

**PROGRAMME SPECIFICATION**

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| <b>1</b> | <b>Awarding Institution</b>     | Newcastle University                                      |
| <b>2</b> | <b>Teaching Institution</b>     | Newcastle University                                      |
| <b>3</b> | <b>Final Award</b>              | BSc (Hons)  |
| <b>4</b> | <b>Programme Title</b>          | Mathematics with Biology                                  |
| <b>5</b> | <b>UCAS/Programme Code</b>      | G1C1  |
| <b>6</b> | <b>Programme Accreditation</b>  | None  |
| <b>7</b> | <b>QAA Subject Benchmark(s)</b> | Mathematics, Statistics and Operational Research, Biology |
| <b>8</b> | <b>FHEQ Level</b>               | 6   |
| <b>9</b> | <b>Date written/revised</b>     | April 2011  |

**10 Programme Aims**

1. To produce graduates who have a sound, broad knowledge of the fundamental aspects of mathematics and statistics.
2. To develop students' ability to reason logically and their capacity for mathematical and statistical thinking.
3. To provide a modern introduction to mathematical biology, especially the applications of Statistics to Biology.
4. To provide the fundamental knowledge required to tackle practical problems in Mathematical Biology
5. To provide an understanding of model assumptions and when they are violated.
6. To develop mathematical and statistical skills which can be applied in Systems Biology, Bioinformatics and Ecology.
7. To develop skills in written and oral communication.
8. To provide the knowledge to be able to use information technology in this area.
9. To equip students with the knowledge and skills to apply mathematics and statistics in biological applications.

**11 Learning Outcomes**

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. The programme outcomes have been written with regard to the benchmark statements for Mathematics and Statistics and Operational Research.

**Knowledge and Understanding**

On completing the programme students should have:

- A1. An understanding of fundamental concepts and methods of mathematics and statistics
- A2. Knowledge and experience of theoretical concepts and analytical techniques in mathematics and statistics.
- A3. The knowledge and experience to tackle practical problems in mathematical biology.
- A4. Familiarity with some relevant information technology.
- A5. Knowledge and understanding of chosen specialist areas in mathematics, statistics and biology
- A6. An understanding of model assumptions and when they are violated.
- A7. The knowledge to apply mathematics and statistics in biological situations.

**Teaching and Learning Methods**

Lectures are the principal vehicle for presenting the essential material which defines the modules, and provide the key element towards achieving the learning outcomes A1-A3, A5-A7. Problem classes are used to support lectures and enhance students' understanding by providing an opportunity to clarify issues arising from lectures and work through additional examples. In Stage 1, the module MAS1041 includes regular seminars where students present solutions to mathematical problems. Practical classes in some of the Biological modules (and fieldwork in one module) consolidate the understanding of biological concepts in a practical context (A3 and A5). Computer practical classes enable the students to become familiar with relevant IT (A4).

**Assessment Strategy**

The standard assessment format, used for nearly all modules, is based on an unseen written examination (counting for at least 70% of the assessment in MAS modules but sometimes less in some BIO modules), together with an appropriate mixture of course assignments, in-course tests and mini-projects. These methods all enable assessment of the Learning Outcomes A1-A7. Assessment by unseen examinations is seen as a valid and reliable method of assessing both ability and knowledge. Details of the specific assessment modes and weightings, for each module, are set out in the module specification in the Degree Programme Handbooks. Some of the more practically oriented BIO modules are mainly assessed by project work (A3 and A5).

In Stages 2 and 3, the MAS modules use a standard format for examination papers in which there is a Section A, consisting of short, straightforward questions which cover the whole module, and a Section B with questions designed to test a greater depth of understanding. In Stage 1, there are a variety of short and medium length questions enabling the students to demonstrate their knowledge of the subject unconstrained by the need to answer complete long questions.

In the BIO and ACE modules, there are typically 2 hour exams where two or three essay type questions are selected from a choice of 5 or 6 questions. However in Stage 1 other exam formats are used such as answering a large number of true/false questions.

**Intellectual Skills**

On completing the programme students should be able to demonstrate:

- B1. A facility for mathematical and statistical thinking.
- B2. A facility for the critical evaluation of arguments and evidence.
- B3. The skill to formulate biological problems in a quantitative way.
- B4. Skill in the organisation and interpretation of data.
- B5. The ability to draw conclusions from data supplied to the student or acquired by the student.

**Teaching and Learning Methods**

Regular drop-in sessions are used in all stages to give students the opportunity to ask individual questions about exercises and to clarify issues arising from lectures. This helps with learning outcomes B1-B3 in most mathematics modules and with B4 and B5 in most statistics modules. The Biology modules have a mixture of practicals and tutorials which help with B2-B5.

**Assessment Strategy**

In the MAS modules, homework assignments are used to allow students to test and develop these intellectual skills. The assignments are normally set weekly (20 credit modules) or fortnightly (10 credit modules) basis in Stage 2, 3 and 4. In Stage 1 modules there are normally four coursework assessments per Semester and there is significant use of computer based assessment (CBA). Model solutions to all homework exercises are made available to students when the marked work is returned, sometimes earlier if appropriate. Marked work is returned within two weeks of the submission date. Computer based assignments are used in Stage 1 and, to a lesser extent, in Stage 2 to help the students to develop their problem solving skills (B3). The students are given access to try questions in CBA practice mode and then a fixed period to attempt randomly generated questions in 'exam' mode. Having completed an assignment, they are given their marks and the full solutions. In-course tests are used in some Stage 2 and 3 modules to give students practise in problem solving under exam-like conditions (B3). All three forms of assessment contribute to both formative and summative assessment. In the BIO and ACE modules essays, tests and project work are used to develop these skills (B2-B5)

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| <b>Practical Skills</b> |
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| On completing the programme students should be able to:<br>C1. Apply their knowledge of mathematics to biological problems.<br>C2. Have expertise in the use and application of programming languages and software to biological problems.<br>C3. Exercise numerical and computational skills. |
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| <b>Teaching and Learning Methods</b> |
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| Practical classes, held in a computer teaching laboratory, introduce students to the use of computer packages (Maple and R) and other relevant software. At Stage 1, Mathematics modules have classes involving the computer algebra package Maple and in Statistics modules students learn how to use R for data analysis and simulation studies (C2, C3). In later stages, students are expected to use the computer network, as appropriate, for homework assignments or minor projects. Such work often starts in a practical session and is finished in the student's own time (C1). In the biological modules computer practicals are used to develop these practical skills (C1-C3) |
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| <b>Assessment Strategy</b> |
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| Computing skills are assessed through mini projects or through questions in homework assignments (C2, C3) |
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| <b>Transferable/Key Skills</b> |
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| On completing the programme students should be able to:<br>D1. Communicate orally in English.<br>D2. Write cogently.<br>D3. Use computer-based information resources.<br>D4. Use relevant IT<br>D5. Work independently. |
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| <b>Teaching and Learning Methods</b> |
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| Students' learning is supported by weekly or fortnightly exercises (D2 and D5). Project work is normally started within Practical sessions (D3 and D4). Further support is given in drop-in sessions (D1). The Biology modules enhance the students' communication skills and use of information resources (D1-D3). They also develop team-working skills through group projects. The project module in Stage 3 particularly develops independent study (D5) as well as the other transferable key skills (D1-D4). |
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| <b>Assessment Strategy</b> |
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| Many statistics and biological modules, and some mathematical modules, have a project element (D2-D5). |
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| <b>12 Programme Curriculum, Structure and Features</b> |
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| <b>Basic structure of the programme</b> |
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| This major-minor degree programme combines mathematics and statistics applicable to biology with appropriate biology modules. To be able to read and understand biology, it is a great help if students have a sound grounding in core mathematical techniques, such as calculus, differential equations, real analysis, linear algebra etc. Assessing and understanding the intrinsic variability that exists in biology is also of major interest. A sound grounding in probability and statistics allows an understanding of such variability and how to study and analyse biological systems and experiments. These substantial bodies of mathematical and statistical knowledge are covered in the core Stage 1 and 2 modules. Appropriate biological topics are studied alongside these modules. In Stage 3 further relevant topics in biology, mathematics and statistics are studied alongside a biology research topic which will involve using mathematical and statistical knowledge acquired in stages 1 and 2. |
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**Key features of the programme (including what makes the programme distinctive)**

(a) the duration of the course: 3 years

(b) the number of Stages: 3

(c) the overall credit arrangements

In each year, students take 120 credits divided between two subject areas as follows:

- 80 credits of modules offered by the School of Mathematics and Statistics
- 40 credits from an approved list of modules offered by School of Biology.

(d) the module credit arrangements: see below for the list of modules.

(e) requirements for progression are as detailed in the University Degree Programme Regulations and Examination conventions.

(f) innovative features of the course

This degree scheme allows students with a strong interest in mathematics to develop an understanding of various biological systems and leads to the application of advanced mathematical and statistical techniques in biology.

**Programme regulations (link to on-line version)**

<http://www.ncl.ac.uk/regulations/>

**13 Criteria for admission***Entry qualifications*

Our standard offer is likely to be a grade A in 'A' level Mathematics with an A and B in two other 'A' levels including Biology. Corresponding offers will be made to applicants taking other combinations of A and AS levels and other forms of UK or overseas exams.

*Admissions policy/selection tools*

An academic member of the admissions staff will consider each application. Based on the information supplied, the staff member will decide whether to offer the applicant a place and if so what the terms of the offer are to be.

*Non-standard Entry Requirements*

Mature students and those with non-standard qualifications will be interviewed whenever this is practical (by telephone if necessary) before any offer is made.

*Additional Requirements*

While 'A' level Further Mathematics is not required, preference may be given at confirmation to those who have studied it and who have attained a reasonable grade.

*Level of English Language capability*

The School uses the standard University entrance requirement (i.e. an IELTS score of 6.5).

**14 Support for Student Learning***Induction*

During the first week of the first semester students will attend an induction programme. New students will be given a general introduction to University life and the University's principle support services and general information about the School and the programme offered, as described in the Degree Programme Handbook. New and continuing students will be given detailed programme information and the timetable of lectures/practicals/problem classes, etc. The International Office offers an additional induction programme for overseas students.

Revision sessions on key material taught the previous year are provided for returning students.

#### *Study skills support*

Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined in the Programme Specification. Guidance will be given on study skills using the booklet "Winning at Mathematics" which is issued to all new students.

Help with academic writing will be available from the Writing Centre.

#### *Academic support*

The initial point of contact for a student will be with a lecturer or module leader, or with their personal tutor (see below) for more generic issues. Thereafter the Degree Programme Director or Head of School may be consulted. Issues relating to the programme may be raised at the Staff-Student Committee, and/or at the Board of Studies. The School organises meetings with students to discuss pre-registration for the following academic year.

#### *Pastoral support*

Each student will be assigned a personal tutor whose responsibility will be to monitor the academic performance and overall well-being of their tutees and the School has a Senior Tutor. In addition, the University offers a range of support services, including one-to-one counselling and guidance or group sessions/workshops on a range of topics, such as emotional issues eg. stress and anxiety, student finance and budgeting, disability matters, etc. There is specialist support available for students with dyslexia and mental health issues. Furthermore, the Union Society operates a Student Advice Centre, which can provide advocacy and support to students on a range of topics including housing, debt, legal issues, etc. The School has a member of the administrative staff designated to give pastoral support as needed.

#### *Support for students with disabilities*

The University's Disability Support Service will provide help and advice for disabled students at the University - and those thinking of coming to Newcastle. It provides individuals with: advice about the University's facilities, services and the accessibility of campus; details about the technical support available; guidance in study skills and advice on financial support arrangements; a resources room with equipment and software to assist students in their studies. The Schools have a designated disability support staff member.

#### *Learning resources*

The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), and Information Systems and Services, which supports campus-wide computing facilities.

All new students whose first language is not English are required to take an English Language Proficiency Test. This is administered by INTO Newcastle University Centre on behalf of Newcastle University. Where appropriate, in-session language training will be provided.

### **15 Methods for evaluating and improving the quality and standards of teaching and learning**

#### *Module reviews*

All modules are subject to review by questionnaires which are considered by STLC and the Board of Studies. Changes to, or the introduction of new, modules are considered at the School Teaching and Learning Committee and at the Board of Studies. Student opinion is sought at the Staff-Student Committee and/or the Board of Studies. New modules and major changes to existing modules are subject to approval by the Faculty Teaching and Learning Committee.

#### *Programme reviews*

The Board of Studies conducts an Annual Monitoring and Review of the degree programme and reports to Faculty Teaching and Learning Committee.

*External Examiner reports*

External Examiner reports are considered by the Board of Studies. The Board responds to these reports through Faculty Teaching and Learning Committee. External Examiner reports are shared with institutional student representatives, through the Staff-Student Committee.

*Student evaluations*

All modules, and the degree programme, are subject to review by student questionnaires. Informal student evaluation is also obtained at the Staff-Student Committee, and the Board of Studies. The National Student Survey is sent out every year to final-year undergraduate students, and consists of a set of questions seeking the students' views on the quality of the learning and teaching in their HEIs. With reference to the outcomes of the NSS and institutional student satisfaction surveys, actions are taken at all appropriate levels by the institution.

*Mechanisms for gaining student feedback*

Feedback is channelled via the Staff-Student Committee and the Board of Studies.

*Faculty and University Review Mechanisms*

The programme is subject to the University's Internal Subject Review process. Every five years degree programmes in each subject area receive a review. This involves both the detailed consideration of a range of documentation, and a two-day review visit by a review team which includes an external subject specialist in addition to University and Faculty representatives. Following the review a report is produced, which forms the basis for a decision by University Teaching and Learning Committee on whether the programmes reviewed should be re-approved for a further five year period. The School of Mathematics and Statistics was reviewed in 2006/7 and its programmes were approved until November 2011.

*Accreditation reports*

None

*Additional mechanisms*

None

## 16 Regulation of assessment

### *Pass mark*

The pass mark is 40 (Undergraduate programmes)

### *Course requirements*

Progression is subject to the University's Undergraduate Progress Regulations and Undergraduate Examination Conventions. In summary, students must pass, or be deemed to have passed, 120 credits at each Stage. Limited compensation up to 40 credits and down to a mark of 35 is possible at each Stage and there are resit opportunities, with certain restrictions.

### *Weighting of stages*

The marks from Stages 2 and 3 will contribute to the final classification of the degree. The weighting of marks contributing to the degree for Stages 2 and 3 is 1:2.

### *Common Marking Scheme*

The University employs a common marking scheme, which is specified in the Undergraduate Examination Conventions, namely

|       |                               | <b>Modules not used for degree classification</b> |
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| <40   | Fail                          | Failing   |
| 40-49 | Third Class                   | Basic   |
| 50-59 | Second Class, Second Division | Good  |
| 60-69 | Second Class, First Division  | Very Good   |
| 70+   | First Class                   | Excellent   |

### *Role of the External Examiner*

An External Examiner, a distinguished member of the subject community, is appointed by Faculty Teaching and Learning Committee, after recommendation from the Board of Studies.

The External Examiner is expected to:

- See and approve examination papers
- Moderate examination and coursework marking
- Attend the Board of Examiners
- Report to the University on the standards of the programme

In addition, information relating to the programme is provided in:

The University Prospectus (see <http://www.ncl.ac.uk/undergraduate/> or <http://www.ncl.ac.uk/postgraduate/>)

The School Brochure (contact [enquiries@ncl.ac.uk](mailto:enquiries@ncl.ac.uk))

The University Regulations (see <http://www.ncl.ac.uk/calendar/university.regs/>)

The Degree Programme Handbook (see <http://www.ncl.ac.uk/math/>)

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

## Mapping of Intended Learning Outcomes onto Curriculum/Modules

| Module  | Type       | Intended Learning Outcomes |           |       |           |
|---------|------------|----------------------------|-----------|-------|-----------|
|         |            | A                          | B         | C     | D         |
| ACE1013 | Compulsory | 3,4,7                      | 2,3       | 3     | 2,4       |
| BIO1001 | Compulsory | 3,4,7                      | 2,3,4,5   | 3     | 2,3,4     |
| BIO1005 | Compulsory | 3,7                        | 2,3       |       | 2,3       |
| BIO1006 | Compulsory | 3,4,7                      | 2,3,4,5   | 2,3   | 1,2,4     |
| MAS1041 | Core       | 1,2,4                      | 1         | 3     | 4         |
| MAS1042 | Core       | 1,2,4                      | 1         | 3     | 4         |
| MAS1141 | Core       | 1,2,4                      | 1         | 2,3   | 4         |
| MAS1142 | Core       | 1,2,4                      | 1         | 2,3   |           |
| MAS1241 | Core       | 1,2                        | 1,2       |       |           |
| MAS1242 | Core       | 1,2                        | 1,2       |       |           |
| MAS1341 | Core       | 1,2,4,6                    | 1,2,4,5   | 2,3   | 4         |
| MAS1342 | Core       | 1,2,4,6                    | 1,2,4,5   | 2,3   | 4         |
| ACE2032 | Compulsory | 3,7                        | 2,3       |       | 2,3       |
| BIO2008 | Compulsory | 3,4,6,7                    | 2,3,4,5   | 3     | 2,4       |
| BIO2009 | Compulsory | 3,6,7                      | 2,3,4,5   | 3     | 2         |
| BIO2010 | Compulsory | 3,4,6,7                    | 2,3       | 2,3   | 2,3,4     |
| MAS2104 | Compulsory | 1,2                        | 1         |       |           |
| MAS2105 | Compulsory | 1,2                        | 1         |       |           |
| MAS2223 | Compulsory | 1,2                        | 1,2       |       |           |
| MAS2224 | Compulsory | 1,2                        | 1,2       |       |           |
| MAS2302 | Compulsory | 1,2,4,6                    | 1,2,4,5   | 1,2,3 | 4         |
| MAS2304 | Compulsory | 1,2,6                      | 1,2,3,4   | 3     | 4         |
| MAS2316 | Compulsory | 1,2,6                      | 1,2,3,4   | 1,3   |           |
| MAS2317 | Compulsory | 1,2,4,6                    | 1,2,4     | 1,2   | 4         |
| BIO3002 | Compulsory | 3,5,6,7                    | 2,3       |       | 2         |
| BIO3003 |            | 3,4,5,6,7                  | 2,3,4,5   | 2,3   | 1,2,4     |
| BIO3196 | Compulsory | 3,4,5,6,7                  | 2,3,4,5   | 1,2,3 | 1,2,3,4,5 |
| MAS3103 |            | 2,4,5                      | 1         |       |           |
| MAS3106 |            | 2,4,5                      | 1         | 2,3   |           |
| MAS3111 |            | 2,4,5                      | 1         |       |           |
| MAS3121 |            | 2,4,5                      | 1         |       |           |
| MAS3210 |            | 2,4,5                      | 1,2       |       |           |
| MAS3213 |            | 2,4,5                      | 1,2       |       |           |
| MAS3214 |            | 2,4,5                      | 1,2       | 3     |           |
| MAS3216 |            | 2,4,5                      | 1,2       |       |           |
| MAS3301 | Compulsory | 2,4,5,6                    | 1,2,4,5   | 1,2,3 | 4         |
| MAS3309 |            | 2,3,4,5,6                  | 1,2,3,4,5 | 1,2,3 | 4         |
| MAS3311 | Compulsory | 2,3,4,5,6,7                | 1,2,3,4,5 | 1,2,3 | 4,5       |
| MAS3313 |            | 2,4,5,6                    | 1,2,3,4,5 | 1,2,3 | 4         |