SCHOOL of ENGINEERING

PHYSICS & MATHEMATICS

Undergraduate Degree Programmes in Mathematics

Session 2011-2012

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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 at the MSI/WTB/JBC Complex, Old Hawkhill. Our front door is beside the reception of the Wellcome Trust. 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 which 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.

Professor Mark A.J. Chaplain, Head of Division

1 ORGANISATION OF THE DIVISION

1.1 Staff in the Division

Name	Room	Phone (3xxxxx)	Email xx@maths.dundee.ac.uk
Teaching Staff			
Professor Mark Chaplain	1.43G	85369	chaplain
Professor Ping Lin	1.43H	84473	plin
Dr Fordyce Davidson	1.43B	84692	fdavidso
Dr Niall Dodds	1.43F	84470	ndodds
Dr Raluca Eftimie	2.47		
Dr Gunnar Hornig	1.43D	88315	gunnar
Dr Hiroko Kamei	1.43K	84476	hiroko
Dr David Pontin	1.43C	84466	dpontin
Dr Antonia Wilmot-Smith	1.43A	84482	antonia
Dr Gibin Powathil	1.43K	84897	gibin
Dr Maria Ptashnyk	2.47		
Dr Alan Terry	1.43K	84475	aterry
Dr Dumitru Truco	1.43K	84462	truco
Technical Staff			
Mr Nick Dawes	2.48	84839	ndawes
Mr Mahamadou Niakate	2.48	84839	mniakate
Secretarial Staff			
Mrs Shirley Fox	1.43P	84471	sfox

1.2 Modules available in the Division

The Mathematics Division teaches the modules listed below. 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 and Advanced 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.

Modules taught in the Division (when more than one member of staff is involved, the module leader is marked by `L'):

LEVEL 1

MA11001 Mathematics 1A Dr N Dodds (L), Dr A Wilmot-Smith

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 D Pontin (L), Dr H Kamei

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.

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 (L), Dr H Kamei

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 Dr A Wilmot-Smith (L), Dr H Kamei

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 N Dodds (L), Dr A Terry

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 G Hornig

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.

MA22003 Statistics and Discrete Mathematics Dr F Davidson (L), Dr M Ptashnyk

20 credits. Assessment: 60% exam, 40% coursework.

Aims: The module gives an introduction to statistics, probability and discrete mathematics, laying the foundation for a broad range of applications of mathematics to modelling real-world problems.

LEVEL 3

MA31002 Differential Equations Dr A Wilmot-Smith

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 Dr D Trucu

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 D Pontin

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.

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

MA32007 Differential Geometry Dr 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.

MA32003 Operational Research Dr N Dodds

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.

MA32006 Complex Analysis not being taught this year

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.

MA32008 Graph Theory not being taught this year

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

MA40001 PTS and Project Work Dr G Hornig (L), Dr D Pontin, Dr H Kamei

30 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. A more substantial project is carried out in the second part of the module. This includes the writing of a project report, followed by a verbal presentation.

MA41002 Mathematical Biology I Dr H Kamei (level 4, semester 1)
Dr G Powathil (level 3, semester 2)

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 Eq.s and their Approximation Prof P Lin

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 (level 4, sem 1)
Dr G Hornig (level 3, sem 2)

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.

MA42002 Mathematical Biology II Dr F Davidson

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 Dr A Wilmot-Smith

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 or Dr Antonia Wilmot-Smith.

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

2.2 Attendance and Ill-health

2.2.1 Attendance

You are required to attend lectures, tutorials, laboratories, workshops and generally perform all the work of the class in order to qualify for entry to the corresponding degree examination. A record of your attendance will normally be maintained. Continued unjustified absences can lead to your being debarred from the degree examination by the Head of Division.

2.2.2 Reporting Ill-health and other Absences: examinations and class tests

Absence from all examinations and class tests must be confirmed by a medical certificate signed by a GP, regardless of the duration of the illness. This must be submitted to the School Office no later than 7 days after the event to be taken into consideration. Where the absence is from a degree examination at the end of semester two then the medical certificate must be supplied within 7 days or at least 2 days in advance of the meeting of the relevant Board of Examiners, whichever is the sooner.

2.2.3 Reporting Ill-health and other Absences: classes

You can self-certify absence from lectures, tutorials, workshops or computer laboratories for up to 5 days by completing the self-certification form available at School Offices. This means that for minor illnesses, which last only a few days, a doctor's medical certificate is not required. A copy of this self-certification will then be forwarded to this division.

If an illness results in absence for more than 5 days, you must go to your doctor for confirmation of the illness and obtain a medical certificate signed by the GP. Medical certificates should be sent to the School Office, which will again inform this division. Please note that self-certification or the submission of a medical certificate does not, in itself, relieve you of the obligation to complete and submit an assessment. You should consult the member of staff concerned for details of the implications of absence upon your overall assessment. If you wish an illness to be taken into account by a board of examiners, it is your responsibility to bring the illness, and evidence thereof, to the attention of the School Office within 7 days of the event occurring.

2.3 Assessment

2.3.1 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%.

2.3.2 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.

2.3.3 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 Applied Computing
- 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

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 Optional module Optional module	Mathematics 1B Optional module Optional module
2	Mathematics 2A CADS Optional module	Mathematics 2B Statistics and Discrete Maths 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 Optional module Optional module	Mathematics 1B Optional module Optional module
2	Mathematics 2A CADS Optional module	Mathematics 2B Statistics and Discrete Maths 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 40 credits from Life Sciences	Mathematics 1B 40 credits from Life Sciences
2	Mathematics 2A CADS 20 credits from Life Sciences	Mathematics 2B Statistics and Discrete Maths 20 credits from Life Sciences
3	Differential Equations Mathematical Methods 30 credits from Life Sciences	Mathematical Biology I 1 other Maths module 30 credits from Life Sciences
4	PTS and Mini-projects ODEs and their Approximation 1 other Maths module 15 credits from Life Sciences	Project Mathematical Biology II PDEs and their Approximation 15 credits from Life Sciences

Table 4: Honours Degrees Mathematics and X - Mathematics content:

LEVEL	SEMESTERS 1 and 2
1	Mathematics 1A Mathematics 1B
2	Mathematics 2A Mathematics 2B CADS Statistics and Discrete Maths (optional)
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 Access to Divisional Buildings

Access to the Division building is controlled by swipe-card. You should come to the Division during ‘Welcome Week’ or week 1 to get your student card activated so that you can swipe into the building. This will allow you access Monday – Friday during business hours.

4.3 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.

4.4 Blackboard VLE (MyDundee)

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

4.5 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.

4.6 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 one the University webpages.

A green first aid box is located in room 1.43M. The contents of these is only sufficient for the treatment of minor injuries, such as small cuts, grazes or minor sprains and strains. If you use these, inform the person in charge of your class, who will inform the Divisional Safety Officer, Mrs Shirley Fox.