Programme Specification

MSc Micro and Nanotechnology (2020-21)

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	
Final award	Master of Science (MSc)
Name of award	Micro and Nanotechnology
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	8108
QAA Subject Benchmark or other external reference	Master's Degree Characteristics 2016
Programme Lead	Maurits de Planque

Programme Overview

Brief outline of the programme

This programme outlines the micro and nanotechnology aspects of electronic engineering, with a focus on microelectromechanical systems and nanoelectronics. These technologies, for example, underpin research and development of miniaturised sensors, including the motion and position sensors in mobile phones, and of nanoscale logic and memory devices for next-generation consumer electronics and future quantum devices. The programme also addresses microfluidic technology, enabling miniaturised biodevices for point-of-care diagnostic applications, and covers the fundamentals of photonic circuits and devices.

The modules which comprise this masters degree involve state-of-the-art design, fabrication and characterisation methodologies, utilising industry-standard tools and our state-of-the-art cleanroom complex. In the taught element of the programme you can select half of your modules to suit your interest. You will also have the opportunity to prepare yourself for your individual research project with a dedicated project preparation module. The contact hours and the extent of group work will vary depending on your module choices; full information is

provided in individual module profiles.

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

The range of teaching and learning methods is explained in the following sections covering programme learning outcomes.

Assessment

The range of assessment methods used to enable students to demonstrate the achievement of intended learning outcomes is explained in the following sections.

Special Features of the programme

Southampton is recognised to be internationally leading in the areas mentioned above, and specialist modules are taught by staff involved in leading edge research. Students are therefore exposed to the most up to date thinking, current research problems, and state of the art techniques, technologies and tools.

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: 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 the microtechnology and nanotechnology aspects of electronic engineering
2) Integrate knowledge and handle complexity in this area of electronic 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

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

Knowledge and Understanding

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

A1. The scientific and engineering principles underpinning a range of micro and nanoscale technologies and the application of electronic engineering to micro and nanoscale devices.

A2. Techniques used for the fabrication of micro and nanoscale electronic devices.

A3. Methods for the characterisation and analysis of micro and nanoscale electronic systems and devices.

A4. The design and simulation of micro and nanoscale electronic systems and devices.

A5. A range of applications of micro and nano technologies, including sensors.

Teaching and Learning Methods

A1-A5: Most modules consist of a combination of lectures, small group teaching, practical work, directed reading and coursework assignments. At the end of the taught part of the course you will undertake an individual project within a research group. The MSc dissertation and several courseworks contain a literature review component. Small group teaching, including all practical work, and the individual project accommodate different learning styles. One-on-one tutorials can support full-class lectures, when required.

Assessment Methods

Testing of the knowledge base is through a combination of unseen written examinations and assessed coursework in the form of problem solving exercises, laboratory reports with literature review components, design exercises, and individual and small-group projects.

Subject Specific Intellectual and Research Skills

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

B1. Specify, design and realise electronic micro and nano devices with attention to a wide range of outcomes, including technical, practical, innovation and sustainability.

B2. Use mathematical methods to model and simulate the behaviour of micro and nanoscale electronic systems, in part or entirely, at the appropriate level of detail.

B3. Verify the functionality of a micro or nanoscale device design with an appropriate characterisation methodology.

B4. Find, select, summarise and explain literature related to micro and nanoscale electronic engineering technologies, including scientific publications, industrial documentation, standards, ethical, legal and environmental guidance.

B5. Plan and manage a research project involving an advanced and specialised micro/nanoscale system/device/methodology, using appropriate state of the art techniques/technologies/tools, to obtain, analyse and discuss scientific data.

Teaching and Learning Methods

B1-B4: Most modules consist of a combination of lectures, small group teaching, practical work including clean room, wet lab and simulation laboratories, directed reading and coursework assignments, which can include a literature review.
B4, B5: The Project Preparation module and the Individual Project itself concern the formulation of a research project. Small group teaching, including all practical work, and the individual project accommodate different learning styles. One-on-one tutorials can support full-class lectures, when required.

Assessment Methods

B1-B5: Testing of the subject specific intellectual and research skills is through a combination of unseen written examinations and assessed coursework in the form of problem solving exercises, laboratory reports with literature review components, design exercises, and individual and small-group projects.
B4: The Project Preparation module and the dissertation from the MSc Project include a significant literature survey and have assessment criteria to reflect this specifically.
B5: The Project dissertation is centrally focussed on assessing the difference aspects of research skills.

Transferable and Generic Skills

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

C1. Use conventional and electronic indexing and search methods to find technical information.

C2. Present technical information concisely in written and verbal forms to a range of audiences.

C3. Work in a pair or in a small group, managing your own contribution and the overall task.

C4. Work independently on a significant research project, managing time and risk in an effective manner.

C5. Recognise legal and ethical issues of concern to business, professional bodies and society, and follow relevant guidelines to address these issues.

Teaching and Learning Methods

A number of modules have a significant coursework element. This can range from design work through to presentations resulting from directed reading. The individual project includes independent research, project management and report writing.
C1-C3: Most modules include small group teaching, practical work with one or more lab partners, directed reading and coursework assignments with a literature review component. The Project Preparation module includes project management and the delivery of a project plan via a presentation. Small group teaching, including all practical work, and the individual project accommodate different learning styles.
C4: The individual project includes independent research and report writing.
C5: Legal, ethical and professional issues are covered in the Project Preparation module.

Assessment Methods

Coursework is generally assessed through written reports. The individual project is assessed by a dissertation of up to 15,000 words. The Project Preparation module is assessed via a literature review, as well as written and presentation versions of the project plan.

Subject Specific Practical Skills

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

D1. Use specialist tools for the design, realisation and analysis of micro and nanoscale electronic systems and devices.

Teaching and Learning Methods

D1: Most modules include practical work, ranging from clean room to wet lab to simulation laboratories. The individual project will involve one or more subject specific practical skills. Small group teaching, including all practical work, and the individual project accommodate different learning styles.

Assessment Methods

Assessment is based on coursework in the form of laboratory reports and on the MSc dissertation.

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.

Typical course content

This programme consists of eight taught modules, each worth 7.5 ECTS credits and an individual research project worth 30 ECTS credits. In semester 1, three compulsory modules cover core material for Micro and Nanotechnology. In the compulsory module Research Methods and Project Preparation, which runs over both semesters, you will undertake appropriate preparatory study for your research project and you will also examine ethical and legal issues around professional practice. In semester 2 you can choose three optional modules from a range of topics covering advanced and specialised aspects of microtechnology and nanotechnology, allowing you to tailor the structure to suit your own interests.

Programme details

There are a number of compulsory and optional taught modules. All modules are at level 7 (masters) with the exception of ELEC3202 (level 6). As there are several optional modules, students will be given generic and individual advice to help them make an appropriate selection, based on their background and interests (note for example that OPTO6011 requires prior knowledge of optical fibres). It is possible to concentrate on specific technologies: MicroElectroMechanical Systems, Nanoelectronics, Biodevices, or Optoelectronics, but this is not required.

Most of the modules are shared with Master of Engineering programmes in Electronics. 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.

In semester 1, ELEC6201, ELEC6203 and ELEC6256 are compulsory. In semester 2, ELEC6208 is compulsory.

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

Semester 1:
Three compulsory technical modules. Examinations are held in January.

Semester 2:
One compulsory technical module and three optional modules. Examinations are held in May/June.

Semester 1+2:
The Research Methods and Project Preparation module is compulsory.

Summer/Semester 3:
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

ELEC6201 - compulsory
ELEC6203 - compulsory
ELEC6256 - compulsory

SEMESTER 1 + 2:

ELEC6259 - compulsory

SEMESTER 2 - select three optional modules

ELEC6208 - compulsory
ELEC3202 - optional
ELEC6204 - optional
ELEC6206 - optional
ELEC6207 - optional
ELEC6227 - optional
OPTO6011 - optional

SUMMER

COMP6200 - core
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Part I Compulsory

Code	Module Title	ECTS	Type
ELEC6208	Bio/Micro/Nano Systems	7.5	Compulsory
ELEC6201	Microfabrication	7.5	Compulsory
ELEC6203	Microsensor Technologies	7.5	Compulsory
ELEC6256	Nanoelectronic Devices (MSc)	7.5	Compulsory
ELEC6259	Research Methods and Project Preparation	7.5	Compulsory

Part I Core

Code	Module Title	ECTS	Type
COMP6200	MSc Project	30	Core

Part I Optional

Select three semester 2 modules (22.5 ECTS/45 CATS) from the following:

Code	Module Title	ECTS	Type
ELEC3202	Green Electronics	7.5	Optional
ELEC6227	Medical Electrical and Electronic Technologies	7.5	Optional
ELEC6204	Microfluidics and Lab-on-a-Chip	7.5	Optional

ELEC6206	Nanofabrication and Microscopy	7.5	Optional
OPTO6011	Optical Fibre Sensors	7.5	Optional
ELEC6207	Quantum Devices and Technology	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.

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· 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
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· 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
· Other support that includes health services (GPs), chaplaincy (for all faiths) and 'out of hours' support for students in Halls (18.00-08.00)
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· 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 mentor system – you will have a personal mentor whom you can meet regularly for study advice, or for pastoral support
· The ECS Student Advisory Team provides additional pastoral support
· ECS computer workstations, with a range of manuals and books
· Specialist project laboratories
· Post-graduate demonstrators who provide additional support for your practical projects
· Personal email account and web access, including use of on-line collaboration tools
· Helpdesk in ECS (programming advisory)
· A web-site for each taught module, 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, 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

This programme provides an excellent platform for a career in industry or in academia. Examples of industrial sectors are the electronics/semiconductor, telecommunications, photonics, materials and packaging, biotechnology, and car and aerospace industries. Graduates from our MSc programmes are employed worldwide in leading companies at the forefront of technology. As well as for larger multinationals, many students also go on to work for small to medium enterprises, including start-ups. ECS runs a dedicated careers hub which is affiliated with over 100 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 A Manu Haddad - University of Cardiff

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	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. 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. Although not essential reading, you may benefit from the additional reading materials for the module.

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.