

# Programme Specification

---

## MSc in Space Systems Engineering 2018/19

**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	1 year
Accreditation details	Royal Aeronautical Society, Institute of Mechanical Engineers
Final award	Master of Science
Name of award	Space Systems Engineering
Interim Exit awards	Postgraduate Certificate Postgraduate Diploma
FHEQ level of final award	Level 7
UCAS code	N/A
QAA Subject Benchmark or other external reference	QAA Subject Benchmark in Engineering. QAA Qualifications and Credit Framework (QCF). Engineering Council, UK-SPEC.
Programme Coordinator	Dr Zhiwei-Hu
Date specification was written	22 <sup>nd</sup> April 2010
Date programme was validated	July 2014
Date specification last updated	August 2016

## Programme Overview

---

The multidisciplinary nature of space systems engineering requires people with a range of talents. The MSc in Space Systems Engineering incorporates the design of all the elements that make up a space mission providing a solid grounding for those seeking a career in the space industry.

The taught element of the programme consists of 8 modules totalling 60 ECTS/120 CATS and is followed by a substantial research project leading to a dissertation (30 ECTS/60 CATS). The specific educational aims are outlined in Educational Aims of the Programme, below.

### Learning and teaching

The different subject matter of the modules lends itself to different teaching and learning techniques but these include lectures, tutorials, individual and group projects and practical exercises. You are encouraged throughout to contribute your own professional experiences and thoughts to the learning of the whole class through a free exchange of ideas.

### Assessment

Testing of the knowledge base is through a combination of unseen written examinations and assessed coursework in the form of problem solving exercises, assignments, design exercises, and individual and group projects.

The assessment on the programme is undertaken through a variety of methods, enabling students to experience different ways to demonstrate their learning and understanding.

Many modules include assessed coursework assignments which require you to carry out a substantial study of selected topics, either as individuals or in groups, leading to considerable depth of understanding and specialist knowledge. Assessment is designed to show that you can rationally use taught material and have a fundamental understanding of the subject matter. Feedback on progress is given to students on all submitted work.

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 Faculty of Engineering and Physical Sciences hosts a spectrum of exciting and challenging programmes at undergraduate and postgraduate levels. Within this particular postgraduate taught (PGT) programme of study, we aim to provide you with a thorough professional knowledge of Space Systems Engineering. It has been configured for graduates, or similarly qualified individuals, with an engineering or scientific background, who desire to specialise in the area of Space Systems Engineering for further research or career-based reasons.

The MSc programme has been accredited by the Royal Aeronautical Society (RAeS) and the Institute of Mechanical Engineers (IMechE) on behalf of the Engineering Council as meeting the requirements for Further Learning for registration as a Chartered Engineer. Candidates must hold a CEng accredited BEng/BSc (Hons) undergraduate first degree to comply with full CEng registration requirements.

This programme will focus on the design of all the elements that make up a space mission. The programme uses an integrated approach to the complete design of a total space system and shows how the various component subsystems function and interface with each other.

The aims of the course are to provide:

- an advanced knowledge of Space Systems Engineering
- an understanding of the use, and an appreciation of the limitations, of computational analysis and design tools in the development of a space mission and related hardware.

Also, the course aims to

- enable you to acquire advanced knowledge and practical skills needed for a professional career in the space industry providing you with relevant specialist knowledge and skills.
- enhance your transferable skills, including critical analysis, problem solving, project management, decision making, leadership, and communication by oral, visual and/or written means.
- equip you with specialist knowledge, scientific and technical expertise and research skills for further research and/or application in the design of Space Systems.

The MSc programme provides opportunities for you to achieve and demonstrate the learning outcomes described below.

## Programme Learning Outcomes

---

The programme provides opportunities for you to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. The programme outcomes have been developed with reference to the Accrediting Institution guidelines and the UK-SPEC Degree Output Standards General and Specific Learning Outcomes.

## Knowledge and Understanding

---

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

- a) Fundamental scientific principles and concepts that underpin Space Systems Engineering;
- b) Analytical and computational tools appropriate to the design of a space mission with particular focus on the space segment;
- c) Current problems and developments in the design of spacecraft subsystems, informed by leading edge research within the field;
- d) Essential facts, concepts and principles relevant to spacecraft applications;
- e) Issues, terminology and technical background sufficient to permit study of the current research literature, and to engage in meaningful discussion with peers, about critical issues within the broader field of Space Systems Engineering.

At the PG Diploma level you are expected to reach broadly MSc-equivalent level for items (a), (b), (c) and (d), with some elements of (e).

At the PG Certificate level you are expected to reach PG Diploma level over a restricted range of topics.

### **Teaching and Learning methods**

Items (a), (b) and (c) are provided through lectures in designated common and core engineering modules (levels 6 and 7), supported through directed example questions together with coursework assignments and laboratory experiments.

Items (d) and (e) are provided through lectures and project work in modules at level 7, together with a major research project into a specific aspect of Space Systems Engineering.

Items (c), (d) and (e) are also developed through regular research seminars offered in term-time, which you are strongly encouraged to attend.

### **Assessment methods**

Your knowledge and understanding will be assessed through a combination of unseen written examinations [items (a)-(e)], problem-solving exercises [(a)-(e)], laboratory assignments [(a)-(e)], individual and group project reports [(a)-(e)] and a major research dissertation [(d), (e)].

## Subject Specific Intellectual and Research Skills

---

On successful completion of the programme, you will be able to:

- a) Solve design problems by identifying information needs and assembling information from different sources, in order to build a clear overall picture of a complex problem or situation;
- b) Evaluate different types of information critically in a variety of formats;
- c) Analyse and solve engineering problems, using appropriate tools, methods and models as necessary;
- d) Select appropriate computational methods to model engineering and design problems and critically appraise the results of such modelling;
- e) Apply creative and original thought in order to propose appropriate new design solutions to complex problems.

At the PG Diploma level you are expected to reach broadly MSc-equivalent level for skills (a), (b) and (c).

At the PG Certificate level you are expected to develop skills (b) and (c) within the limited range of subjects studied.

### **Teaching and Learning methods**

Skills (a) and (b) are acquired through your self-learning associated with taught modules, together with individual assignments/laboratory work and a group design project (Concurrent Engineering Design). A further source is provided by the research project, through its requirement that you critically appraise the state of knowledge in your selected research field.

Skill (c) is acquired through the solution of directed examples given in taught modules and in completing assignments and the group design project.

Skills (d) and (e) are acquired through your individual assignments in specified modules and the group design and individual research projects.

#### **Assessment methods**

Your intellectual skills will be assessed through unseen written examinations [(a)-(c)], directed problem-solving questions [(a)-(c)], assignments and the group design project [(a)-(e)], and the research dissertation [(d)-(e)].

### **Transferable and Generic Skills**

---

The following skills are developed progressively throughout the MSc programme. The levels attained by MSc/PG Diploma/PG Certificate students will reflect the differing length of study.

- a) Learning: independent study and skills development;
- b) Problem solving: recognition, definition, analysis and solution;
- c) Information processing (including IT skills): literature searching, abstracting documents, and collating information for the purposes of technical writing;
- d) Data manipulation (including IT skills): analysis of data, application of statistical methods, interpretation of results;
- e) Communication: oral and written presentation of information, scientific writing;
- f) Individual: critical and creative thinking, decision-making, initiative-taking, self-motivation and direction, personal responsibility and reflection, leadership;
- g) Management: safe and effective project planning and execution, time management (more highly developed for MSc through research project).

#### **Teaching and Learning methods**

Skills (a)-(b), (d)-(f) are acquired through your individual work associated with specific taught modules, including the group design project.

Skills (a)-(b), (f) are acquired through directed problem-solving exercises and your self-learning associated with taught modules, and coursework assignments set for the taught modules.

Skills (a)-(g) are acquired through your research project.

#### **Assessment methods**

Transferable and generic skills are assessed through unseen written examinations, problem-solving exercises, assignments, your group project report and your individual research dissertation.

### **Subject Specific Practical Skills**

---

During this programme, you will learn to:

- a) Use computational tools and packages effectively for the solution of engineering design problems with particular application to spacecraft systems;
- b) Use appropriate design tools and mathematical models for analysing space systems / subsystems;
- c) Conceive and conduct an appropriate design activity in order to reach research objectives;
- d) Evaluate design or analytical results and their validity;
- e) Use scientific and technical literature effectively.

#### **Teaching and Learning methods**

Skill (a) is acquired through your individual assignments and project work associated with specific taught modules.

Skill (b) is acquired through directed problem-solving exercises and your self-learning associated with taught modules, coursework assignments and your research project.

Skills (c) and (d) are acquired in core and optional modules in your course, and your research project.

Skill (e) is acquired through your research project.

#### **Assessment methods**

Practical skills are assessed through problem-solving exercises, individual- and group-project reports and your individual research dissertation.

## Programme Structure

---

The programme involves 90 ECTS/180 CATS distributed between taught, project and individual research components. The taught component consists of modules worth 60 ECTS/120 CATS credits, of which at least 45 ECTS/90 CATS are at level 7. You will take a number of compulsory modules and select the remainder from a given list of optional modules. Details of the compulsory and example optional modules are shown in Appendix 1. Any of these modules can form part of a Postgraduate Certificate, requiring at least 30 ECTS/60 CATS to be completed successfully. A Postgraduate Diploma 60 ECTS/120 CATS credits to be completed successfully. The MSc requires successful completion of 90 ECTS/180 CATS, of which 30 ECTS/60 CATS are due to the research project.

The MSc programme lasts for 12 months. The first 8 months are spent mainly on the taught component, with lectures divided into two 12-week periods (Semesters 1 and 2), with exams at the end of each semester. The final four months are spent full-time on an individual research project, for which some preparation is undertaken in Semester 2. It is important that you commence project work before the Semester 2 exams to allow yourself maximum time, especially where practical work is involved.

The MSc award depends on passing the examinations and on successful completion of a dissertation on the project.

### Typical course content

You will study a number of core and optional subjects during both semesters (see Appendix 1 for details). These provide sound preparation for the final part of the degree, the Research Project.

### Special Features of the programme

As a student of this programme you will be integrated into the Astronautics Research Group and will, for example, be encouraged to attend research seminars and guest lectures related to astronautics and spacecraft engineering. The programme includes a module (SESA6068 Concurrent Engineering Design) in which you will conduct a spacecraft design exercise as a group project activity.

This programme has been accredited by the Royal Aeronautical Society (RAeS) and the Institute of Mechanical Engineers (IMechE) on behalf of the Engineering Council as meeting the requirements for Further Learning for registration as a Chartered Engineer. Candidates must hold a CEng accredited BEng/BSc (Hons) undergraduate first degree to comply with full CEng registration requirements.

As an accredited programme in the field of aerospace engineering it qualifies for the UK Government's Aerospace MSc Bursary Scheme. For further details of this scheme please see:

<http://www.raeng.org.uk/>

### Programme details

The programme follows university guidelines for inclusivity and flexibility and provides an array of teaching and learning approaches that will enable any student who meets the entry requirements to access the curriculum and demonstrate achievement of all the intended learning outcomes.

### 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.

## Progression Requirements

The programme follows the University's regulations for Progression, Determination and Classification of Results : Standalone Masters Programmes as set out in the University Calendar (<http://www.calendar.soton.ac.uk/sectionIV/sectIV-index.html>) and in particular at <http://www.calendar.soton.ac.uk/sectionIV/progression-regs-standalonemasters.html> and <http://www.calendar.soton.ac.uk/sectionIV/credit-bearing-progs.html>

Faculty specific regulations for Standalone Masters can be found here <http://www.calendar.soton.ac.uk/sectionVIII/fee-sam.html>

## 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/CATS credits	Minimum ECTS/CATS credits required at level of award
Postgraduate Diploma	at least 60/120	45/90
Postgraduate Certificate	at least 30/60	20/40

## Programme outcomes for different exit points

Level 7	You will have shown originality in the application of knowledge, and you will understand how the boundaries of knowledge are advanced through research. You will be able to deal with complex issues both systematically and creatively, and show originality in tackling and solving problems individually and as part of a team. You will have the qualities needed for employment in circumstances requiring sound judgement, personal responsibility and initiative, in complex and unpredictable professional environments.
---------	--

## 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 Faculty or discipline area.

The University provides:

- Public workstations supporting a comprehensive range of computer packages, internet and email.
- Well stocked central library, including access to a wide range of paper and electronic journals and information search facilities.
- Counselling service.
- Two Health Centres on the main campus.
- Assistive Technology Service offering support for dyslexia and other learning differences.
- Student Services Centre.
- Disability Service.
- Adviser to overseas students.
- Language support for international students (if required).
- Academic skills support (see <http://www.academic-skills.soton.ac.uk> and the student portal at <http://www.sussed.soton.ac.uk>)
- Social and sporting facilities (mainly through the Students Union)
- Careers advice via Career Destinations (see <http://www.southampton.ac.uk/careers/>)

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.

In the Faculty you will be able to access:

- Induction programme for orientation, introduction of the programme and staff, and dissemination of materials.
- Student Coursebook, including guidance on selection of study programmes.
- Administrative and academic material on the Faculty, Programme and individual module web sites and/or Blackboard.
- A personal tutor to assist with organisational and personal matters. This important role is taken over by the project supervisor when the research project starts.
- Careers advice and dissemination of available job advertisements.
- Personal e-mail account and e-mail access to staff via University system.
- Faculty clusters of computers with relevant specialist software.
- Formal progress monitoring during research project.
- Support for international students.

## 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:

- Anonymous student evaluation questionnaires for each module of the programme.
- Student representation on the Staff-Student Liaison Committee, which typically meets two or three times per academic year.
- Meetings, individually or as a group, with the Programme External Examiner.
- University Student Experience Questionnaire

It should be noted that meetings with your personal tutor can also be used to comment on quality related issues.

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

- External examiners, who produce an annual report
- Annual review of the modules via Subject Panels and Module Co-ordinators.
- Annual appraisal of academic staff and staff development activity.
- Informal and Formal Examination Boards.
- Periodic meetings of the Faculty Industrial Advisory Board.
- Periodic accreditation by professional institutions (RAeS and IMechE)
- Periodic Programme Review by the University

### ***Taught component***

Each of the modules that make up the programme will be taught at the University of Southampton. The academic coordinator of the module (Module Lead) is responsible for ensuring appropriate content of modules and quality of delivery.

Assessment procedures for each module will be administered by the Faculty of Engineering and Physical Sciences (or the Faculty owning the specific module) in accordance with University policy.

### ***Research component***

Each research project will be supervised by a member of academic staff. A second assessor will be allocated who will normally be an academic or senior consulting engineer from within the Faculty. The supervisor and co-supervisor conduct a formal progress review with the student, normally during July.

### **External Examiner**

In accordance with standard University practice, the examination setting and marking procedures will be evaluated by the External Examiner at all stages. The External Examiner will be a senior academic from a UK University actively involved in teaching and research. He/she will serve a period of office of normally 3 years.

## **Career Opportunities**

---

This programme will prepare you well for a career in the spacecraft industry, either in the UK or abroad. Alternatively, the programme provides an excellent platform for further study leading towards a PhD in this area of research.

## **External Examiners(s) for the programme**

---

**Name** Dr Matthew Stickland

**Institution** University of Strathclyde

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 at

<http://www.southampton.ac.uk/student-services/academic-life/faculty-handbooks.page>

And at

[http://www.southampton.ac.uk/engineering/postgraduate/taught\\_courses/engineering/msc\\_aerodynamics\\_aerodynamics\\_and\\_computation.page?](http://www.southampton.ac.uk/engineering/postgraduate/taught_courses/engineering/msc_aerodynamics_aerodynamics_and_computation.page?)

### **Revision History**

- 1 Created 20 April 2010
- 2 Revised 16 December 2010
- 3 Revised 21 January 2011
- 4 Checked August 2012 - A Tatnall
- 5 Regulations updated March 2013 - D Mead
- 6 Updated to reflect new curriculum structure July 2013 - G Roberts\_CQA\_251113
- 7 Updated June 2014 (G Roberts), CQA\_DM\_130614\_prog'n regs name
- 8 CQA April 2015 addition of SESA6076
- 9 Update to Programme Overview (CMA changes) - September 2015
- 10 CQA textual updates August 2016
- 11 Module updates, textual changes March 2017
- 12 Updated to reflect 201819 version and removal of Admissions Criteria - CQA March 2018
- 13 Updated Faculty name to Faculty of Engineering and Physical Sciences July 2018



# MSc in Space Systems Engineering

## Appendix 1

### Programme Structure

---

The list below reflects the modules that are planned to be offered in 2018/19, and is subject to minor alteration from year to year. Each module has an ECTS/CATS value of 7.5 ECTS/15 CATS or 15 ECTS/30 CATS at level 6 or 7. A maximum of 15 ECTS/30 CATS can be taken at level 6.

A 7.5 ECTS/15 CATS module has a total load of 150 notional hours, typically made up of 36 lectures, laboratory work, self-learning and assessment. Some modules are assessed based solely on examinations, others involve significant project work. Syllabuses indicate the broad outline of content for each subject. Detailed elements of content may change from year to year depending on the emphasis deemed necessary by the lecturer and the need to keep modules up to date.

Over Semester 1 and 2, students must study modules totalling 60 ECTS/120 CATS, with a minimum of 45 ECTS/90 CATS credits at level 7.

#### ***Mandatory modules***

The following modules are mandatory for this theme and total 82.5 ECTS/165 CATS. All modules are level 7 except as indicated.

Module Code	Module Title	ECTS/CATS credits	Semester
FEEG6012	MSc Research Project (Core)	30/60	1&2
SESA3039	Advanced Astronautics	7.5/15	1
SESA6059	Spacecraft Structural Design	7.5/15	1
SESA6080	Concurrent Engineering Design	7.5/15	2
SESA6079	Space Systems Engineering	7.5/15	1
SESA6071	Spacecraft Propulsion	7.5/15	1
SESA6076	Spacecraft Orbital Mechanics and Control	7.5/15	2
SESA6081	Spacecraft Instrumentation	7.5/15	2

#### ***Optional modules***

Please select a total of 7.5 ECTS/15 CATS from the following lists of level 7 modules. Please bear in mind the balance of modules between the semesters (note most mandatory modules are in Semester 1).

#### **Level 6 and 7 options**

Module Code	Module Title	ECTS/CATS	Semester
FEEG6005	Applications of CFD	7.5/15	1
FEEG6006	Systems Reliability	7.5/15	1
FEEG6007	Fuel Cells, Batteries & Photovoltaic Systems I	7.5/15	1
SESA6061	Turbulence: Physics and Modelling	7.5/15	1
SESA3038	Space Environment	7.5/15	2

Note: It is possible that module prerequisites may be omitted at the discretion of the module lecturer depending on previous experience. Modules may be taken from Faculties other than the Faculty of Engineering and Physical Sciences only by prior arrangement with the Programme Coordinator.

## Appendix 2:

### 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](http://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		<p>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.</p> <p>Some modules suggest reading texts as <b>optional</b> 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.</p>
Equipment and Materials	Design equipment and materials:	Standard construction/modelling materials will be provided where appropriate, unless otherwise specified in a module profile.

Main Item	Sub-section	PROGRAMME SPECIFIC COSTS
		For customisation of designs/models calling for material other than standard construction/ modelling materials, students will bear the costs of such alternatives.
	Excavation equipment and materials:	
	Field Equipment and Materials:	<p>A number of essential items will be provided to you e.g.: field notebook(s); compass-clinometer; geological hammer; steel tape measure; map case; pocket lens (x 10); safety helmet; safety goggles; bottle of dilute hydrochloric acid. If items provided are lost replacements can be purchased from:</p> <p>However, you will need provide yourselves with a ruler; a pair of compasses; set squares; protractor; pencils (including coloured); eraser; calculator, penknife. These can be purchased from any source.</p>
	Laboratory Equipment and Materials:	
	Photography:	
	Recording Equipment:	
<b>Printing and Photocopying Costs</b>		<p>In some cases, coursework and/or projects may be submitted electronically. Where it is not possible to submit electronically students will be liable for printing costs, which are detailed in the individual Module Profile and can be found in Appendix 2.</p> <p>Reasonable expenses for travel and materials of up to £300 may be reclaimed through the Faculty Student Office. For project costs in excess of £300 students should discuss possible sources of funding with their supervisor and should not proceed with any expenditure until a further funding source has been agreed. The printing costs associated with dissertation are the responsibility of the student (FEEG2012)</p>

Main Item	Sub-section	PROGRAMME SPECIFIC COSTS
		Students are expected to cover the costs associated with the printing and binding of reports, including any drawings and graphic presentations. Two copies will need to be submitted. Depending on the quality of printing and binding chosen students can expect to pay approximately £25-30 per copy, totalling approximately £50-60 for both copies.(FEEG2012)
<b>Optional Visits (e.g. museums, galleries)</b>		Some modules may include additional optional visits. You will normally be expected to cover the cost of travel and admission, unless otherwise specified in the module profile.