F1BM-BEM Master of Science in Mathematical Biology, Ecology and Medicine

PROGRAMME DETAILS
Programme Code: F1BM-BEM
Department: Mathematics
Main Award: MSC - Master of Science
Full Award Title: Master of Science in Mathematical Biology, Ecology and Medicine
Level: Postgraduate Taught

LOCATION OF STUDY
Edinburgh Y Scottish Borders N Orkney N
Dubai N Malaysia N Approved Learning Partner N
Independent Distance Learners N Collaborative Learning Partner N Other N

ASSOCIATED AWARDS
Programme Code Award Title
F1BC-ZZZ PGCERT Postgraduate Certificate in Mathematical Modelling in Biology, Ecology & Medicine
F1BD-BEM PGDIP Postgraduate Diploma in Mathematical Modelling in Biology, Ecology & Medicine
F1BM-BEM MSC MSc Math Mod Eco Bio Med

ACCREDITATION
N/A

LEARNING OUTCOMES – SUBJECT MASTERY
Understanding, Knowledge and Cognitive Skills

On completion of the programme, students will be able to demonstrate:

-Extensive and detailed knowledge, and critical understanding, of central areas in mathematical biology, ecology and medicine, including at Master's level two or more specialist areas such as cancer modelling, modelling of cell movement, mathematical epidemiology and modelling of arid ecosystems;

-Knowledge and critical understanding of certain areas in mathematics applied to the life sciences within the context of a range of applications in government (e.g. environmental policy-making) and industry (e.g. the pharmaceutical sector);

-The acquisition of a range of new skills required in mathematical biology, ecology and medicine, including skills in modelling, model and solution analysis, computation and simulation;

-Awareness and understanding of current issues in mathematical biology, ecology and medicine, through teaching informed by current developments in industry, government policy and in academic research;

-Extensive knowledge and critical understanding of many of the principal theories and concepts of
contemporary mathematical biology ecology and medicine, particularly model selection and formulation, and of some of the principal theories and concepts of contemporary advanced analysis, computation and simulation, probability and statistics;

- Expertise in applying, in a practical context, many of the principal skills and techniques used in mathematical biology ecology and medicine;

- Extensive knowledge and understanding of problems in some or all of the following areas: multiscale modelling, agent-based modelling, cellular automata models, structured models, optimization, computation and simulation, dynamical systems, and two or more specialist topics in research level mathematical biology ecology and medicine.

- The ability to manage, research, assimilate knowledge in, critically assess, analyse, write and complete a high quality lengthy dissertation on a contemporary problem in research level mathematical biology, ecology or medicine over a period of approximately 10 weeks.

Scholarship, Enquiry and Research (Research Informed Learning)

On completion of the programme, students will be able to:

- Demonstrate that they have developed and can apply skills in critical analysis and evaluation of a wide range of theories, concepts, and techniques which arise in the study and practice of mathematical biology ecology and medicine including model formulation, analysis, computation and simulation;

- Demonstrate that they have developed problem solving skills;

- Identify, analyse and solve problems, and discuss issues, at a professional level, critically review existing practices in a way that will enable them to move on to research or professional careers with confidence.

LEARNING OUTCOMES – PERSONAL ABILITIES

Industrial, Commercial and Professional Practice

On completion of the programme, students will be in a strong position to move on to a research or professional environment, with sound knowledge and awareness of the nature of that environment and
the demands it will make. They will also have the necessary background and experience to enable them to be ready and able to communicate on technical and general matters with peers and senior colleagues.

**Autonomy, Accountability and Working With Others**

On completion of the programme students will be able to:

- Plan and organise their own learning through self-management and time management;
- Assess issues associated with working as part of a team;
- Communicate effectively at all levels and using a range of media;
- Critically evaluate research work and research proposals in mathematical biology ecology and medicine.

**Communication, Numeracy & Information and Communications Technology**

On completion of the programme, students will be able to:

- Demonstrate high levels of modelling, analysis, simulation and problem solving as required by PhD or other research supervisors as well as industry supervisors and/or professionals;
- Adopt a mature and professional attitude to the solution of technical problems;
- Demonstrate use of computer packages such as matlab and related software for solving problems in mathematical biology ecology and medicine;
- Present, communicate and problem solve.

**APPROACHES TO TEACHING AND LEARNING**

Teaching on the programme will be student-focused, with students encouraged to take responsibility for their own learning and development. The full-time MSc/Diploma course is offered in a traditional campus-based model. The material is organised within courses. All material is presented in a manner appropriate to postgraduate study. Parts of some lecture courses may be given jointly with final-year Honours undergraduate students. The Department uses a wide range of L&T approaches and techniques to achieve this, from traditional lectures and discussions to demanding tutorial and computer lab work. Lecturers use a range of tools from chalk/OHs to extensive use of web-based materials. The two new courses developed as part of this programme have significant components of discussion-based learning and group work. Approaches to teaching and learning are continually reviewed and developed with the aim of matching them to the abilities and experiences of our students with regard to the subject area. Specific details about teaching and learning methods are provided in the appropriate course descriptors.

**EDUCATIONAL AIMS OF THE PROGRAMME**

The principal aims of the programme are to:

- Provide intensive and high-quality education in a postgraduate context in a wide range of topics within mathematical biology ecology and medicine, and in related areas of mathematical analysis, applied mathematics, computational mathematics and probability and statistics;

- Develop detailed knowledge and understanding in these key areas;

- Cultivate skills and enable students to develop original and creative solutions to problems in these key areas;

- Provide a challenging period of study which enables students to test themselves against standards requiring intensive work and strong commitment in a demanding postgraduate environment;

- Enable students to develop detailed knowledge and critical understanding, and acquire a range of new skills, in central areas of mathematical biology ecology and medicine;

- Provide tutorial and discussion opportunities of a style and at a level appropriate for postgraduate taught study;
- Enable students to communicate and work effectively with peers and academic staff, demonstrating appropriate levels of autonomy, initiative and responsibility;

- Provide students at Master's level with the opportunity to plan and execute a significant investigation and write a dissertation requiring detailed and critical understanding in an area of study within mathematical biology ecology or medicine, and demonstrating originality.

ASSESSMENT POLICIES

The assessment policy for the programme incorporates a range of assessment types. Continuous assessment during some courses and summative assessment at the conclusion of courses both contribute to the overall assessment and will be used to formally measure achievement in specified learning outcomes. Understanding, knowledge and subject-specific skills are assessed by coursework assignments and written examinations. Approaches to assessment are continually reviewed. Specific details about methods of assessment are provided in the appropriate course descriptors.

The programme consists of two phases:

1. A taught phase, consisting of a set 8 courses studied over two semesters, as defined in the programme structure. Assessment of the taught phase is through a variety of methods including coursework and/or examination, and students must submit all elements of assessment before being permitted to progress.

2. A dissertation phase, consisting of a project dissertation report over the summer. Progression to the dissertation phase is dependent on assessed performance. To progress, students must meet the criteria set out in the programme structure document. Students meeting the required standards for Masters in the taught phase will be permitted to progress. Students meeting the required standards for Postgraduate Diploma and Postgraduate Certificate in the taught phase, but not meeting the Masters standard, will not be permitted to progress to the dissertation phase.

Any student will be able to retake the assessment of up to a maximum of 3 courses at the next opportunity, subject to payment of the appropriate fees to the University, and may be required to do so to obtain the necessary credits for completion of their programme or for progression. Students may only resit courses for which their examination grade is D, E or F. The method of reassessment for each course is specified in the appropriate course descriptor.
### Mandatory Courses

<table>
<thead>
<tr>
<th>Edinburgh</th>
<th>SBC</th>
<th>Orkney</th>
<th>Dubai</th>
<th>HWUM</th>
<th>IDL</th>
<th>Coll. Partner</th>
<th>ALP</th>
<th>Other</th>
<th>Stage</th>
<th>Semester</th>
<th>Phase</th>
<th>Course Code</th>
<th>Course Title</th>
<th>SCQF Cr</th>
<th>SCQF Lvl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>F11AM</td>
<td>Mathematical Ecology</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>F11MS</td>
<td>Modelling and Simulation in the Life Sciences</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>F11MT</td>
<td>Modelling and Tools</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>F11AN</td>
<td>Mathematical Biology and Medicine</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>F11DB</td>
<td>Data Assimilation with Applications to Biology, Ecology and Medicine</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>3</td>
<td></td>
<td>F11GM</td>
<td>Masters Project and Dissertation</td>
<td>60</td>
<td>11</td>
</tr>
</tbody>
</table>

### Optional Courses

<table>
<thead>
<tr>
<th>Edinburgh</th>
<th>SBC</th>
<th>Orkney</th>
<th>Dubai</th>
<th>HWUM</th>
<th>IDL</th>
<th>Coll. Partner</th>
<th>ALP</th>
<th>Other</th>
<th>Stage</th>
<th>Semester</th>
<th>Phase</th>
<th>Course Code</th>
<th>Course Title</th>
<th>SCQF Cr</th>
<th>SCQF Lvl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>F11MM</td>
<td>Optimisation</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>F11NC</td>
<td>Numerical ODEs</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>F71SM</td>
<td>Statistical Methods</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>F11AL</td>
<td>Applied Linear Algebra</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>F11AS</td>
<td>Dynamical Systems</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>F11MP</td>
<td>Partial Differential Equations</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>F11ND</td>
<td>Numerical Analysis (PDEs)</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>F11SS</td>
<td>Stochastic Simulation</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>F79BI</td>
<td>Bayesian Inference &amp; Computational Methods</td>
<td>15</td>
<td>9</td>
</tr>
</tbody>
</table>

**COMPOSITION NOTES (PG)**

There are four mandatory courses and four optional courses, totalling 120 credits. The mandatory courses concern specific aspects of mathematical modelling in biology ecology and medicine, while the optional courses concern either background material in mathematical analysis, numerical simulation and statistical methods, or complementary material in biological sciences and computer science. Choice of optional courses will be done in consultation with the programme director and will be subject to his/her approval. Subject to meeting the requirements below, students may proceed to the Dissertation Stage of the programme.

- **Mandatory Credits**: 60
- **Optional Credits**: 60
AWARDS, CREDITS AND CRITERIA (PG)

Awards, Credits and Levels

<table>
<thead>
<tr>
<th>Overall Credits</th>
<th>Specific Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masters Degree</td>
<td>180 SCQF credits including a minimum of 150 credits at Level 11</td>
</tr>
<tr>
<td>Postgraduate Diploma</td>
<td>120 SCQF credits including a minimum of 90 credits at Level 11</td>
</tr>
<tr>
<td>Postgraduate Certificate</td>
<td>60 SCQF credits including a minimum of 40 credits at Level 11</td>
</tr>
</tbody>
</table>

Award Requirements

<table>
<thead>
<tr>
<th>Total Course Passes</th>
<th>Overall Mark</th>
<th>Overall Grade</th>
<th>Basis of Overall Mark/Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master (Distinction)</td>
<td>8+Dissertation</td>
<td>70 A</td>
<td>Credit Weighted Average greater than or equal 70% over 8 courses at grades A-C plus a Dissertation at grade A.</td>
</tr>
<tr>
<td>Master</td>
<td>8+Dissertation</td>
<td>50 C</td>
<td>Credit Weighted Average greater than or equal 50% over 8 courses at grades A-D plus a Dissertation at minimum grade C.</td>
</tr>
<tr>
<td>Diploma (Distinction)</td>
<td>8</td>
<td>70 A</td>
<td>Credit Weighted Average greater than or equal 70% over 8 courses at grades A-C</td>
</tr>
<tr>
<td>Diploma</td>
<td>8</td>
<td>40 D</td>
<td>Credit Weighted Average greater than or equal 40% over 8 courses at grades A-E</td>
</tr>
<tr>
<td>Certificate</td>
<td>4</td>
<td>40 D</td>
<td>Credit Weighted Average greater than or equal 40% over 4 courses at grades A-E</td>
</tr>
</tbody>
</table>

DURATION OF STUDY

<table>
<thead>
<tr>
<th>IN MONTHS</th>
<th>Full-time</th>
<th>Part-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masters</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Diploma</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Certificate</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

RE-ASSESSMENT (PG)

1. A student who has been awarded a Grade E or F in a course may be re-assessed in that course. A student who has been awarded a Grade D in a course may be re-assessed in that course in order to proceed to or be eligible to receive the award of Masters.
2. A student shall be permitted only one re-assessment opportunity in a maximum of three taught courses. The opportunity for re-assessment in four or more taught courses shall be at the discretion of the Progression Board.
3. Any further re-assessment opportunities in a course will require the approval of the Postgraduate Studies Committee.
4. A student may be permitted, at the discretion of the Progression Board, to be re-assessed in the dissertation, project or other supervised research component of the course of study.

PROGRESSION TO DISSERTATION/PROJECT

In accordance with University Regulations, to progress to Masters level a minimum of Grade C is required