

Programme Specification

MSc Embedded Systems (2017-18)

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	School of Electronics and Computer Science
Mode of Study	University of Southampton
Duration in Years	Full Time
	1 Year
Accreditation details:	N/A
Final award	MSc
Name of award	Embedded Systems
Interim Exit awards	Postgraduate Diploma
FHEQ level of final award	Postgraduate Certificate
UCAS code	Master
QAA Subject Benchmark or other external reference	The UK Quality Assurance Agency's Framework for Higher Education Qualifications (FHEQ) and Subject Benchmark Statement (Computing Masters)
	The BCS Accreditation Guidelines
	The IET Learning Outcomes Handbook
	The Engineering Council UK-SPEC
Programme Leader	Dr Basel Halak
Date specification was written	05/2014
Date specification was revised	06/2015
Date Specification last updated	07/12/2017

Programme Overview

Embedded systems are electronic systems specifically built for a particular task. The applications of these can be found in all sectors of the economy: consumer electronics, car industry, media and process industries and finally banking and commerce. Examples of everyday products based on embedded systems include digital cameras, media players, ATM machines and robotic surveillance tools. These applications require a high level of skill in hardware and software engineering and an understanding of the practical realities of real systems. They also require knowledge in specialist subjects including Digital Signal Processing (DSP), communications, real time computing and digital design.

The rapid growth of tools, techniques and application in this area has led to a significant skills shortage, particularly for engineers who have both hardware and software skills.

This MSc program targets students with a first degree in electronics engineering, software engineering or computer engineering.

This course will equip the students with the key skills required to design embedded systems, namely hardware design and verification, real time computing and embedded processors, with extensive practical use of cutting-edge and industry-standard tools and methods. Students will be taken through the embedded system design process, from concept to implementation and testing.

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.

Learning and teaching methods are explained in the following sections covering programme learning outcomes.

Assessment methods are explained in the following sections covering programme learning outcomes.

Educational Aims of the Programme

The School of Electronics and Computer Science has a leading international reputation for its research. Each MSc programme offers a postgraduate education in one of the research specialisations of the School.

The programme aims to:

1. Provide you with advanced knowledge in the embedded system discipline within the field of electronic engineering and computer science;
2. Develop your research skills applicable to a career in design, development or research;
3. Stimulate your interest in the subject using a variety of learning environments.

Programme Learning Outcomes

Knowledge and Understanding

Having successfully completed this programme you will be able to:

- a) Demonstrate knowledge and understanding of the scientific and technological principles underlying your chosen specialisation;
- b) Demonstrate an ability to analyse electronics systems;
- c) Demonstrate knowledge and understanding of the design of electronic systems within your chosen specialisation;
- d) Demonstrate the ability to acquire new knowledge and understanding through the critical reading of scientific and technical books and papers.

Teaching and Learning Methods

The programme includes two modules from the third year of the MEng in Electronics, shown as level 6; the remaining modules are shared with the fourth year of the MEng in Electronics or are unique to the MSc programme and are designated as level 7. Level 6 courses are primarily taught using lectures. Level 7 courses are taught using a combination of lectures, small group teaching, directed reading and assignments. The group projects are entirely coursework. At the end of the taught part of the course you will undertake an individual project within a research group or in industry.

Assessment methods

Your knowledge and understanding of each subject will be assessed through a combination of written examinations and coursework. The proportion of examinations to coursework varies between modules. Your individual project will be assessed by dissertation.

Outcomes (a) and (b) are primarily taught and assessed using level 6 lectures and examinations. (c) and (d) are taught through level 7 courses and the individual project and assessed by coursework and the MSc dissertation.

Subject Specific Intellectual and Research Skills

The exact intellectual skills developed by the programme depend upon the degree stream and the units that you choose. Having successfully completed this programme you will, typically, be able to:

- a) Demonstrate an extensive insight into embedded system applications and requirements

- b) Specify and design embedded systems for target applications
- c) Model and simulate the behaviour of parts of systems and complete systems at an appropriate level of detail;
- d) Verify a system design by constructing and applying appropriate tests ;
- e) Find, read, understand and explain scientific publications;
- f) Undertake research into electronics design problems.

Teaching and Learning methods:

Design skills are developed through the group design projects, individual research projects and the individual project. Modelling, simulation and verification are taught in various modules and applied in coursework and design projects. Similarly, the ability to assimilate technical and scientific knowledge is developed through assignments and in the individual project.

Assessment methods:

Design skills are assessed in examination questions and in coursework. Modelling, simulation and verification form a significant aspect of the coursework in the design projects and is assessed through the delivery of a documented design. The dissertation on the individual project will normally include a significant literature survey and this is one of the criteria for assessment of the dissertation.

Outcomes (a) to (f) are taught through level 7 courses and the individual project and assessed by coursework and the dissertation.

Transferable and Generic Skills

As an existing engineering graduate, you will already be expected to have a general proficiency with IT, to be numerate and to be proficient in English. Your choice of modules will determine how and where these general skills are further developed, but typically, having successfully completed this programme you will be able to:

- a) Use conventional and electronic indexing and search methods to find technical information;
- b) Present technical information in written and verbal forms;
- c) Work as a member of a design team, managing both the overall task and your contribution to that task;
- d) Work independently on a significant research project.

Teaching and Learning Methods

A number of courses have a significant coursework element. This can range from design work through to presentations resulting from directed reading. The group design projects are intended to develop team working, project and time management skills. The individual project includes independent research, project management and report writing.

Assessment methods

Coursework is generally assessed through written reports. The group design projects are assessed continuously through logbooks and at the end by delivery of a documented design. The individual project is assessed by a dissertation of up to 15,000 words.

Outcomes (a) to (d) are taught through practical work in level 7 courses and the individual project and assessed by coursework and the dissertation.

Subject Specific Practical Skills (optional)

Having successfully completed this programme you will be able to

- a) Demonstrated a comprehensive knowledge of leading-edge EDA (Electronic Design Automation) tools and techniques for embedded systems
- b) Create models of system components and use simulation software to check your models;
- c) Use EDA tools to realise system functionality using hardware-software co-design approach
- d) Design experiments to evaluate designs and models;
- e) Write software programmes to assist and demonstrate your understanding of design concepts.

- f) Develop comprehensive verification methodologies for system functionality through hardware-software co-simulations

Teaching and Learning methods:

These skills will be developed through coursework and project work.

Assessment methods:

Machine-readable models and software will form part of the deliverable of a coursework assignment or a design project. The correct execution of these models and software will be part of the overall assessment of the assignment or project. Outcomes (a) to (f) are taught through practical work in level 7 and 6 courses and the individual project and assessed by coursework and the dissertation.

Programme Structure

Typical course content

Each MSc programme has a number of compulsory and optional modules. Most of these modules are shared with the School's Master of Engineering programmes in Electronics.

You must choose from the modules described below. Each successfully completed module is equivalent to 7.5 ECTS.

You will be expected to have completed a total equivalent to 60 ECTS for the taught components of the program.

The dissertation is equivalent to a further 30 ECTS.

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.

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

Semester 1:

Three compulsory modules and one of three optional modules

Semester 2:

Two compulsory modules and two of five optional modules

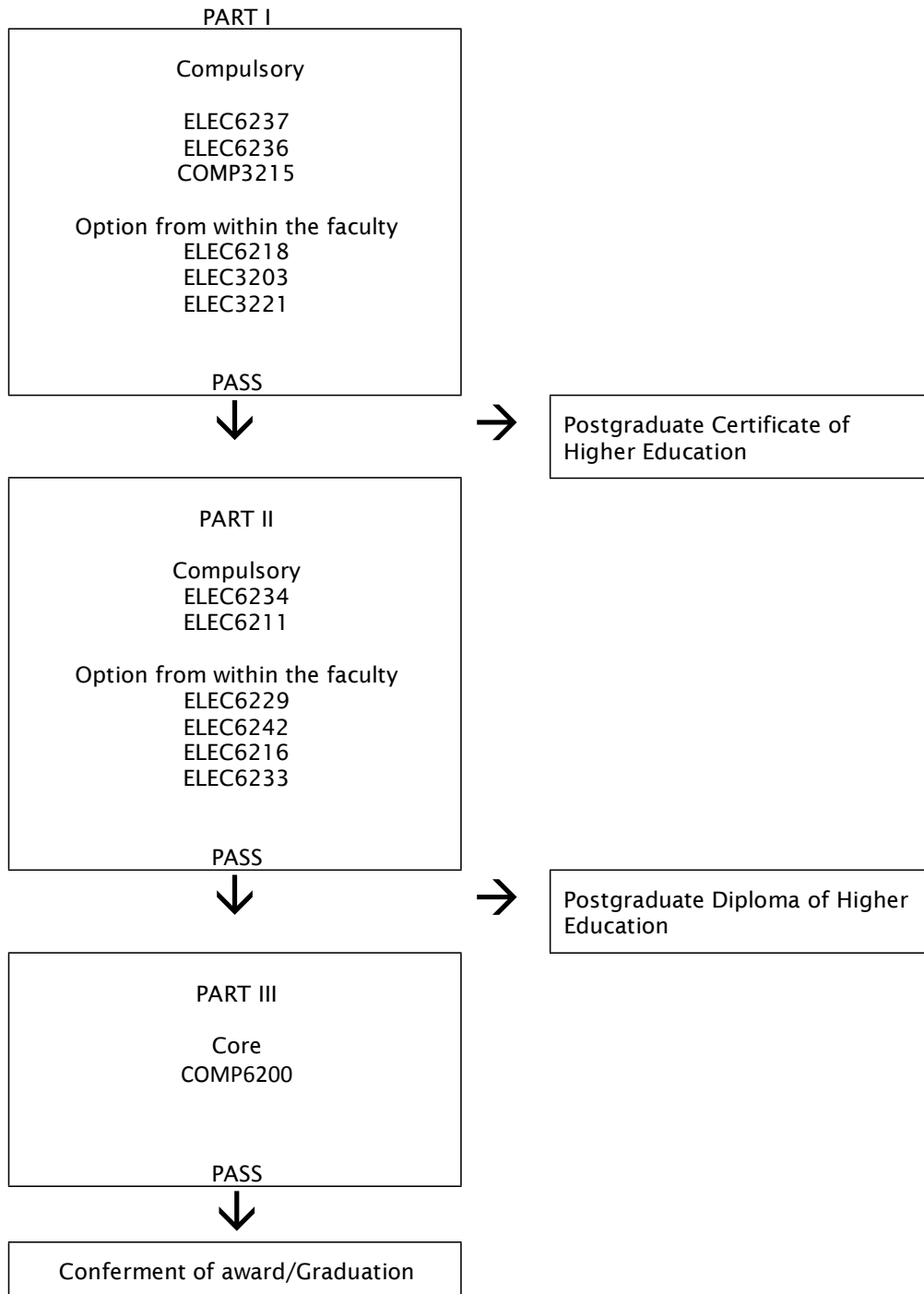
Summer/Semester 3:

Following the successful completion of the taught component of the programme, you will undertake a research project lasting 3 to 4 months, which is assessed by a 15,000 word dissertation.

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 or 60 ECTS worth of taught material may exit with a Postgraduate Certificate or Postgraduate Diploma respectively.

The diagram below shows the overall structure and exit points



Additional Costs

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. Costs that students registered for this programme typically also have to pay for are included in Appendix 2.

Programme details

The information in this SECTION is liable to change in minor ways from year to year. It is accurate at time of writing. For the latest information see the course handbook, either in courses office, or on-line at

http://www.ecs.soton.ac.uk/postgraduatetaught/postgraduate_study

Semester 1 (total of 60 credits)

Type	Code	Title	Level	Pre-requisites	ECTS	Course Work
Compulsory	ELEC6236	Digital System Design	7		7.5	10%
Compulsory	ELEC6237	Secure Hardware Design	7		7.5	100%
Compulsory	COMP3215	Real-Time Computing and Embedded Systems	6		7.5	30%
Optional	ELEC6218	Signal Processing	7		7.5	25%
Optional	ELEC3203	Digital Coding and Transmission	6		7.5	100%
Optional	ELEC 3221	Digital IC and Systems Design	6		7.5	10%

Semester 2 (total of 60 credits)

Type	Code	Title	Level	Pre-requisites	ECTS	Course Work
Compulsory	ELEC6234	Embedded Processors	7		7.5	50%
Compulsory	ELEC6211	Project Preparation	7		7.5	100%
Optional	ELEC6229	Advanced Systems and Signal Processing	7	ELEC6218	7.5	100%
Optional	ELEC6242	Cryptography	7		7.5	30%
Optional	ELEC6216	Personal Multimedia Communications	7	ELEC3203	7.5	100%
Optional	ELEC6233	Digital Systems Synthesis	7			50%

Semester 3

Core	COMP6200	MSc Project	7		30	100%
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Progression Requirements

The programme follows the University's regulations for [*Progression, Determination and Classification of Results: Undergraduate and Integrated Masters Programmes*](#) as set out in the University Calendar, and the ECS specific regulations which supplement these. The pass mark for MSc modules is 50%, and the regulations cover the progression criteria, referral, repeat, and resubmission arrangements, together with degree classification.

Intermediate exit points (where available)

You will be eligible for an interim exit award if you complete part of the programme but not all of it, as follows:

Qualification	Minimum overall credit in ECTS credits	Minimum ECTS credits required at level of award
Postgraduate Diploma	at least 60	45
Postgraduate Certificate	at least 30	20

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. Students can also access SVE (Southampton Virtual Environment), a virtual Windows University of Southampton desktop that can be accessed from personal devices such as PCs, Macs, tablets and smartphones from any location.
- 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 My Southampton Student Mobile Portal which delivers timetables, Module information, Locations, Tutor details, Library account, bus timetables etc. while you are on the move.
- Central IT support is provided through a comprehensive website, telephone and online ticketed support and a dedicated helpdesk in the Hartley Library foyer
- Enabling Services offering assessment and support (including specialist IT support) facilities if you have a disability, dyslexia, mental health issue or specific learning difficulties
- 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 Destinations, 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
- a range of personal support services : mentoring, counselling, residence support service, chaplaincy, health service
- 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:

There are systems for the support of student learning in ECS as well as available from central University facilities. You will receive a handbook with full details of course structures and module syllabuses.

In the School 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 design projects
- A web-site for each taught module, typically with teaching materials – these are also available, where appropriate, off-line on CD-ROM or as printed notes

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
- A national Research Assessment Exercise (our research activity contributes directly to the quality of your learning experience)
- Institutional Review by the Quality Assurance Agency

Criteria for admission

The University's Admissions Policy applies equally to all programmes of study. The following are the typical entry criteria to be used for selecting candidates for admission. The University's approved equivalencies for the requirements listed below will also be acceptable.

Undergraduate programmes

Qualification	Grades	Subjects required	Subjects not accepted	EPQ Alternative offer (if applicable)	Contextual Alternative offer (if applicable)
GCE A level					
GCSE					
BTEC					
International Baccalaureate					
European Baccalaureate					

Postgraduate programmes

Qualification	Grade/GPA	Subjects requirements	Specific requirements
Bachelor's degree	2:1 Honours	3-4 Electronics Modules, Circuit Design and 1-2 Programming Languages Modules	
Master's degree			

Mature applicants

Applications from mature students (over 21 years in the October of the year of entry) are welcome. Applications will be considered on an individual basis.

English Language Proficiency

Overall	Reading	Writing	Speaking	Listening
6.5	6.0	6.0	6.0	6.0

Career Opportunities

The rapid growth of tools, techniques and application in this area has led to a significant skills shortage, particularly for engineers who have both hardware and software skills.

Market analysis shows large demands for engineers with skills in embedded system design around the world especially UK, China, India, and Eastern Europe.

The demand for embedded systems engineers is expected to continue to rise in the coming years. This growth is driven by a rapidly growing global embedded system market

Southampton University, as one of the leading educational institutions, of electronics design is greatly positioned to supply the embedded system design industries with highly skilled engineers to support their growth.

This course will equip the students with the key skills required to secure employment in the area of design embedded systems. This includes hardware design and verification, real time computing and embedded processors, with extensive practical use of cutting-edge and industry-standard tools and methods. Students will be taken through the embedded system design process, from concept to implementation and testing.

External Examiners(s) for the programme

Name Dr Christos Bouganis
Institution. 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 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 (or other appropriate guide) or online at <http://www.ecs.soton.ac.uk/programmes/msc-embedded-systems>

Appendix 1:

Learning outcomes and Assessment Mapping document template

			Knowledge and Understanding				Subject Specific Intellectual and Research Skills						Transferable and Generic Skills				Subject Specific Practical Skills					
Module Type	Module Code	Module Title	a	b	c	d	a	b	c	d	e	f	a	b	c	d	a	b	c	d	e	f
Compulsory	ELEC6236	Digital System Design	x	x	x	x	x		x	x	x		x				x	x	x	x	x	x
Compulsory	ELEC6237	Secure Hardware design	x	x	x	x	x	x	x	x	x	x	x				x					
Compulsory	COMP3215	Real-Time Computing and Embedded Systems	x	x	x	x	x	x	x	x			x	x	x		x	x	x	x	x	
Optional	ELEC3221	Digital IC Design	X	X	X	X	X	X	X	X	X	X	X				X					
Optional	ELEC6218	Signal Processing	x			x	x		x	x			x	x	x		x	x		x	x	
Optional	ELEC3203	Digital Coding and Transmission	x			x	x		x	x			x	x	x		x	x		x	x	
Compulsory	ELEC6234	Embedded Processors	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Optional	ELEC6233	Digital System Synthesis	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Compulsory	ELEC6211	Project Preparation	x			x	x			x	x		x	x								x
Optional	COMP6003	Formal Design of Systems	x	x	x	x	x	x		x	x	x	x	x			x			x		
Optional	ELEC6229	Advanced Systems and Signal Processing	x	x	x	x	x	x		x	x	x	x	x	x		x	x		x	x	
Optional	ELEC6242	Cryptography	x			x	x				x		x	x						x		
Optional	ELEC6216	Personal Multimedia Communications	x			x	x	x				x	x	x			x	x		x		

[illegible]

Appendix 1:

Module Type	Module Code	Module Title	Assessment Method	
			Coursework	Exam
Compulsory	ELEC6236	Digital System Design	Design assignment 10%	2 hours. 90%
Compulsory	ELEC6237	Secure Hardware Design	Coursework 100%	
Compulsory	ELEC6241	System on Chip Design Techniques		2 hours. 100%
Compulsory	COMP3215	Real-Time Computing and Embedded Systems	Coursework 30%	2 hours. 100%
Optional	ELEC6218	Signal Processing	Coursework 25%	2 hours. 75%
Optional	ELEC3203	Digital Coding and Transmission	Coursework 100%	
Compulsory	ELEC6234	Embedded Processors	Coursework 50%	2 hours. 50%
Compulsory	ELEC6211	Project Preparation	Coursework 100%	
Optional	ELEC6229	Advanced Systems and Signal Processing	Coursework 100%	
Optional	ELEC6242	Cryptography	Coursework 20%	2 hours. 80%
Optional	ELEC6216	Personal Multimedia Communications	Coursework 100%	
Core	COMP6200	MSc Project	Couework 100%	

Additional Costs

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 typically also have to pay for the items listed in the table below.

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.

Main Item	Sub-section	PROGRAMME SPECIFIC COSTS
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.
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.
Equipment and Materials Equipment	Art Equipment and Materials: Drawing paper; painting materials; sketchbooks	
	Art Equipment and Materials: Fabric, Thread, Wool	
	Design equipment and materials:	
	Excavation equipment and materials:	
	Field Equipment and Materials:	
	Laboratory Equipment and Materials:	
	Medical Equipment and Materials: Fobwatch;	

Appendix 2:

Main Item	Sub-section	PROGRAMME SPECIFIC COSTS
	stethoscopes;	
	Music Equipment and Materials	
	Photography:	
	Recording Equipment:	
IT	Computer Discs	
	Software Licenses	
	Hardware	
Clothing	Lab Coats	
	Protective Clothing: Hard hat; safety boots; hi-viz vest/jackets;	
	Field course clothing:	
	Wet Suits?	
	Uniforms?	
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.
Fieldwork: logistical costs	Accommodation:	
	Insurance	
	Travel costs	
	Immunisation/vaccination costs	
	Other:	
Placements (including Study Abroad Programmes)	Accommodation	
	Insurance	
	Medical Insurance	
	Travel costs	
	Immunisation/vaccination costs	
	Disclosure and Barring Certificates or Clearance	
	Translation of birth certificates	
	Other	
Conference expenses	Accommodation	
	Travel	
Optional Visits (e.g. museums, galleries)		
Professional Exams		
Parking Costs		
Anything else not covered elsewhere		

Revision History

1. Update to Support and Student Learning, IT Services - June 2015
2. Update to Language Requirements - June 2015
3. Approved by ECS Education Committee - 10 June 2015
4. Update to Programme Overview (CMA Changes) – 24 August 2015
5. Update to Programme Overview (CMA Changes) – 14 September 2015
6. 2016-17 FPC Approval – 24 February 2016
7. Optional Module Viability added – 07 December 2016
8. Module structure updated – 27 February 2017
9. FPC approval 12/04/2017 – CQA Team 20 April 2017
10. FPC approval of optional module size caveat – CQA Team 07 December 2017