THE UNIVERSITY of EDINBURGH
College of Science & Engineering

Proposal for New Degree Programmes

Stage 2

Contents

THE UNIVERSITY OF EDINBURGH

PROGRAMME SPECIFICATION FOR PhD with integrated study in Robotics and Autonomous Systems[1]

PROGRAMME SPECIFICATION

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OVERVIEW	
Awarding Institution	Heriot-Watt University and University of Edinburgh
Teaching Institution	Heriot-Watt University and University of Edinburgh
Programme accredited by	n/a
Final Award	PhD
Programme Title	PhD with integrated study in Robotics and Autonomous Systems
UCAS Code	n/a
Relevant QAA Subject Benchmarking Group(s)	n/a
Postholder with overall responsibility for QA	Director of QA
Date of Production/revision	03/12/18

[1] The information contained in this Programme Specification should be used as a guide to the content of a degree programme and should not be interpreted as a contract.

EXTERNAL SUMMARY

Robots and autonomous systems (RAS) will revolutionise the world's economy and society for the foreseeable future, working for us, beside us and interacting with us. The Edinburgh Centre for Robotics (ECR) combines the University of Edinburgh with Heriot-Watt University to produce an internationally leading research institute with world class infrastructure including the National ROBOTARIUM. Our goal is to train innovation-ready robotics researchers to be part of a multi-disciplinary enterprise, requiring sound knowledge of physics (kinematics, dynamics), engineering (control, signal processing, mechanical design), computer science (algorithms for perception, planning, decision making and intelligent behaviour, software engineering), as well as allied areas ranging from biology and biomechanics to cognitive psychology.

The four-year PhD training programme will include taught courses on the underpinning theory and state of the art and research training, closely linked to career relevant skills in creativity, RI and innovation. The programme will provide cohort-based training with three hallmarks including: i) innovation training and ii) technical training combined with a foundation of iii) international experience. Students will develop an assessed learning portfolio, tailored to individual interests and needs, with access to industry and end-users as required.

EDUCATIONAL AIMS OF THE PROGRAMME

The aims of the programme are to:

- Equip students with the knowledge and skills necessary for research in the subject area of Robotics and Autonomous systems.
- Provide advanced training in the subject matter and technical skills.
- Provide a programme of study that benefits from our research strengths across the disciplines.
- Enable students to develop communication skills, initiative, professionalism, industry awareness and the ability to work independently as well as with others.

PROGRAMME OUTCOMES

Knowledge and Understanding	Students successfully completing the programme should: • Understand the wide scope of technologies, applications and approaches in robotics and autonomous systems. • Have advanced knowledge of the state of the art in research in a specialist area. • Be aware of relevant work in adjacent fields (e.g. data science and computer vision). • Understand responsible innovation and how it should guide the professional practice of RAS researchers.

Graduate Attributes: Skills and abilities in Research and Enquiry	Graduates from the programme will be able to: • Understand research methodologies at a level that permits the student to engage in independent research. • evaluate state of the art research in the field. • explore alternative approaches to a given problem and integrate different approaches. • quickly assimilate existing work of relevance to a given problem.
Graduate Attributes: Skills and abilities in Personal and Intellectual Autonomy	Graduates will have proven ability to: • review and analyse current research literature. • identify important and industrially relevant research questions. • design and evaluate research studies.
Graduate Attributes: Skills and abilities in Communication	Graduates will have proven ability to: • communicate effectively through talks, papers, and posters. • write up their research for an academic audience in the form of conference or journal papers. • communicate technical content to a range of different audiences. • work effectively as part of a research team.
Graduate Attributes: Skills and abilities in Personal Effectiveness	Graduates will have proven ability to: • acquire knowledge from a variety of sources, including the research literature, peer interaction, online materials, conferences. • work effectively on large projects, both individually and as part of a team. • organize their workload and manage their time when working independently, and complete complex tasks under deadline pressure.
Technical/practical skills	Graduates will have proven ability to: • use state of the art programming techniques to implement and evaluate methodologies.

	• work with real robotic hardware or realistic simulations of such. • design, run, and evaluate experiments to test research hypotheses

PROGRAMME STRUCTURE AND FEATURES

Year 1: Year one will focus on **up-skilling and reskilling**. On induction to the programme, each student will be assigned a supervisor, who will guide them to form their Technical Learning Portfolio based on their proposed research area, background and needs. The TLP includes a formal, assessable programme of taught coursework that includes a minimum of four courses in Year 1 drawn from both universities. It also includes one mandatory course, Autonomous Systems Research (30 credits) to build cohort cohesion and acquire fundamentals in RAS and research methods. One of the following 3 courses is also mandatory: Software Engineering Foundations (15 credits), Robotics Science and Systems (20 credits) or Probabilistic Modelling and Reasoning (20 credits). Other optional courses will be agreed between each student and their supervisor. Students will consolidate their PhD topics by providing a Research Report at the end of the first year that contains an outline of the proposed PhD, a literature review, section addressing RI aspects of their proposed topic and a 3-year plan. Progression to Year 2 is formally assessed and dependent on successfully completing all prescribed activities including this research report and assessed courses.

Year 2: Cohort cohesion is further developed and maintained in the second year via a *Group Project* and ongoing *Gateway* and *#Cauldron* events. The group project will be key to promoting and encouraging **cross- disciplinary and co-creation** approaches to working. This group project will be supervised by a mentoring academic, lasting approximately 3 months and will be based **on a real-world problem** proposed by our industrial Project Partners and other RAS stakeholders and with an industry prize for the top group. Students in Year 2 will present their individual and group work over the previous year at the annual conference. Progression to Year 3 is formally assessed and dependent on completing an annual report, assessed by an independent third party, and all prescribed activities in Year 2 including a short group report documenting their group project work.

Year 3: An important innovation in the third year is the placement, this can be with industry or with one of our academic Project Partners or both, at the discretion of the student supervisor and for a maximum of 6 months. These placements will expose students to different working environments and cultures, scientific excellence and broaden their horizons considerably. Whilst on their placement, each student will be required to report to their PhD supervisors on a fortnightly basis so that progress and any problems can be monitored and addressed. Frequent skype communications are also encouraged. A written report on the placement will be required from each student upon their return to Edinburgh and feedback will be solicited from the named host person. Students in Year 3 will present their work over the previous year at the annual conference. Progression to Year 4 is formally assessed and dependent on completing an annual report, assessed by an independent third party.

Year 4: This year will focus on finishing the PhD work but also includes further training opportunities on innovation and industry-readiness. Students in Year 4 will make *full conference length presentations* on their work at the annual conference. They will be encouraged to apply to the CDT-RAS *Innovation Fund* to develop their PhD research into pre-commercial prototype systems and they will be provided with continuing support in writing up their theses.

Entry Requirements:

Applicants should have, or expect to obtain, a first-class degree in Engineering, Computer Science or related subjects such as Maths, Physics, Computational Linguistics or Psychology with a strong technical background and/or experience in statistical research methods. A UK 2:1 honours degree, or its international equivalent, will also be considered for students with Master's degrees.

Non-native English speakers must ensure they meet the English language requirements: evidence of a SELT (Secure English Language Test) at CEFR (Common European Framework of Reference) Level B2 taken within 2 years of the date of application. The minimum requirement is IELTS 6.5 or equivalent, no individual component can be less than 6.0 in a single sitting. A degree from an English-speaking university may also be accepted in some circumstances.

Exit awards: Students whose marks or annual evaluations are unsatisfactory will be asked to leave the program, with the option of being awarded a PG certificate, a PG diploma, or an MSc by Research.

Mode of study: full time

Language of study: English

TEACHING AND LEARNING METHODS AND STRATEGIES

The courses in the taught component of this degrees is taught through lectures (typically around 16 lectures for a 10-point course, and around 32 lectures for a 20-point course). In most cases supporting materials, including notes, slides and sometimes video recordings of the lectures themselves, are made available to students on the web. Lecturers also direct students to recommended reading to supplement the lecture material.

Lectures are often supported by weekly scheduled tutorials, in which students in groups of 10–15 work through set tutorial exercises with the help of a tutor and have the opportunity to seek assistance with the course material where required. Some courses are supported by scheduled laboratory sessions or supervised drop-in laboratory time, in which they are able to seek help with the practical (e.g. programming) aspects of the course material.

The PhD research component of the degree is delivered by a team of two supervisors (principal and assistant supervisor) who hold regular supervision meetings with the student.

TEACHING AND LEARNING WORKLOAD

Please indicate the typical workload for a student on this programme for each year of study

Start Year	Time in scheduled teaching (%)	Time in independent study (%)	Time on placement (%)
Year 1	40	60	0
Year 2	0	100	0
Year 3	0	50	50
Year 4	0	100	*0*

ASSESSMENT METHODS AND STRATEGIES

For most courses, the student's achievement is assessed by academic staff via a combination of examinations and coursework assignments. (The balance is typically around 75% for the examination and 25% for coursework, with some variation between courses.) Depending on the course, examinations may be written or online, and assessed assignments may be pen-and-paper or practical programming exercises.

The final PhD will be assessed through a viva involving both external and internal examiners, as per standard University procedures

ASSESSMENT METHOD BALANCE

Please indicate the typical assessment methods for a student on this programme for each year of study. Additionally please complete the Assessment matrix.

Start Year	Assessment by written exams (%)	Assessment by practical exams (%)	Assessment by coursework (%)
Year 1	30	0	10
Year 2-4	0	0	0

CAREER OPPORTUNITIES

It is estimated that the application of advanced robotics could generate a potential worldwide economic impact of $1.7-4.5 trillion by 2025 per year by 2025 (McKinsey). Our PhD programme is well positioned to supply the UK workforce in this growing area, through strong links with industry, its extensive CDT-RAS Project Partners network and a training emphasis on 'innovation-ready' graduates. Our students have the opportunity to grow into industrial leaders of tomorrow through direct experience and company placements, as well as, through the programme's extensive support for commercialisation and start-ups.

OTHER ITEMS

None

ABOUT THE PROGRAMME

ADDITIONAL REQUIREMENTS	
PRSB Accreditations (where relevant)	*Please note accreditations awarded or planned*
Admissions requirements **Before completing this section please contact a member of the Recruitment and Admissions team for further guidance.**	*To be demonstrated through certificated or experiential learning (around 100 words). English language requirements across the accepted tests should also be included.*
To be completed by R & A Team	*Please select to confirm that a member of the R & A section have consulted on the Admissions requirements.* ☐
Work experience/work based learning opportunities	*Details of organised work experience / work based learning opportunities available during the programme (if applicable)*

CONSULTATION	
Student body	n/a

External Review/Critical Friend	The proposal is currently subject to external peer review as part of the EPSRC selection process. We will take into account any comments regarding the programme received from reviewers and during the selection interview.

ADDITIONAL DOCUMENTS	
Memorandum of Agreement (if applicable)	
Award letter (if applicable)	
DPT (please use your current template)	X

APPROVAL

Programme Title:	PhD with integrated study in Robotics and Autonomous Systems
Programme Proposer:	Dr. Michael Mistry

STAGE 1: SCHOOL BOARD OF STUDIES REVIEW AND APPROVAL

Confirmation of approval of the proposal at the School Board of Studies should be entered below.

Date of BoS:
Convener Name:
Comment and Approval (BoS Minute): *Please provide either a link to the minutes of the Board or a copy of the relevant text from the minutes.*

STAGE 2: HEAD OF SCHOOL REVIEW AND APPROVAL

Head of School: *Please print name*
Comment and Approval:
Signature:

STAGE 3: COLLEGE CURRICULUM APPROVAL BOARD REVIEW AND OUTCOME

Date of CCAB:

Convener Name:	
Stage 2 Outcome (please select as appropriate)	
Proposal approved ➧ Proceed to *New Programme Request & DPT creation*	☐
Proposal approved with conditions	☐
Proposal rejected with recommendations	☐
Proposal rejected	☐
Comment:	

DOCUMENT CHECKLIST	
Document	**Completed**
DPT	☐
Memorandum of Agreement (if applicable)	☐
Assessment Matrix	☐
Award letter (if applicable)	☐