG11003 Science & Engineering Mathematics 1A; Dr N Dodds
20 credits. Assessment: 100% coursework.
Aims: To provide students with the necessary pre-requisite mathematical skills and knowledge to handle CEng level degree courses. To increase students confidence in using and understanding mathematics.

EG12003 Science & Engineering Mathematics 1B; Dr N Dodds
20 credits. Assessment: 50% exam, 50% coursework.
Aims: To provide students with the necessary pre-requisite mathematical skills and knowledge to handle CEng level degree courses. To increase students confidence in using and understanding mathematics. To build on and advance the skills acquired in EG11003.

LEVEL 2

MA21001 Mathematics 2A; Prof G Hornig, Dr R Eftimie
20 credits. Assessment: 60% exam, 40% coursework.

Aims: This course contains the first half of the basic algebra and calculus required for intending honours students. The course may also be taken by science and arts students not intending to proceed to an honours mathematics degree.

MA22001 Mathematics 2B; Dr D Trucu, Dr H Kamei
20 credits. Assessment: 60% exam, 40% coursework.
Aims: This module contains the second half of the basic algebra and calculus required for intending honours students. The module may also be taken by science and arts students not intending to proceed to an honours mathematics degree.

MA21002 Computer Algebra & Dynamical Systems; Dr D Pontin, Dr I Kyza
20 credits. Assessment: 60% exam, 40% coursework.
Aims: to make students familiar with a Computer Algebra software package and to use this software to solve a number of problems from the area of Dynamical Systems.

MA21003 Discrete Mathematics; Dr M Ptashnyk , Dr H Kamei
20 credits. Assessment: 60% exam, 40% coursework.
Aims: The module gives an introduction to discrete mathematics, laying the foundation for a broad range of applications of mathematics to modelling real-world problems.

LEVEL 3

MA31002 Differential Equations; Dr P Murray
15 credits. Assessment: 80% exam, 20% coursework.
Aims: The Module provides students with the opportunity to study differential equations beyond the introductory material contained in Module MA21001. The main topics covered in the Module are First order differential equations and second order differential equations, Systems of first order linear ordinary differential equations subject to initial conditions, Fourier analysis and the method of separation of variables in partial differential equations.

MA32001 Analysis; (not taught this year)
15 credits. Assessment: 80% exam, 20% coursework.
Aims: Calculus is basic to much of mathematics and its applications but a non- rigorous approach to calculus can lead to confusion and contradictions. In this module concepts from calculus are defined precisely and results are proved rigorously. In many cases these topics are placed in a much more general context, so that results have broad application and proofs are not cluttered by unnecessary detail. The module also illustrates the logical development of an area of mathematics.

MA32002 Mathematical Methods; Dr H Kamei
15 credits. Assessment: 80% exam, 20% coursework.
Aims: Many problems arising in Science and Engineering are formulated mathematically by developing equations which model the interplay between various physical effects and the forces of phenomena giving rise to them. Vector analysis is a key tool for studying many equations that arise. The aim of the course therefore is to provide the student with a variety of basic mathematical techniques with which to analyse a wide class of mathematical models arising in Science and Engineering.

MA32003 Operational Research; (not taught this year)
15 credits. Assessment: 80% exam, 20% coursework.
Aims: The application of mathematics to military operations during World War II (the deployment of radar and the management of convoys, for example) was called Operational (or Operations) Research. Today the term means a scientific approach to decision making. The intention is to determine how best or most efficiently to design and operate a system, often in the presence of scarce resources. The aim of this course is to introduce you to some of the mathematical techniques which are used in Operational Research; a particular objective is to study basic techniques for solving linear and combinatorial optimization problems that arise in applications.

MA32005 Fundamentals of Scientific Computing; Prof P Lin
15 credits. Assessment: 70% exam, 30% coursework.
Aims: The aims of this course are: (1) to provide an introduction to scientific computing software (MATLAB) and its use in developing algorithms to solve problems that can be stated in terms of matrix equations, and (2) to develop relevant matrix theory that underpins these algorithms.

MA32006 Complex Analysis; Dr D Trucu
15 credits. Assessment: 80% exam, 20% coursework.
Aims: This course extends ideas of differentiation and integration to functions of a complex variable. It develops the theory with important applications such as evaluation of integrals via residue calculus, the fundamental theorem of algebra and conformal mapping.

MA32007 Differential Geometry; Prof G Hornig
15 credits. Assessment: 80% exam, 20% coursework.
Aims: The aim of the course is to provide students with an introduction to Differential Geometry, a modern branch of mathematics which is used in all modern presentations of physical theories. These include continuum mechanics, fluid dynamics, electromagnetism, thermodynamics and general relativity, and reaches up to the most recent gauge theories. This course develops some of the geometrical concepts and tools that are essential for understanding both classical and modern physics and engineering.

MA32008 Graph Theory; Dr N Dodds
15 credits. Assessment: 80% exam, 20% coursework.
Aims: In this course you will be studying the theory and application of graphs, including both theoretical work and the use of algorithms.

LEVEL 4

MA41001 PTS and Project Work; Dr F Davidson
15 credits. Assessment: 100% coursework.
Aims: Personal transferable skills (PTS) are an important asset to any mathematician who wishes to make a useful contribution within any group or organisation, be it academic or commercial. Thus the module introduces and practices skills such as report writing, lecture and slide preparation, and presentational skills. Mathematical modelling is an essential bridge between the applied mathematician and a practical application. The module gives an introduction to MATLAB, a widely used language for implementing numerical techniques. This is used in tackling a selection of short case studies that illustrate modelling techniques. Each student writes reports on the case studies and gives a short verbal presentation on one of them.

MA41002 Mathematical Biology; Prof M Chaplain
15 credits. Assessment: 80% exam, 20% coursework.
Aims: This course provides an introduction to mathematical biology and modelling. It focuses on biological systems which can be modelled using nonlinear difference equations and ordinary differential equations.

MA41003 Ordinary Differential Equations and their Approximation Dr I Kyza
15 credits. Assessment: 80% exam, 20% coursework.
Aims: Ordinary differential equations are an important modelling tool in Science and Engineering. These can rarely be solved exactly and so techniques have been developed to derive approximate solutions that may, in principle, be made as accurate as desired. This module examines the basic numerical methods for the approximate solution of both initial and boundary value problems (IVPs and BVPs). We describe how methods may be constructed, how they may be applied and, via aspects of convergence theory, the principal requirements

of successful methods. We shall also discuss eigenvalue problems and Green's functions and their role in solving BVPs.

MA41006 Maths of Fluids and Plasmas 1: Fluid Dynamics Dr D Pontin
15 credits. Assessment: 80% exam, 20% coursework.
Aims: The aim of the course is to provide students with an introduction to the mathematical methods of fluid dynamics. A key focus will be the relationship between the mathematical equations and how they describe the physical properties of fluids and plasmas.

MA42001 Project, Dr F Davidson
15 credits. Assessment: 100% coursework
A substantial project is carried out in this module. This includes the writing of a project report, followed by a verbal presentation.

MA42002 Mathematical Biology II Dr M Ptashnyk
15 credits. Assessment: 80% exam, 20% coursework.
Aims: The course follows on from MA41002 and focuses on biological systems which can be modelled using nonlinear partial differential equations.

MA42003 Partial Differential Equations and their Approximation Prof P Lin
15 credits. Assessment: 80% exam, 20% coursework.
Aims: Mathematical models in most areas of Science and Engineering give rise to partial differential equations (PDEs) that cannot usefully be reduced to ordinary differential equations. Some typical examples include simulations of chemical reactions, population genetics, cooling systems in power stations and the flow of air around cars and aircraft. Here we give a broad introduction to PDEs that includes classification into different types, classical solution methods, qualitative properties and, for the majority of problems that cannot be solved exactly, we provide techniques for constructing approximate solutions. The module will not tackle specific applications but aims to provide a sound basis by focussing on model situations.

MA42007 Maths of Fluids and Plasmas 2: MHD and the Sun Prof G Hornig
15 credits. Assessment: 80% exam, 20% coursework.
Aims: The aim of the course is to provide students with an introduction to the mathematical methods of magnetohydrodynamics, and the ways in which these can be employed to model physical phenomena which occur on the sun. A key focus will be the relationship between the mathematical equations and how they describe the physical properties of plasmas.

2 ORGANISATION OF YOUR PROGRAMME OF STUDY

2.1 Adviser of Studies

You will be allocated an Adviser of Studies on entry to the University. He/she will normally remain as your Adviser throughout your undergraduate studies. You can expect your Adviser of Studies to provide the following types of guidance:

- advice on the structure and content of your programme of study
- assistance with the selection of optional modules where appropriate
- approval of changes in your programme of study

As a Mathematics student, your Adviser of Studies will be either Dr David Pontin, Dr Antonia Wilmot-Smith or Dr H Kamei.

The School also operates a Personal Tutor Scheme for all students – please see the school handbook for details.

2.2 Assessment

2.2.1 Assessment Criteria

Assessment of modules in the curriculum will be by coursework, class test and degree examination or a combination of these elements. Coursework assessment can differ from module to module. The Course Guide for the module will contain detailed information and you should make sure that you understand the rules. The minimum pass mark for all modules is 40%.

2.2.2 Coursework Policy

Coursework will be set in a way that is appropriate for the particular module. More information will be posted in the Module Guide on Blackboard. You should read the appropriate Module Guide carefully so that you understand precisely what is required of you. Coursework submitted after the deadline, unless there are exceptional circumstances, will not count.

2.2.3 Class Medals and Prizes

There are prizes available to students in Mathematics. For details see the School Guidebook. In particular, there may be a Class Medal awarded for the best academic performance in particular modules or groups of modules.

3 DEGREE PROGRAMMES

3.1 Degrees Offered

The names of the degree programmes are listed below. Those degrees in which students spend all of their time above Level 2 in the Mathematics Division are:

- BSc Honours Degree in Mathematics
- BSc Degree in Mathematics

In addition Mathematics contributes to a range of other Honours degrees:

- BSc Honours Degree in Mathematical Biology
- BSc Honours Degree in Mathematics and Accountancy
- BSc Honours Degree in Mathematics and Economics
- BSc Honours Degree in Mathematics and Financial Economics
- BSc Honours Degree in Mathematics and Physics
- BSc Honours Degree in Mathematics and Psychology
- MA Honours Degree in Mathematics and Business Economics with Marketing
- MA Honours Degree in Mathematics and English
- MMath Honours Degree in Mathematics
- MSci Honours Degree in Mathematical Biology

3.2 Aims and Objectives

Degree programmes involving Mathematics have aims which are consistent with those of the School of Engineering, Physics and Mathematics (see the School Handbook).

The learning outcomes of the Mathematics degree programmes are that students should have a secure knowledge of the basic material and

- be able to apply the ideas learned in a range of applications
- be able to formulate and present mathematical arguments in a logically coherent way
- be able to develop mathematical models of certain, physical and/or biological systems
- be able to do mathematical project work both in teams and individually
- be able to communicate mathematical ideas clearly and coherently
- be able to appreciate recent developments in certain areas of applied mathematics.

3.3 Programme Pathways

All of the Honours degrees require 480 Scotcat points; the BSc degree in Mathematics requires 360 Scotcat points. Tables 1-4 give details of the pathways for different degree programmes.

Table 1: BSc Mathematics:

LEVEL	SEMESTER 1	SEMESTER 2
1	Mathematics 1A Topics in Pure Mathematics Optional module	Mathematics 1B Statistics and Probability Optional module
2	Mathematics 2A Discrete Mathematics Optional module	Mathematics 2B Computer Algebra Optional module
3	Differential Equations Mathematical Methods 2 other maths modules	Scientific Computing Differential Geometry Mathematical Biology I Maths of Fluids and Plasmas I

Table 2: BSc Honours Mathematics:

LEVEL	SEMESTER 1	SEMESTER 2
1	Mathematics 1A Topics in Pure Mathematics	Mathematics 1B Statistics and Probability

	Optional module	Optional module
2	Mathematics 2A Discrete Mathematics Optional module	Mathematics 2B Computer Algebra Optional module
3	Differential Equations Mathematical Methods 2 other maths modules	Scientific Computing Differential Geometry Mathematical Biology I Maths of Fluids and Plasmas I
4	PTS and Mini-projects ODEs and their Approximation 2 other maths modules	Project Mathematical Biology II PDEs and their Approximation Maths of Fluids and Plasmas II

Table 3: BSc Honours Mathematical Biology:

LEVEL	SEMESTER 1	SEMESTER 2
1	Mathematics 1A 4 Life Science modules (half-size modules)	Mathematics 1B 4 Life Science modules (half-size modules)
2	Mathematics 2A Discrete Mathematics 2 Biology modules (half-size modules)	Mathematics 2B Computer Algebra Biology module
3	Differential Equations Mathematical Methods 2 Biology modules	Mathematical Biology I 1 other maths module 2 Biology modules
4	PTS and Mini-projects ODEs and their Approximation 1 other maths module 1 Biology module	Project Mathematical Biology II PDEs and their Approximation 1 Biology module

Table 4: Honours Degrees Mathematics and Physics:

LEVEL	SEMESTER 1	SEMESTER 2
1	Mathematics 1A 3 Physics modules (including 2 half-size modules)	Mathematics 1B Statistics and Probability 1 Physics module
2	Mathematics 2A 2 Physics modules	Mathematics 2B Computer Algebra (or similar Physics module) Physics module
3	Differential Equations Mathematical Methods 2 Physics modules	2 Maths modules 2 Physics modules
4	2 Maths modules and 2 Physics modules	2 Maths modules and 2 Physics modules

Table 6: Honours Degrees Mathematics and X (not maths and physics)- Mathematics content:

LEVEL	SEMESTERS 1 and 2
1	Mathematics 1A Mathematics 1B Pure Maths (optional) Statistics and Probability (optional)
2	Mathematics 2A Mathematics 2B Discrete Mathematics (optional) Computer Algebra
3	Differential Equations Mathematical Methods At least two other Maths modules
4	Usually four Level 3 or Level 4 modules (at most two at Level 3)

3.4 Progression

Progression through the degree programmes is dependent upon the satisfactory completion of each prerequisite module. There are different requirements depending on your particular degree programme, and certain Level 2 modules are prerequisites for entry to particular Level 3 or Level 4 modules (see the Division website for details).

For more detailed information, you should consult your Adviser of Studies. Information can also be obtained from the School website.

3.5 Staff/Student Liaison Committee

The Mathematics Division has a Staff/Student Committee made up of staff and student representatives, which exists as a forum for discussion of matters of mutual concern. It is expected to highlight issues to do with course provision, and to play an important role in academic audit. Each module (or group of modules) will have a class representative who will be a member of the committee, so you may raise issues with them. Dates of meetings will be publicised in due course.

4 STUDENT MATTERS

4.1 How to Successfully Complete Your Degree

The great secret of success is to study effectively and consistently, which does not mean a superhuman effort or the necessity to lose sleep! It means effectively planning your time and developing good study techniques. You will be given advice on this in your lecture courses. If you follow it, there will be plenty of time for work and play. This balance is important and can be difficult for new students to achieve since you will have little experience of what is expected of you. Your rewards at the end will, however, reflect your efforts.

Please talk to a member of staff if you find that you are in any way not coping with the work. Most of the time we will be able to help. We can only assist if we know that things are going wrong.

4.2 Communication with Lecturers

The normal line of communication between staff and students will be by email. As a matriculated student you will be automatically allocated a computer id and email address on the centralised Novel-based computer system available from various computer labs around campus. This email address (of the form "abcsmith@dundee.ac.uk") is your official university email address and as such you are expected to monitor it.

4.3 Blackboard VLE (My Dundee)

It is Mathematics Division policy to make use of the Blackboard system for teaching, learning and also communication with students. More information will be available from your lecturers.

4.4 DUMaS

The undergraduate students run a (Dundee University) Mathematics Society for all students studying mathematics as part of their degree programme. You will be encouraged to join! Information about activities is usually circulated by email.

4.5 Health & Safety Within the Division

The University operates a strict health and safety policy to protect students and staff alike. Your responsibilities to both yourself and your colleagues begin from the time you start your studies. You can find more information in the School Handbook or on the University webpages.