Programme Specification

MSc Systems, Control and Signal Processing (2019-20)

This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided.

Awarding Institution	University of Southampton
Teaching Institution	University of Southampton
Mode of Study	Full-time
Duration in years	1
Accreditation details	British Computer Society (BCS)
	Institution of Engineering and Technology (IET)
Final award	Master of Science (MSc)
Name of award	Systems, Control and Signal Processing
Interim Exit awards	Postgraduate Certificate in Higher Education
	Postgraduate Diploma in Higher Education
FHEQ level of final award	Level 7
UCAS code	N/A
Programme code	6074
QAA Subject Benchmark or other external reference	
Programme Lead	Bing Chu (bc1d11)

Programme Overview

Brief outline of the programme

This programme is structured around a core of topics in signal processing, with specialisms in control and systems theory, image processing and machine learning. It is centred around the research base at Southampton and reflects leading research in ECS in the areas of signal processing, robotics, systems and control theory, image processing and machine learning.

You will develop skills that are sought after by the academic research industry, as well as the biotech, financial services, systems engineering and medical imaging industries. The high mathematical content and strong

computational-base of the programme will help you build good transferable skills in algorithmic development and programming.

Your contact hours will vary depending on your module/option choices. Full information about contact hours is provided in individual module profiles.

Learning and teaching

You will have a variety of opportunities to achieve these learning outcomes. Learning and teaching methods include: staff-led lectures, demonstrations, and seminars; directed reading; student-led seminars and presentations; technical reports, including literature searches and surveys; specification, design, analysis, implementation and verification exercises; group design exercises, presentations and reports; revision for written examinations; staff and post-graduate supervision of your research project.

Assessment

Your achievement is assessed as follows. In the case of staff-led lectures and seminars, your knowledge and understanding is assessed through written examinations and technical reports. Your understanding of research issues and your ability to locate and present technical information is assessed through student-led presentations, technical reports and written examinations, and additionally your dissertation. Your ability to design and implement signal processing systems, perhaps using novel techniques, is developed through design exercises, and additionally your research project, and assessed through technical reports and your dissertation. These reports are expected to include a rationale for your design and implementation decisions and evidence of verification activities. Students are expected to maintain log-books that demonstrate their contribution to group projects (outcome J), and these may also be assessed. The research project is assessed through your dissertation, which must include a significant literature survey to set the context for your work, a review of your progress relative to your initial plan, and a critical evaluation and reflection.

Special Features of the programme

N/A

Please note: As a research-led University, we undertake a continuous review of our programmes to ensure quality enhancement and to manage our resources. As a result, this programme may be revised during a student's period of registration; however, any revision will be balanced against the requirement that the student should receive the educational service expected. Please read our Disclaimer to see why, when and how changes may be made to a student's programme.

Programmes and major changes to programmes are approved through the University's programme validation process which is described in the University's Quality handbook.

Educational Aims of the Programme

The aims of the programme are to enable you to:

1) Develop original ideas and solve complex problems in new or unfamiliar environments, based on advanced knowledge of the principles and methodologies of systems, control and signal processing
2) Integrate knowledge and handle complexity in this area of information engineering, formulating sound judgements with incomplete or limited data
3) Communicate your conclusions and the underpinning knowledge and rationale clearly and unambiguously to specialist and non-specialist audiences
4) Develop your independent learning skills as required for continued professional development

Programme Learning Outcomes

Knowledge and Understanding

On successful completion of this programme you will have knowledge and understanding of:

A1. Scientific and technological principles underlying information engineering systems.

A2. Specialist tools and techniques used to design, analyse, implement and verify signal processing based systems.

A3. Current research issues relevant to information engineering

Teaching and Learning Methods

a. Staff-led lectures, demonstrations, and seminars.
b. Directed reading
c. Technical reports, including literature searches and surveys.
d. Staff and post-graduate supervision of your research project.

Assessment Methods

a) Written examinations
b) Technical reports
c) Student-led presentations
d) Your dissertation

Subject Specific Intellectual and Research Skills

On successful completion of this programme you will be able to:

B1. Use specialist tools and techniques to specify, design, analyse, implement and verify signal processing systems.

B2. Model and simulate the behaviour of systems and sub-systems at an appropriate level of detail.

B3. Acquire new knowledge and understanding through critical reading of research material.

B4. Apply such knowledge and understanding to specialist design problems.

Teaching and Learning Methods

a.   Staff-led lectures, demonstrations, and seminars.
b.   Directed reading
c.   Specification, design, analysis, implementation and verification exercises.
d.   Technical reports, including literature searches and surveys.
e.   Group design exercises, presentations and reports.
f.   Revision for written examinations.
g.   Staff and post-graduate supervision of your research project.

Assessment Methods

a)   Written examinations
b)   Technical reports
c)   Student-led presentations
d)   Your dissertation
e)   Group/individual design exercises

Transferable and Generic Skills

On successful completion of this programme you will be able to:

C1.   Use printed and on-line catalogues and databases to locate relevant technical information.

C2.   Present specialist technical information in written and verbal forms.

C3.   Work efficiently and effectively as a member of a design team.

C4.   Work independently on a significant research/development project.

Teaching and Learning Methods

a.   Directed reading
b.   Technical reports, including literature searches and surveys.
c.   Group design exercises, presentations and reports.
d.   Research project.

Assessment Methods

a)   Technical reports
b)   Student-led presentations
c)   Your dissertation
d)   Group/individual design exercises

Programme Structure

The programme structure table is below:

Information about pre and co-requisites is included in individual module profiles.

Where optional modules have been specified, the following is an indicative list of available optional modules, which are subject to change each academic year. Please note in some instances modules have limited spaces available.

Part I

Typical course content

This programme consists of eight taught modules, each worth 7.5 ECTS (15 CATS) credit points and an individual research project worth 30 ECTS (60 CATS) credit points. Five compulsory modules cover core material for Systems, Control and Signal Processing. Another compulsory module prepares you for your individual research project. Two optional modules can be selected to enable you to focus on either Computer Vision, Control Systems or Machine Learning.

Programme details

The programme runs over three semesters. The first semester consists of four compulsory modules. The second semester consists of two compulsory modules and two optional modules during which the students will be able to further develop their knowledge and skills in one of the three streams chosen by them. Following the first two semesters of the taught component of the programme, the students will undertake a research project which will be assessed by a degree dissertation.

It should be noted that it may not be possible to run some optional modules if the number of students registered on the module is very small. It should also be noted that optional module choice can be restricted by the University Timetable, which varies from year to year: some optional modules may clash with other optional or compulsory modules. Please be aware that many modules are shared between different cohorts; the class size depends on cohort size, which varies from year to year.

Examinations are held at the end of Semester 1 (January) and at the end of Semester 2 (May/June). Students who have successfully completed 30 ECTS (60 CATS) or 60 ECTS (120 CATS) at the level of the award may exit with a Postgraduate Certificate or Postgraduate Diploma, respectively.

The following is the normal pattern of study for a full-time student, completing the programme within 12 calendar months:

Semester 1:
Four compulsory modules. Examinations are held in January.

Semester 2:
Four modules, including two compulsory modules (ELEC6211 and ELEC6229) and two optional modules from a selected stream. Examinations are held in May/June.

Summer:
You will undertake an individual research project lasting up to 14 weeks, which is assessed by a 15,000-word dissertation.

The programme structure, including the compulsory and optional modules for each semester, is summarised below:

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SEMESTER 1

COMP6223 - compulsory
COMP6245 - compulsory
ELEC6218 - compulsory
ELEC6243 - compulsory
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SEMESTER 2 - select two optional modules from your chosen stream

ELEC6211 - compulsory
ELEC6229 - compulsory
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COMP6211 - optional  (Computer Vision stream)
ELEC6213 - optional  (Computer Vision stream)
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ELEC6212 - optional  (Control Systems stream)
ELEC6228 - optional  (Control Systems stream)
ELEC6240 - optional  (Control Systems stream)
-
COMP6208 - optional  (Machine Learning stream)
COMP6212 - optional  (Machine Learning stream)
COMP6247 - optional  (Machine Learning stream)
COMP6248 - optional  (Machine Learning stream)
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SUMMER

COMP6200 - core
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Part I Compulsory

Code	Module Title	ECTS	Type
ELEC6229	Advanced Systems and Signal Processing	7.5	Compulsory
COMP6223	Computer Vision (MSc)	7.5	Compulsory
ELEC6243	Control System Design (MSc)	7.5	Compulsory
COMP6245	Foundations of Machine Learning (MSc)	7.5	Compulsory
ELEC6211	Project Preparation	7.5	Compulsory
ELEC6218	Signal Processing	7.5	Compulsory

Part I Core

Code	Module Title	ECTS	Type
COMP6200	MSc Project	30	Core

Part I Optional

Select two semester 2 modules (15 ECTS/30 CATS) from the following streams:

Part I Optional Computer Vision stream

Code	Module Title	ECTS	Type
COMP6211	Biometrics	7.5	Optional
ELEC6213	Image Processing	7.5	Optional

Part I Optional Control Systems stream

Code	Module Title	ECTS	Type
ELEC6228	Applied Control Systems	7.5	Optional
ELEC6212	Biologically Inspired Robotics	7.5	Optional
ELEC6240	Digital Control System Design (MSc)	7.5	Optional

Part I Optional Machine Learning stream

Code	Module Title	ECTS	Type
COMP6208	Advanced Machine Learning	7.5	Optional
COMP6212	Computational Finance	7.5	Optional
COMP6248	Deep Learning	7.5	Optional
COMP6247	Reinforcement and Online Learning	7.5	Optional

Progression Requirements

The programme follows the University's regulations for *Progression, Determination and Classification of Results : Undergraduate and Integrated Masters Programmes* and *Progression, Determination and Classification of Results: Postgraduate Master's Programmes* as set out in the University Calendar: http://www.calendar.soton.ac.uk/sectionIV/sectIV-index.html

Support for student learning

There are facilities and services to support your learning some of which are accessible to students across the University and some of which will be geared more particularly to students in your particular Faculty or discipline area.

The University provides:
- library resources, including e-books, on-line journals and databases, which are comprehensive and up-to-date; together with assistance from Library staff to enable you to make the best use of these resources
- high speed access to online electronic learning resources on the Internet from dedicated PC Workstations onsite and from your own devices; laptops, smartphones and tablet PCs via the Eduroam wireless network. There is a wide range of application software available from the Student Public Workstations.
- computer accounts which will connect you to a number of learning technologies for example, the Blackboard virtual learning environment (which facilitates online learning and access to specific learning resources)
- standard ICT tools such as Email, secure filestore and calendars.
- access to key information through the MySouthampton Student Mobile Portal which delivers timetables, Module information, Locations, Tutor details, Library account, bus timetables etc. while you are on the move.
- IT support through a comprehensive website, telephone and online ticketed support and a dedicated helpdesk in the Hartley Library.
- Enabling Services offering support services and resources via a triage model to access crisis management, mental health support and counselling. Support includes daily Drop In at Highfield campus at 13.00 – 15.00 (Monday, Wednesday and Friday out of term-time) or via on-line chat on weekdays from 14.00 – 16.00. Arrangements can also be made for meetings via Skype.
- assessment and support (including specialist IT support) facilities if you have a disability, long term health problem or Specific Learning Difficulty (e.g. dyslexia).
- the Student Services Centre (SSC) to assist you with a range of general enquiries including financial matters, accommodation, exams, graduation, student visas, ID cards
- Career and Employability services, advising on job search, applications, interviews, paid work, volunteering and internship opportunities and getting the most out of your extra-curricular activities alongside your degree programme when writing your CV
- Other support that includes health services (GPs), chaplaincy (for all faiths) and 'out of hours' support for students in Halls and in the local community, (18.00-08.00)
- A Centre for Language Study, providing assistance in the development of English language and study skills for non-native speakers.

The Students' Union provides
- an academic student representation system, consisting of Course Representatives, Academic Presidents, Faculty Officers and the Vice-President Education; SUSU provides training and support for all these representatives, whose role is to represent students' views to the University.
- opportunities for extracurricular activities and volunteering
- an Advice Centre offering free and confidential advice including support if you need to make an academic appeal
- Support for student peer-to-peer groups, such as Nightline.

Associated with your programme you will be able to access:
- The tutorial system – you will have a personal tutor whom you can meet on request for advice on your programme and choice of options, or for pastoral support
- The ECS Student Advisory Team who provide additional pastoral support
- ECS computer workstations, with a range of manuals and books
- Specialist project laboratories
- Personal email account and web access, including use of on-line collaboration tools
- Helpdesk (programming advisory)
- Post-graduate demonstrators who provide additional support for your R & D projects
- A web-site for each taught unit, typically with teaching materials

Methods for evaluating the quality of teaching and learning

You will have the opportunity to have your say on the quality of the programme in the following ways:

- Completing student evaluation questionnaires for each module of the programme
- Acting as a student representative on various committees, e.g. Staff: Student Liaison Committees, Faculty Programmes Committee OR providing comments to your student representative to feed back on your behalf.

- Serving as a student representative on Faculty Scrutiny Groups for programme validation
- Taking part in programme validation meetings by joining a panel of students to meet with the Faculty Scrutiny Group

The ways in which the quality of your programme is checked, both inside and outside the University, are:

- Regular module and programme reports which are monitored by the Faculty
- Programme validation, normally every five years.
- External examiners, who produce an annual report
- Professional body accreditation/inspection
- A national research evaluation exercise (our research activity contributes directly to the quality of your learning experience)
- Institutional Review by the Quality Assurance Agency

Further details on the University's quality assurance processes are given in the *Quality Handbook.*

Career Opportunities

Graduates of the course have found employment opportunities in both the industrial and academic sectors, while many of them may continue to do PhD research. You may find numerous employment opportunities across a wide range of industrial organisations carrying out research and development related to systems and signal processing: computer games, security systems, medical imaging equipment etc. for computer vision stream; robotics, advanced manufacturing systems, aerospace systems etc. for control systems stream; financial market analysis, biological systems, data mining etc. for machine learning stream. ECS runs a dedicated careers hub which is affiliated with over 100 renowned companies like IBM, ARM, Microsoft Research, Imagination Technologies, Nvidia, Samsung and Google to name a few. Visit our careers hub for more information.

External Examiner(s) for the programme

Name: Professor Athanassios Manikas - Imperial College London

Students must not contact External Examiner(s) directly, and external examiners have been advised to refer any such communications back to the University. Students should raise any general queries about the assessment and examination process for the programme with their Course Representative, for consideration through Staff: Student Liaison Committee in the first instance, and Student representatives on Staff: Student Liaison Committees will have the opportunity to consider external examiners' reports as part of the University's quality assurance process.

External examiners do not have a direct role in determining results for individual students, and students wishing to discuss their own performance in assessment should contact their Personal Academic Tutor in the first instance.

Please note: This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided. More detailed information can be found in the programme handbook.

Appendix 1:

Students are responsible for meeting the cost of essential textbooks, and of producing such essays, assignments, laboratory reports and dissertations as are required to fulfil the academic requirements for each programme of study. In addition to this, students registered for this programme also have to pay for:

Additional Costs

Type	Details
Stationery	You will be expected to provide your own day-to-day stationary items, e.g. pens, pencils, notebooks, etc). Any specialist stationery items will be specified under the Additional Costs tab of the relevant module profile.
Textbooks	Where a module specifies core texts these should generally be available on the reserve list in the library. However due to demand, students may prefer to buy their own copies. These can be purchased from any source.
	Some modules suggest reading texts as optional background reading. The library may hold copies of such texts, or alternatively you may wish to purchase your own copies. Although not essential reading, you may benefit from the additional reading materials for the module.
Approved Calculators	Candidates may use calculators in the examination room only as specified by the University and as permitted by the rubric of individual examination papers. The University approved models are Casio FX- 570 and Casio FX-85GT Plus. These may be purchased from any source and no longer need to carry the University logo.
Printing and Photocopying Costs	In the majority of cases, coursework such as essays; projects; dissertations is likely to be submitted on line. However, there are some items where it is not possible to submit on line and students will be asked to provide a printed copy.

In some cases you'll be able to choose modules (which may have different costs associated with that module) which will change the overall cost of a programme to you. Details of such costs will be listed in the Module Profile. Please also ensure you read the section on additional costs in the University's Fees, Charges and Expenses Regulations in the University Calendar available at www.calendar.soton.ac.uk.