B321-RAI Master of Science in Robotics, Autonomous and Interactive Systems with a specialism in Marine Robotics

PROGRAMME DETAILS
Programme Code: B321-RAI
Department: Elect Electronic & Comp Eng
Main Award: MSC - Master of Science
Full Award Title: Master of Science in Robotics, Autonomous and Interactive Systems with a specialism in Marine Robotics
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
<table>
<thead>
<tr>
<th>Programme Code</th>
<th>Award</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>B321-RAI</td>
<td>MSC</td>
<td>Master of Science in Robotics, Autonomous and Interactive Systems with a specialism in Marine Robotics</td>
</tr>
<tr>
<td>B32C-RAI</td>
<td>PGCERT</td>
<td>Postgraduate Certificate in Robotics Autonomous and Interactive Systems</td>
</tr>
<tr>
<td>B32D-RAI</td>
<td>PGDIP</td>
<td>Postgraduate Diploma in Robotics Autonomous and Interactive Systems</td>
</tr>
</tbody>
</table>

ACCREDITATION
N/A

LEARNING OUTCOMES – SUBJECT MASTERY
Understanding, Knowledge and Cognitive Skills

Understanding

- Critical understanding of the principal theories, concepts and tools underpinning the design of robotic systems and related range of application domains.
- Extensive, detailed and critical understanding of at least one specialist area within this domain.
- Understanding and use of a selected principal skills, techniques and practices in the design and development of robotic systems, together with a range of specialised skills, research and investigation techniques, and practices informed by leading-edge research and development.

Knowledge

- In detail knowledge of specific areas of robotic systems and their applications including terminology, conventions, underpinning theory, techniques and practices.
- Detailed and critical knowledge of at least one area of specialism in robotic systems, incorporating awareness of current issues and research.
- Application-based knowledge and skills relating to the broad range of activities within the
domain of robotic systems technologies, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.

**Cognitive skills**

- Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of robotic systems, and in the design of projects and experimental models.
- Abilities to critically understand and apply relevant theories and technologies to developing analytical and design skills
- Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues.

**Subject-Specific skills**

- Develop detailed knowledge of diverse software, hardware and theoretical tools relevant to the production of robotic systems for existing applications and novel new applications.
- Develop a critical understanding of the applications of robotic systems techniques and systems, as well as of their scope and performance.
- Specialist and critical knowledge, understanding and skills in a number of mainstream and specialist areas within the domain of robotic systems, design, and hardware and software development.

**Scholarship, Enquiry and Research (Research Informed Learning)**

- Develop and demonstrate skills and techniques in oral and written communication with peers and academic staff or industry advisors, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.
- Develop and demonstrate critical knowledge and skills in the planning and usage of industry standard tools, programming languages and numerical techniques
- An ability to identify, formulate and resolve problems.

**LEARNING OUTCOMES – PERSONAL ABILITIES**

**Industrial, Commercial and Professional Practice**

- Demonstrate critical awareness of the current issues within the discipline, and make informed judgements with incomplete or inconsistent data, or where there are no professional/ethical codes or practices for guidance.
- Work autonomously and within project teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.
• Understand the concepts of robotic systems and technologies
• Critically discuss the technical issues associated with robotic systems in a number of application-specific domains
• Critically apply theory to the analysis and design of robotic systems

• Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of robotic systems and in the design of devices and models.
• Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain of robotic systems.

Core skills

• Develop and demonstrate skills and techniques in communication with peers and academic or industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.
• Develop and demonstrate critical knowledge and skills in the planning and usage of software tools and numerical techniques to develop, present and communicate information on projects and processes such as design, simulation, interfacing, algorithmic methods

Autonomy, Accountability and Working With Others

• Demonstrate critical awareness of the current issues within the discipline, and make informed judgements with incomplete or inconsistent data, or where there are no professional/ethical codes or practices for guidance.
• Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.

Communication, Numeracy & Information and Communications Technology

• Develop and demonstrate skills and techniques in communication, numeracy and ICT with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

APPROACHES TO TEACHING AND LEARNING

This is not a custom-based programme; it shall use existing modules already being delivered to create a new programme not available at any other UK institution. The staff/student contact in individual modules shall not differ from current deliveries.
The core element in the teaching and learning approach is the research lead, and the leadership engagement of top researchers to act as tutors to students within identified programme themes. The programme director works together with tutors to place selected students appropriate to their interests and experience. Within the programme framework, tutors then advise students on course and project selection, monitor their progress and provide independent support where possible, including independent reading. More generally, all courses use standard techniques of summative and formative assessment of student progress to provide feedback. Through project work, much learning of a practical and applied nature will be problem based.

The inclusion of modules in professional skills and research techniques is not overlooked. The programme includes training in research planning and methodology; in support both of project and employment skills.

EDUCATIONAL AIMS OF THE PROGRAMME

This is a research lead and industrially relevant programme, designed to appeal to graduates looking to develop skills in specific aspects of robotic systems that can be used in a range of end applications. The UK remains a centre for manufacturing, automotive, offshore, defence and domestic companies where design and R&D take place, attracting appropriately skilled staff is one of the main industry challenges to maintaining international competitiveness.

The primary aim of the new programme is to provide specialist postgraduate training in robotic systems and control that emphasises students' interests across a multi-disciplinary area. Graduates will gain an in-depth understanding of their chosen constituent parts of a robotic system that can be applied to many sectors, and internationally. They will also acquire, through the MSc project, experience of research relevant to industrial applications, creating graduates with cross-disciplinary understanding and an ability to operate effectively within mixed hardware/software groups.

Via on-campus delivery, students shall have to apply a mature approach to learning and organising their own study. They will learn written and oral communication skills, and mix of continuous assessment and examinations will be applied.

ASSESSMENT POLICIES

Postgraduate Taught MSc in Robotic systems will consist of the following:

- Taught phases in the schools of EPS and MACS, in total having a value of 180 SCOTCAT credits. Assessment for all modules taken will be varied and will be through continuous assessment, wholly by examination, and/or a mixture of continuous assessment and examination.
• A dissertation/project phase in one of the schools associated to a research group. The dissertation will be marked using two stages: 1) an appropriate technical research project and project dissertation report (90% of the total mark); and a poster and demonstration-based presentation (10% of the total mark).
• Students will normally complete the taught phase at which point progression to the dissertation/project phase will be dependent on assessed performance.
• Students meeting the required standards for Masters in the taught phase (set out in point 9 below) will be permitted to progress to the MSc project/dissertation phase.
• Students meeting the required standards for Postgraduate Diploma (set out in point 9 below) in the taught phase, but not meeting the Masters standard, will not be permitted to progress to the MSc project/dissertation phase.
• Students meeting the required standard for Postgraduate Certificate may be recommended to graduate at this point.
• Students failing to meet the required standards for Postgraduate Diploma and Postgraduate Certificate (set out in point 9 below) in the taught phase will not be permitted to progress to the MSc project/dissertation phase, nor will they be eligible for any award.
• In any circumstance which it deems to be exceptional the Examination Board has the discretion to permit student progress or award, irrespective of student performance against required standards and policies

1. To obtain an MSc Degree, candidates must gain 180 credits and satisfy the examiners by achieving the required standards (set out in point 9 below) in two components:
   i. Written Examinations/Continuous Assessment
   ii. MSc project/dissertation comprising two stages (see point 9 below)

2. To obtain a Postgraduate Diploma candidates must gain 120 credits from taught modules and must satisfy the examiners by achieving the required standards (see point 9 below) in one component:
   i. Written Examinations/Continuous Assessment

3. To obtain a Postgraduate Certificate candidates must gain 60 credits and must normally satisfy the examiners by achieving the required standards (see point 9 below) in one component:
   i. Written Examinations/Continuous Assessment
ii. The Examiners may specify certain modules as mandatory to achieve the award of Postgraduate Certificate, to properly reflect the nature of the course.

4. All course work must be submitted before the due date. Late submissions will only be accepted with the prior permission of the Course Director. The examiners may request the submission of unsubmitted or resubmission of unsatisfactory course work before the student is allowed to proceed.

5. In exceptional personal or medical circumstances students may be granted leave by the examiners to resit part or all of the written examinations on one occasion only and at a date decided by the examiners, as stated in Heriot-Watt university regulations. This provision is in addition to the provision that students may retake module examinations for modules in which they have achieved a grade less than D.

6. MSc project dissertations must be submitted on or before the publicised submission date. Project dissertations submitted after that date and without the prior consent of the Course Director will be assessed in accordance with the University policy of late submissions.

7. Allowance for poor performance in or non-submission of a component on medical grounds is normally made only where supported by written testimony from a professional health practitioner. Such testimony must be lodged with the Course Director prior to the Examination Board meeting.

8. Allowance for poor performance in or non-submission of a component on personal grounds is normally made only where supported by written evidence from the student or appropriate other sources. Such evidence must be lodged with the Course Director prior to the Examination Board meeting.

9. The minimum level of achievement expected in each component is an average of:

- 40% for PgDip or PgCert
- 50% for MSc Degree
- Candidates displaying exceptional merit by obtaining an average of 70% or more in a weighted average of the written examinations and dissertation may be recommended for the award of MSc with distinction, the award being subject to the discretion of the Exam Board.
- Required Standards - Candidates must achieve the following minimum levels of performance in:
  - Examination:
    - An average of 50% or better for Masters, with no module returning a result of less than E (180 credits)
    - An average of 40% or better for Postgraduate Diploma (120 credits) or Certificate (60 credits), with no module returning a result of less than E
    - Examination performance may be compensated for Masters, within a 5% range, at the discretion of the Exam Board, by dissertation performance
      - MSc Project/Dissertation
        - An average of 50% or better for Masters
        - Dissertation performance may be compensated for Masters, within a 5% range, at the discretion of the
Exam Board, by examination performance
- The Dissertation is conducted in two stages, these being:
  - Stage 1 - A technical project, written up in a dissertation report (90%)
  - Stage 2 - A Poster presentation and demonstration of the project work and results (10%)

### PROGRAMME STRUCTURE

#### Mandatory Courses

<table>
<thead>
<tr>
<th>Edinburgh</th>
<th>SBC</th>
<th>Orknay</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>X</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>B30EJ</td>
<td>Linear Control</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>X</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>B51RO</td>
<td>Robotic Mechanical Systems</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>B81EZ</td>
<td>Critical Analysis and Research Preparation</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>F21RO</td>
<td>Intelligent Robotics</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>3</td>
<td></td>
<td>B31VZ</td>
<td>MSc Project</td>
<td>60</td>
<td>11</td>
</tr>
</tbody>
</table>

#### Optional Courses

<table>
<thead>
<tr>
<th>Edinburgh</th>
<th>SBC</th>
<th>Orknay</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>X</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>B31DD</td>
<td>Embedded Systems</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>B31PB</td>
<td>Software Engineering 2</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>B51EK</td>
<td>Fluids 1</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>B51EO</td>
<td>Dynamics 1</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>F21BC</td>
<td>Biologically Inspired Computation</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>B31DE</td>
<td>Advanced Digital Electronics</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>B31DG</td>
<td>Embedded Software</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>B31SE</td>
<td>Image Processing</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>X</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>B31VW</td>
<td>Embedded Systems Design Project</td>
<td>15</td>
<td>11</td>
</tr>
</tbody>
</table>

### COMPOSITION NOTES(PG)
B321-RAI Master of Science in Robotics, Autonomous and Interactive Systems with a specialism in Marine Robotics

9 courses (including a project dissertation)
8 taught courses (4 mandatory & 4 elective according to theme)

<table>
<thead>
<tr>
<th></th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory Credits</td>
<td>60</td>
</tr>
<tr>
<td>Optional Credits</td>
<td>60</td>
</tr>
<tr>
<td>Elective Credits</td>
<td>0</td>
</tr>
<tr>
<td>Dissertation Credits</td>
<td>60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>180</strong></td>
</tr>
</tbody>
</table>

AWARDS, CREDITS AND CRITERIA(PG)

Awards, Credits and Levels

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

Award Requirements

<table>
<thead>
<tr>
<th>Award</th>
<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</td>
<td>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</td>
<td>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</td>
<td>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</td>
<td>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</td>
<td>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.
B321-RAI Master of Science in Robotics, Autonomous and Interactive Systems with a specialism in Marine Robotics

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