

## Programme Specification

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### Biomedical Engineering (Electronics) (2021-22)

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	3 Years
Accreditation details	
Final award	Bachelor of Engineering with Honours (BEng (Hons))
Name of award	Biomedical Engineering (Electronics)
Interim Exit awards	Bachelor of Engineering (BEng) Diploma of Higher Education (DipHE) Certificate of Higher Education (CertHE)
FHEQ level of final award	Level 6
UCAS code	BB90
Programme code	8794
QAA Subject Benchmark or other external reference	Engineering 2010
Programme Lead	Daniel Spencer

### Programme Overview

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#### Brief outline of the programme

New entrants 2020/21.

This programme will provide you with a detailed knowledge of electronics and biomedicine, together with the ability to apply engineering principles to medicine and healthcare. The course has a strong emphasis on new technologies in bio-sensing, bio-signal analysis, bio-control and rehabilitation, and lab-on-a-chip diagnostic systems. In the first two years you will take core and compulsory modules in electronics together with a thorough grounding in mathematics, complemented by modules covering the fundamentals in Life Science. In year two, you will apply your knowledge to design a health and wellness monitoring platform within a healthcare technologies design project. In the third year, a mixture of optional and compulsory modules together with an individual project allows you to specialise within biomedical electronic engineering.

At Southampton, we will ensure that you have a thorough grounding in a wide range of technologies. Our project work will enable you to acquire valuable skills in teamwork, project planning, time-management and presentation, applying your learning to design and build problems, and working to a brief. All of these will stand you in good stead as you move into your career. We offer outstanding facilities in our labs, and teaching is based on the latest research. This approach ensures that at the end of your studies your skills will be highly regarded by leading employers. All of our programmes have a wide range of courses and modules to choose from, enabling you to specialise and focus in depth on what really interests you.

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**

A range of learning and teaching methods are used on this programme, including:

- Staff-led lectures, demonstrations, laboratories and seminars
- Directed reading
- Student-led seminars and presentations
- Specification, design, analysis, implementation and verification exercises
- Revision for written examinations
- Staff and post-graduate supervision of your research dissertation
- Industrial placements

### **Assessment**

A range of assessment methods are used on this programme to enable students to demonstrate their achievement of the intended learning outcomes, including:

- Written examinations
- In-class tests
- Design exercises
- Programming exercises
- Oral presentations
- Written assessments, including technical reports, literature searches and surveys
- Assessed laboratories and logbook checks
- Group work exercises, presentations and reports

### **Feedback**

A range of feedback methods are used on this programme to enable students to gauge their progress in meeting the intended learning outcomes, including:

- Feedback from your personal tutor
- Written feedback for large courseworks
- Instant oral feedback on presentations, tutorials and practical laboratories
- Feedback on the overall class performance in particular modules
- Marked coursework

## **Special Features of the programme**

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### **Transfer policy**

Biomedical Electronic Engineering (BEE) has a significantly different course structure than the other electronics programmes (Electronic Engineering (EL), Electrical & Electronic Engineering (EEE), Electrical Engineering (EE), Mechatronic Engineering (EM) and Aerospace Electronic Engineering (AEE). This imposes complications upon transfers between these programmes.

Students who are thinking about transferring between BEE, AEE, EL, EEE, EE and EM are encouraged to discuss this with their academic tutors at the earliest possible opportunity. Transfers between these programmes can be

arranged at any time, at the discretion of the programme leader of the destination programme.

Similarly, students who are thinking about transferring from BEng to MEng programmes are encouraged to discuss this with their academic tutors at the earliest possible opportunity. Transfers from BEng to MEng programmes can be arranged at any time, at the discretion of the programme leader of the destination programme. Additionally, the programme leaders will guarantee transfers from BEng to MEng programmes at the end of part 2, for students that have passed that part with an overall average (before referral marks are capped) of at least 58% (without rounding up).

**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

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The aims of the programme are to: The aims of the programme are to:

- Provide you with a sound foundation and to develop the skills, knowledge, and application required for a wide range of professional engineering careers as a high quality practitioner and leader in business, engineering, research and development, and industry.
- Provide a coherent and well balanced coverage of the theory, design and practical aspects of the subject based on mathematics, science and engineering, integrated with business and management.
- Have a flexible academic structure, which is relevant and attractive not only to you, but also to staff and industry, and which is responsive to progress and development in technology and the needs of the industrial and academic communities.
- Be at the leading edge of scholarship in biomedical electronic engineering.
- Maximise the benefit of an environment in which staff are carrying out internationally competitive and leading research across all aspects of electronics and life science.
- Provide an environment which contributes towards your personal and professional development and provides a foundation for a wide range of subsequent study and lifelong learning.
- Provide a well-found learning environment with sufficient laboratories containing appropriate equipment and facilities, up-to date CAD tools, and a first class web-site, motivating you towards the practice of engineering.
- Provide a supportive pastoral environment with opportunities for you to participate in social and recreational activities.

## Programme Learning Outcomes

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Having successfully completed this programme you will be able to demonstrate knowledge and understanding of:

### Knowledge and Understanding

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

- A1. Underpinning key mathematics and science skills appropriate to biomedical electronic engineering, both

as a method for communicating results, concepts and ideas and as a tool for solving complex problems.

- A2. Underpinning principles, methodologies and concepts applicable to biomedical electronic engineering, as well as their role in historical, current, and future developments and technologies.
- A3. Practical, computational and programming skills relating to engineering, and compatible with current industrial practice.
- A4. The development and evaluation of possible solutions to engineering problems.
- A5. Major issues at the frontiers of engineering research and development, and their possible exploitation to enhance current practices.
- A6. Financial, economic, social and ethical factors of significance to biomedical engineering, including the broader obligations of engineers to society.

### **Teaching and Learning Methods**

This programme is taught mainly through Lectures and Directed Reading. Learning is reinforced through tutorials (in the first two parts), design exercises (in the first two parts), coursework assignments, and project work (both individual and in groups). Outcome A1 is largely taught by self-paced methods (worksheets and in-class tests) in parts 1 and 2. A satisfactory knowledge and understanding of outcome A1 is required to complete the modules in parts I and II. Outcomes A2, A5-A6 are reached through lectured modules with understanding developed through coursework and laboratories. A substantial body of coursework in part 2 develops outcome A3, and outcome A4 is developed through project supervisions in parts 3.

### **Assessment Methods**

Knowledge and understanding of each subject (outcomes A1-A3) are assessed mainly through written examinations. Additional forms of assessment include technical reports, seminar presentations and project reports (outcomes A4-A6).

### **Subject Specific Intellectual and Research Skills**

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

- B1. Integrate knowledge of mathematics, physical and life sciences, information technology, business context and wider engineering practice, to develop analytical and innovative solutions to engineering problems.
- B2. Apply mathematical and computer-based models to critically analyse and evaluate the extent to which designs, products and systems meet the criteria defined for their current use and future developments, taking account of the impact of new and advancing technology to enhance current practice.
- B3. Apply in an appropriate manner computer-aided tools in the design process so as to aid understanding of design trade-offs, and recognise capabilities and limitations of computer-based methods for engineering problem solving.
- B4. Recognise the professional, legal, moral, ethical, cost, aesthetic, environmental, sustainability, health and safety issues involved in the exploitation of technology and science and be guided by the adoption of appropriate professional, ethical and legal practices.

- B5. Assess technical and commercial risks, and take appropriate steps to manage those risks in the context of engineering design and solutions.
- B6. Investigate, define, characterise and solve problems through use of literature, systematic analysis and design methods and to tackle non-routine problems in creative and innovative ways.
- B7. Exercise awareness of quality systems and management in engineering; business and management practices relevant to biomedical electronic engineering enterprises.

### **Teaching and Learning Methods**

These intellectual skills are taught mainly through Course- and Project-work, and design exercises. Relevant material is also covered in Lectures and Guest Lectures. Skill B1 is developed through Group Project Work in parts 2 and 4. Skill B2 is a consistent theme in the taught technical modules in part 3. Advanced CAD tools (skill B3) are used in laboratory and project work in every part of the degree. Skills B4, B5 and B7 are covered through skills laboratories in part 1 and developed further in parts 3 and 4. Skill B6 is developed through the Individual and Group Project work in parts 2-3.

### **Assessment Methods**

In-class tests and Written Examinations (skill B1), Technical Reports (skills B2, B4 and B7), Design Exercises (skill B3), Logbook Checks (skill B4), Design Project Reports and Presentations (skills B4-B7).

### **Transferable and Generic Skills**

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

- C1. Use IT facilities including word processing, spreadsheets, browsers and search engines to find technical information.
- C2. Effectively present to audiences (orally, electronically or in writing) rational and reasoned arguments that address a given engineering problem or opportunity, including assessment of the impact of new technologies.
- C3. Work on a significant technical project both independently and as a member of a design team, managing both the overall task and your contribution to that task.
- C4. Understand the need for continuing professional development in recognition of lifelong learning.
- C5. Competently manage projects, people, resources and time.

### **Teaching and Learning Methods**

General proficiency with IT (skill C1) pervades the degree, and is not specifically taught. Presentations and report-writing (skill C2) are covered in part 1 lectures and practiced throughout the programme. Independent, and group working, and organisational skills (skills C3 and C5) are taught for, and developed by, the Individual and Group Projects. Professional development (skill C4) is covered in lectures.

## Assessment Methods

Design Exercises and Projects (both Individual and Group), Technical Reports, Project and Seminar Presentations.

## Subject Specific Practical Skills

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

- D1. Specify, design, and create electronic circuits, systems and computer software, taking account of commercial and industrial constraints.
- D2. Use CAD, simulation, design, and verification tools to aid in the design of systems, and to report and comment on results.
- D3. Use test and measurement instrumentation appropriate to the biomedical discipline including awareness of measurements accuracy and coverage.
- D4. Recognise any risks or safety aspects that may be involved in the operation of systems within a given context.
- D5. Search for information related to a design solution and present it for discussion.
- D6. Plan and safely execute practical and laboratory-based biomedical experiments.

## Teaching and Learning Methods

Skill D1 is taught and developed through Design Modules and Projects in parts 2-4. Advanced CAD tools (skill D2) are used in laboratory and project work in every part of the degree. Skills D3-D4 are covered in Lectures and Laboratory Sessions in parts 1 and 2. Skill D5 is taught through Lectures and Project Supervisions. Skill D6 is taught in laboratory sessions and project work in every part of the degree.

## Assessment Methods

Design Exercises (skills D1,D2, D5 and D6), Supervised Laboratories (skills D3,D4 and D6), Design Projects (skills D4-D6), Technical Reports and Seminar Presentations (skill D5).

## Programme Structure

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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

You will study 120 CATS points (Credit Accumulation and Transfer Scheme) equivalent to 60 European credit points (ECTS), in parts 1, 2 and 3. These credits are mainly at level 4 in the Framework for Higher Education Qualifications (FHEQ) in part 1, level 5 in part 2 and level 6 in part 3.

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.

### Part I Core

Code	Module Title	ECTS	Type
ELEC1212	Biomedical Engineering Design 2020-21	7.5	Core
ELEC1211	Biomolecular Systems 2020-21	7.5	Core
ELEC1202	Digital Systems and Microprocessors 2020-21	7.5	Core
ELEC1206	Electrical Materials and Fields 2020-21	7.5	Core
MATH1055	Mathematics for Electronic and Electrical Engineering 2020-21	7.5	Core
ELEC1203	Mechanics 2020-21	7.5	Core
ELEC1201	Programming 2020-21	7.5	Core
ELEC1213	Sensor Interfaces 2020-21	7.5	Core

## Part II

All modules are compulsory. A compulsory module is a module which must be taken by all students. Compulsory modules may be passed by compensation or by referral. Pass by compensation is the award of credit for a failed module on the basis that performance elsewhere in the part is sufficient to ensure the learning outcomes of the programme tested in that part have been met, or will be met following successful referral.

## Part II Compulsory

Code	Module Title	ECTS	Type
ELEC2216	Advanced Electronic Systems 2021-22	7.5	Compulsory
ELEC2226	Biomedical Control 2021-22	7.5	Compulsory
ELEC2221	Digital Systems and Signal Processing 2021-22	7.5	Compulsory
BIOL1025	Fundamentals of Cell Biology and Physiology 2021-22	15	Compulsory
ELEC2231	Healthcare Technology Design 2021-22	7.5	Compulsory
MATH2047	Mathematics for Electronics & Electrical Engineering Part II 2021-22	7.5	Compulsory
ELEC2230	Semiconductor Devices, Materials and Sensors 2021-22	7.5	Compulsory

## Part III

Part III: 120 CATS credit points, all at FHEQ level 6 (except for BIOL2051 and some language and broadening modules which are FHEQ level 5)

All students must take the COMP3200 Individual Project (45 CATS credits), which is core and is weighted 15 CATS credits in Semester I and 30 CATS in semester II. Students must also take COMP3219 Engineering Management and Law (15 CATS). In addition, students must take certain specified modules, up the total of 120 CATS credits.

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We recommend picking modules from one of the three following themes.

a) Sensors and diagnostics;

ELEC3226 Biosensors and Diagnostics

BIOL2051 Introduction to Neuroscience

ELEC3218 Signal and Image Processing

ELEC3201 Robotic Systems

b) Digital health

BIOL3063 Bioinformatics and Systems Biology

COMP3212: Computational Biology

COMP3222 Machine learning technologies

COMP3207 Cloud Application Development

c) Therapeutics and Prosthetics

SESM3033 Orthopaedic Biomechanics

SESG3024 Manufacturing and Materials  
SESM3028 Biomaterials  
ELEC3201: Robotic Systems

Students may pick any combination of modules from the table. Besides the modules listed in the table, a maximum of 2 other “externally taught” modules (BIOLXXXX, USOMXXXX, COMPXXXX, SESGXXXX, SESMXXXX, ENTRXXXX, FRENXXXX, GERMXXXX, LANGXXXX, LAWSXXXX MANGXXXX and MATHXXXX ) may be chosen. Students are very strongly advised to select a 30:30 credit balance between semesters. No more than two modules at FHEQ Level 5 (e.g ELEC20XX, UOSM20XX, BIOL20XX) may be taken.

Additional optional modules that can be taken include:

- BIOLXXXX modules: Modules from the Centre of Biological Sciences may be taken subject to approval by the module leaders and fulfilment of the prerequisites.
- LANGXXXX modules: A language module scheduled in the Broadening Horizons slot. The appropriate stage will be selected after diagnostic testing by the language school.
- UOSMXXXX modules: Any other module from the University’s Broadening Horizons programme. Particularly relevant modules include:  
UOSM2004 Global Health  
UOSM2027 Health Policy and Economics  
UOSM2031 Engineering Replacement Body Parts

### Part III Compulsory

Code	Module Title	ECTS	Type
COMP3219	Engineering Management and Law 2022-23	7.5	Compulsory

### Part III Core

Code	Module Title	ECTS	Type
COMP3200	Part III Individual Project 2022-23	22.5	Core

### Part III Optional

Code	Module Title	ECTS	Type
BIOL3063	Bioinformatics and Systems Biology 2022-23	7.5	Optional
SESM3028	Biomaterials 2022-23	7.5	Optional
ELEC3226	Biosensors and Diagnostics 2022-23	7.5	Optional
COMP3207	Cloud Application Development 2022-23	7.5	Optional
COMP3212	Computational Biology 2022-23	7.5	Optional

UOSM2031	Engineering Replacement Body Parts 2022-23	7.5	Optional
UOSM2004	Global Health 2022-23	7.5	Optional
COMP3222	Machine Learning Technologies 2022-23	7.5	Optional
SESG3024	Manufacturing and Materials 2022-23	7.5	Optional
SESM3033	Orthopaedic Biomechanics 2022-23	7.5	Optional
BIOL2051	Principles of Neuroscience 2022-23	7.5	Optional
ELEC3201	Robotic Systems 2022-23	7.5	Optional
ELEC3218	Signal and Image Processing 2022-23	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](#) Any exemptions or variations to the University regulations, approved by AQSC are located in [section VI of the University Calendar](#).

## 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:

- Induction – You will have an induction programme at the start of your programme. Besides covering the usual routine matters, it is especially important for you to be properly registered and to have your computer account set up, since the modules you study are supported by on-line systems. Assessment is also managed on-line, so any delay in registration could be detrimental to your studies. In addition, a diagnostic exercise helps us to assess your strengths and offer advice on how best to focus your efforts in the early stages of your studies.
- Personal tutoring – At the start of your studies, you are allocated a Personal Tutor who you will see regularly. Also there is Senior Tutoring team if your personal tutor is not available.
- Computer workstations, with a range of software, manuals and books, with early to late access through a card-lock mechanism.
- Traditional and wireless local area networks.
- Helpdesk for computer support and programming advice.
- Postgraduate demonstrators, who support programming intensive modules.
- A website with notes for every module.
- The Student Handbook.

## Methods for evaluating the quality of teaching and learning

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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, School Programmes Committee OR providing comments to your student representative to feedback 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.

Further details on the University's quality assurance processes are given in the [Quality Handbook](#).

## Career Opportunities

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Major employers worldwide are keen to employ our graduates. There is a growing demand for interdisciplinary engineers who can work in the biomedical engineering field. Finalists could also work in other industries including system development, information technology and communications in the IT sector, the general engineering sectors, and in the finance, service, communications and entertainment industries. We have strong relationships with employers, run our own Careers Hub website ([www.ecs.soton.ac.uk/careers](http://www.ecs.soton.ac.uk/careers)) and hold our own annual careers fair.

## External Examiner(s) for the programme

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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 they take 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
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.
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	<p>Where a module specifies essential (or core) texts, these should be available in the library. Where possible, primary provision will be in electronic format. However, due to demand students may prefer to buy their own copies; these can be purchased from any source.</p> <p>Some modules suggest optional additional or (background) reading texts. The library will hold copies of such texts, or alternatively you may wish to purchase your own copies.</p> <p>Although not essential reading, you may benefit from the additional reading materials for the module.</p>

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](http://www.calendar.soton.ac.uk).