

Programme Specification

Title of programme:

MSc Sustainable Energy Technologies 2019/20

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

Awarding Institution	University of Southampton
Teaching Institution	University of Southampton
Mode of study	Full time
Duration in years	1 years
Accreditation details	Accredited by IMechE as meeting the requirements for Further Learning for a Chartered Engineer (CEng) candidate who has a partial CEng undergraduate first degree
Final award	Master of Science
Name of award	Sustainable Energy Technologies (3878)
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	Engineering 2010, Engineering Council UK-SPEC, Joint Board of Moderators
Programme Coordinator	Dr. Carlos Ponce De Leon Albarran
Date specification was written	November 2005 (K.H. Luo)
Date Programme was validated	April 2019
Date specification last updated	April 2019

Programme Overview

Brief outline of the programme

This programme aims to provide science or engineering graduates from a diversity of backgrounds with an academically challenging exposure to modern energy technologies for sustainable developments. The School of Engineering has strengths in a broad range of areas in energy research, including photovoltaics, fuel cells, energy storage and batteries, combustion, electrical power systems, wind, wave and tidal energy. The research carried out by academic staff provides direct input into a challenging and stimulating teaching programme and student research projects.

The programme is accredited by the Institution of Mechanical Engineers and meets the further learning requirements to become a Chartered Civil Engineer.

Learning and teaching

You are encouraged from an early stage to supplement and consolidate your understanding and knowledge by independent study. The MSc uses a broad range of learning and teaching methods. In a classroom environment these include lectures, short period breakout group tasks, interactive discussions and workshops. The 'Democratisation of Energy, SESG6041' and 'Eling Tide Mill, SESG6041' are good examples.

Fieldtrips provide real world insight, enabling students to translate concepts discussed in lectures to case study sites. Examples include, Fawley Power Station (SESG6041, Intro Module), Eling Tide Mill (SESG6041, Intro Module), BRE Innovation Park (CENV6148)

Assessment

Testing of the knowledge base and development of skills is through a combination of unseen written examinations and assessed coursework in the form of problem solving exercises, laboratory reports, design exercises, essays and individual projects.

Assessment methods are a mix of exams and coursework (LO EA6M, EA5M, EA7M) balanced between individual and group work. Exams enable students to demonstrate a comprehensive understanding of the scientific principles (LO SM7M). Questions are a mix of shorter problems assessing core understanding (LO SM7M, SM9M) and longer, open ended tasks where students have the ability to demonstrate a deeper understanding and critical thinking (LO SM8M).

The ability of students to present their work is assessed through poster presentations and individual and group formal presentations / reports (LO P11m, G1, G2, G3m, G4). Group work alongside the dissertation assesses management and research analysis skills (LO EA7M, D9M, D10M, D11M). Engineering practice is assessed through group work on specific briefs such as the Tide Mill and 2 countries to 80% renewables tasks (LO P9m, P10m, P11m). Sustainability and ethical practice and general skills are assessed throughout the programme, driven by the brief of numerous courseworks and the dissertation study (LO EL8M, EL9M, EL10M, EL11M, EL12M, EL13M, G1, G2, G3m, G4).

Special Features of the programme

There are a number of special features to the programme aimed at building a cohort identity, supporting students, particularly international, and improving the student experience and learning opportunity. These include:

1. Induction week activities, including a group outdoor activity aimed at promoting interaction between the students on the MSc Energy and Sustainability. Photo Challenge on day 1 of the introduction module (SESG6041).
2. This programme includes a number of workshops and field trips. These include the 3-day 'Democratisation of Energy' workshop where the challenges of delivering energy policy in terms of fairness, acceptability and cost are explored. Large group work tasks such as the 80% renewables by 2040 study for two countries enable students to apply and extend their knowledge to solve complex, multi-disciplinary problems.

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:

- Provide you with a sound understanding of the fundamental principles, methods, analysis and synthesis in engineering design and applications appropriate to Sustainable Energy Technologies.
- Provide you with a range of specialist modules integrated within the structured learning environment, reflecting the internationally-renowned research expertise within the School, in order to broaden and deepen your educational experience.
- Enable your career pathway towards chartered engineer status.
- Offer you a degree structure that is relevant to industry and responsive to changes in technology and the needs of the community.
- Provide you with a supportive and intellectually stimulating environment that encourages an attitude of independent learning and enquiry, and fosters an ethos of lifetime learning and professional development.
- Offer you a choice of research projects which are supported by the research activities within the Faculty and stimulate individual innovation, self-assessment and teamwork skills required in engineering.
- Afford you the opportunity of applying theoretical knowledge gained on the programme through a substantial piece of research (dissertation).

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 of learning: science and mathematics; engineering analysis; design; economic, legal, social, ethical and environmental context; engineering practice; and additional general skills. The programme learning outcomes have been developed with reference to the Subject Benchmark Statement for engineering (<https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/sbs-engineering-15.pdf>) which is aligned with the Engineering Council publication Accreditation of Higher Education Programmes: UK Standard for Professional Engineering Competence (third edition) ([https://www.engc.org.uk/engcdocuments/internet/Website/Accreditation%20of%20Higher%20Education%20Programmes%20third%20edition%20\(1\).pdf](https://www.engc.org.uk/engcdocuments/internet/Website/Accreditation%20of%20Higher%20Education%20Programmes%20third%20edition%20(1).pdf))

Learning outcomes listed are AHEP 3 Learning Outcomes: Technical and 'Non-Technical' MSc programmes which provide further learning (FL) to partly meet the educational requirement for CEng.

Science and mathematics (SM) Engineering is underpinned by science and mathematics, and other associated disciplines, as defined by the relevant professional engineering institution(s). The main science and mathematical abilities will have been developed in an accredited engineering undergraduate programme. Masters graduates will therefore need additionally:	
SM7M	A comprehensive understanding of the relevant scientific principles of the specialisation
SM8M	A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation engineering
SM9M	Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.
Engineering Analysis (EA) Engineering analysis involves the application of engineering concepts and tools to the solution of engineering problems. The main engineering analysis abilities will have been developed in an accredited engineering undergraduate programme. Masters graduates will therefore need additionally:	
EA6M	Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations
EA5M	Ability to use fundamental knowledge to investigate new and emerging technologies
EA7M	Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods
Design (D) Design at this level is the creation and development of an economically viable product, process or system to meet a defined need. It involves significant technical and intellectual challenges and can be used to integrate all engineering understanding, knowledge and skills to the solution of real and complex problems. The main design abilities will have been developed in an accredited engineering undergraduate programme. Masters graduates will need additionally:	
D9M	Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies
D10M	Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations
D11M	Ability to generate an innovative design for products, systems, components or processes to fulfil new needs
Economic, legal, social, ethical and environmental context (EL) Engineering activity can have impacts on the environment, on commerce, on society and on individuals. Graduates therefore need the skills to manage their activities and to be aware of the various legal and ethical constraints under which they are expected to operate, including:	
EL8M	Awareness of the need for a high level of professional and ethical conduct in engineering
EL9M	Awareness that engineers need to take account of the commercial and social contexts in which they operate

EL10M	Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation
EL11M	Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate
EL12M	Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation
EL13M	Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk
Engineering Practice (P)	
P12M	Advanced level knowledge and understanding of a wide range of engineering materials and components
P9m	A thorough understanding of current practice and its limitations, and some appreciation of likely new developments
P10m	Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints
P11m	Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader
Additional general skills (G)	
Graduates must have developed transferable skills, additional to those set out in the other learning outcomes, that will be of value in a wide range of situations, including the ability to:	
G1	Apply their skills in problem solving, communication, information retrieval, working with others, and the effective use of general IT facilities
G2	Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
G3m	Monitor and adjust a personal programme of work on an on-going basis
G4	Exercise initiative and personal responsibility, which may be as a team member or leader
Some of the programme learning outcomes (indicated with (m)) correspond to AHEP Learning Outcomes: CEng (full) FHEQ Level 7) and are partially met during the programme. Programme learning outcomes (indicated with (M)) correspond to AHEP Learning Outcomes: CEng (full) FHEQ Level 7) are fully met during the programme. See http://www.engab.org.uk/media/186353/EAB%20Form%20ACC2%20Appendix%20B%20-%20Masters%20other%20than%20Integrated%20Masters.%20and%20EngD%20Learning%20Outcomes%20(AHEP%203rd%20edition).pdf	

Knowledge and Understanding

Having successfully completed this programme you will be able to demonstrate:

- comprehensive understanding of the relevant scientific principles of renewable and fossil fuel electricity generation. Fundamentals of solar, wave, tidal and nuclear energy alongside energy storage. **SM1M**
- critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of energy storage technologies and their linkage to renewables. **SM4M**
- understanding of concepts relevant to energy and sustainability, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects. **SM6M**
- awareness of the need for a high level of professional and ethical conduct in engineering **EL1M**
- awareness that engineers need to take account of the commercial and social contexts in which they operate. **EL2M**
- knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of sustainable development. **EL3M**
- awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate. **EL4M**
- awareness of relevant regulatory requirements governing engineering activities in the context of sustainable development and climate change. **EL5M**
- awareness of and ability to make general evaluations of risk issues in the context of renewable energy technologies, including health & safety, environmental and commercial risk. **EL6M**
- advanced level knowledge and understanding of a wide range of engineering materials and components. **P2M**
- a thorough understanding of current energy storage technologies, practice and its limitations, and some appreciation of likely new developments. **P9M**

- understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader. **P11M**

Subject Specific Intellectual and Research Skills

Having successfully completed this programme you will be able to demonstrate:

- ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations. **EA3M**
- ability to use fundamental knowledge to investigate new and emerging technologies. **EA5M**
- ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods. **EA6M**

Transferable and Generic Skills

Having successfully completed this programme you will be able to:

- apply your skills in problem solving, communication, information retrieval, working with others, and the effective use of general IT facilities. **G1M**
- plan self-learning and improve your performance, as the foundation for lifelong learning/CPD. **G2M**
- monitor and adjust a personal programme of work on an on-going basis. **G3M**
- exercise initiative and personal responsibility, as a team member or leader. **G4M**

Subject Specific Practical Skills

Having successfully completed this programme you will be able:

- apply engineering techniques taking account of a range of commercial and industrial constraints. **P10M**

Disciplinary Specific Learning Outcomes

Having successfully completed this programme you will be able:

- demonstrate knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies. **D3M**
- demonstrate knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations. **D7M**
- ability to generate an innovative design for products, systems, components or processes to fulfil new needs. **D8M**
- balance economic, social and environmental drivers to develop a sustainable solution to a future energy scenario for a country
- analyse an energy based problem and develop a solution which meets the sustainability challenges of a site or country.
- analyse energy storage options in a renewable energy context
- choose appropriate energy storage options based on renewable energy and load profile contexts.
- Detailed knowledge of the fundamentals of wind, wave, solar and tidal energy

Programme Structure

The University uses the European Credit Transfer Scheme (ECTS) to indicate the approximate amount of time a typical student can expect to spend in order to complete successfully a given module or programme, where 1 ECTS indicates around 20 nominal hours of study. Previously, Credit Accumulation and Transfer Scheme (CATS) points were used for this purpose where 1 CATS credit was 10 nominal hours of study. The University credit accumulation and transfer scheme is detailed at <http://www.calendar.soton.ac.uk/sectionIV/cats.html>.

The teaching is structured on a semester pattern. You study modules comprising 90 ECTS (180 CATS). The course is only available full-time.

In addition to the final award, there are the following exit points:

- Postgraduate Certificate of Higher education, following successful completion of 30 ECTS (60 CATS).
- Postgraduate Diploma of Higher education, following successful completion of 60 ECTS (120 CATS).

Each module is a self-contained part of the programme of study and carries a credit rating. The syllabus and assessment related to each module is detailed in the associated module profile.

The Programme Structure is outlined in Appendix 1. In Appendix 2 the modules contributing to meeting the different programme learning outcomes are listed.

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

Typical course content

In addition to the research project you will undertake 8 taught modules from the Sustainable Energy Technology programme catalogue.

Progression Requirements

The programme follows the University's regulations for [Progression, Determination and Classification of Results: Postgraduate Master's Programmes](https://www.southampton.ac.uk/calendar/sectioniv/index.page) as set out in the University Calendar
<https://www.southampton.ac.uk/calendar/sectioniv/index.page>

Faculty specific regulations for Standalone Masters can be found here:

<https://www.southampton.ac.uk/calendar/sectionvi/feps.page>

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	60	45
Postgraduate Certificate	30	20

Programme outcomes for different exit points

Level 7 (MSc)	Much of the study undertaken at Masters level reflects research at the forefront of Civil Engineering. 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.
PGDip	You will have attained knowledge of research being undertaken by academic staff at the forefront of Civil Engineering. You will have shown that you are capable of applying knowledge to solve problems, 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 be able to contribute to solving problems individually and as part of a team. You will have the qualities needed for employment in circumstances requiring sound judgement and personal responsibility under the guidance of others, in complex and unpredictable professional environments.

PGCert	You will have been exposed to research being undertaken by academic staff at the forefront of Civil Engineering. You will have gained experience in applying knowledge to solve problems, and you will understand how the boundaries of knowledge are advanced through research. You will be able to deal with complex issues by following existing procedures, and will be able to contribute to solving problems individually and as part of a team. You will have some of the qualities needed for employment in circumstances requiring sound judgement and personal responsibility under the guidance of others, in complex and unpredictable professional environments.
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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. There is a wide range of online training and workshops available to support writing, study skills, IT and maths. The Academic skills hub holds several workshops every week day to support students.
- 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 MySouthampton 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 through a comprehensive website, telephone and online ticketed support and a dedicated helpdesk in the Hartley Library.
- 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 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.
- 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.

In the School of Engineering and your Discipline you will be able to access:

- Introductory sessions for the programme.
- Library information retrieval seminar.

- Engineering Development and Manufacturing Centre (EDMC) equipped with a range of workshop equipment, CAD/CAM.
- Engineering specific software.
- Personal academic tutors to assist you with personal problems and to advise on academic issues.
- Access to academic staff through an open door policy as well as timetabled tutor meetings, appointment system and e-mail.
- Research seminars and invited lectures.
- School Student Office for the administration of your programme.

Methods for evaluating the quality of teaching and learning

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

- Anonymous evaluation questionnaires for each module of the programme.
- Acting as or represented by Student Representatives on the staff-student liaison committee. You are also represented on the School Programmes Committee and Faculty Education Committee.
- Meetings, individually or as group, with programme external examiner.

It should be noted that meetings with personal academic 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:

- Evaluation for each module of the programme based on your feedback from evaluation questionnaires and carried out by lecturer(s) involved in the module and a colleague acting as advisor.
- A discipline specific Education Board which convenes several times a year to consider the quality of delivery of each module of your programme.
- Moderation of examination papers, coursework and projects, both internally and externally.
- Comments by external examiners, who produce an annual report.
- Annual examiners' meetings and Boards of Examiners.
- Annual programme and module reviews considering your feedback from all sources, feedback from Education Boards, external examiners and other bodies and student performance in assessment.
- Periodic meetings of the Civil Engineering Industrial Advisory Board.
- Response to results from the National Student Survey.
- Accreditation by professional institutions.
- Programme Revalidation by the University at least every 5 years.

Note that quality assurance of part of the programme taken abroad, where applicable, is subject to the quality procedures of the relevant institutions. These procedures are subject to periodic monitoring by members of staff of the Faculty of Engineering and Physical Sciences.

Career Opportunities

Student graduating from our MSc degrees obtain employment as graduate engineers with many leading employers both consultants and contractors and also regulatory authorities and local authorities. Support is available to develop their CVs and interview skills. In addition to careers in civil and mechanical engineering, the transferrable skills that our students obtain make them attractive to a wide range of graduate recruiters, from financial services through to IT and management consultancy.

External Examiner(s) for the programme

Name Professor Tim O'Doherty

Institution Cardiff University

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/undergraduate/courses/civil_engineering/h201_meng_civil_engineering.page?

Revision History

1. April 2008 J.S. Shrimpton)
2. August 2012 (P.A.B. James)
3. March 2013 Regulations updated (D Mead)
4. July 2013 Revised module structure follows move from 10 to 15 CATS (P.A.B. James)
5. Nov. 2013 CQA_251113
6. March 2014 CQA_250314CQA_130614
7. Update to Programme Overview (CMA Changes) – September 2015
8. CQA textual updates August 2016, August 2017
9. March 2019 (Patrick James, for programme validation, AHEP LOs and programme LOs)
10. Revision following Programme Validation, LO, April 2019

MSc Sustainable Energy Technologies

The information within this Appendix is liable to change in minor ways from year to year. It is accurate at the time of writing.

Students are required to take ONE optional module in semester 1 and ONE optional module in semester 2 in addition to THREE compulsory modules in each semester. 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.

The research component of the MSc consists of a Core module (FEEG6012) of 30 ECTS/60 CATS which is a research dissertation.

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Module Code	Module Name	Semester	ECTS/ CATS Credit Points	Type of module	Level
SESG6041	Introduction to Energy Technologies, Environment and Sustainability	1	7.5/15	Compulsory	7
FEEG6007	Principles of photovoltaics, fuel cells and batteries	1	7.5/15	Compulsory	7
SESM6032	Sustainable Energy Systems, Resources and Usage	1	7.5/15	Compulsory	7
FEE6008	Advanced photovoltaics, fuel cells and batteries	2	7.5/15	Compulsory	7
SESS6067	Renewable energy from environmental flows: wind, wave and tide	2	7.5/15	Compulsory	7
SESM6043	Applications of Renewable Energy, Storage and Nuclear Energy	2	7.5/15	Compulsory	7
FEEG6012	Research Project for FEE Masters Programmes (core)	3	30/60	Core	7
	Plus 15 credits (ONE MODULE) in S1 from:				
SESM6034	Advanced Electrical Systems	1	7.5/15	Optional	7
SESM6040	Thermofluid Engineering for Low Carbon Energy	1	7.5/15	Optional	7
SESS6070	Offshore Engineering and Analysis	1	7.5/15	Optional	7
FEEG6025	Data Analysis and Experimental Methods for Civil and Environmental Engineering	1	7.5/15	Optional	7
	Plus 15 credits (ONE MODULE) in S2 from:				
CENV6141	Bioenergy	2	7.5/15	Optional	7
CENV6148	Energy Performance Assessment of Buildings	2	7.5/15	Optional	7
CENV6085	Waste Resource Management	2	7.5/15	Optional	7

Modules contributing to meeting the different programme learning outcomes.

	Learning Outcome	Assessment method	Module	Examples of Learning Outcome within Modules
	Science and Mathematics			
SM7M	A comprehensive understanding of the relevant scientific principles of the specialisation	Exam, coursework	SESG6041, FEEG6007, SESM6032, FEEG6008, SESS6067, SESM6043, FEEG6012, SESM6034, SESM6040, SESS6070, FEEG6025, CENV6148, CENV6085	FEEG60012 <i>DISSERTATION SUBMISSION AND POSTER EVENT</i>
SM8M	A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of civil engineering	Exam, coursework	SESG6041, FEEG6007, SESM6032, FEEG6008, SESS6067, SESM6043, FEEG6012, SESM6034, SESM6040, SESS6070, FEEG6025, CENV6148, CENV6141	SESG6041 <i>GROUP REPORT AND PRESENTATION - 2 COUNTRY ANALYSIS 2040 SCENARIOS</i>
SM9M	Understanding of concepts relevant to mechanical engineering, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.	Exam, coursework	SESG6041, SESM6032, SESS6070, CENV6141	SESG6041 <i>GROUP REPORT AND PRESENTATION - 2 COUNTRY ANALYSIS 2040 SCENARIOS</i>
	Engineering analysis			
EA6M	Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations	Exam, coursework	SESG6041, FEEG6008, SESS6067, SESM6043, FEEG6012, SESM6034, SESS6070, FEEG6025, CENV6148	SESG6041 <i>GROUP REPORT AND PRESENTATION - 2 COUNTRY ANALYSIS 2040 SCENARIOS</i>
EA5M	Ability to use fundamental knowledge to investigate new and emerging technologies	Exam, coursework	SESG6041, FEEG6007, SESM6032, FEEG6008, SESS6067, SESM6043, SESM6034, SESM6040, FEEG6025, CENV6148	FEEG60012 <i>DISSERTATION SUBMISSION AND POSTER EVENT</i>
EA7M	Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods.	Exam, coursework	SESG6041, SESM6032, FEEG6008, SESS6067, SESM6043, FEEG6012, SESM6034, SESM6040, SESS6070, FEEG6025, CENV6148	FEEG60012 <i>DISSERTATION SUBMISSION AND POSTER EVENT</i> SESM6032 <i>BLACKBOARD ASSESSMENTS ON ENERGY RELATING TO DUKES DATASETS</i>
	Design			
D9M	Knowledge, understanding and skills to work with information	Exam, coursework	SESG6041, SESS6067, SESM6043, FEEG6012,	SESG6041 <i>TIDE MILL ANALYSIS - ASSESSED VIA PRESENTATION</i>

	that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies		SESM6034, SESS6070, FEEG6025, CENV6148	<i>OF ANALYSIS APPROACH AND OUTINED ASSUMPTIONS</i>
D10M	Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations	Exam, coursework	FEEG6008, SESS6067, SESM6034, FEEG6025, CENV6148, CENV6085, CENV6141	SESG6041 <i>TIDE MILL ANALSYS – ASSESSED VIA PRESENTATION OF ANALYSIS APPROACH AND OUTINED ASSUMPTIONS</i>
D11M	Ability to generate an innovative design for products, systems, components or processes to fulfil new needs.	Exam, coursework	SESG6041, SESS6067, SESM6034, SESM6040	SESG6041 <i>TIDE MILL ANALSYS – ASSESSED VIA PRESENTATION OF ANALYSIS APPROACH AND OUTINED ASSUMPTIONS</i> SESG6041 <i>2 COUNTRY ANALYSIS OF ENERGY SYSTEM – ASSESSED VIA FORMAL REPORT</i>
	Economic, legal, social, ethical and environmental context			
EL8M	Awareness of the need for a high level of professional and ethical conduct in engineering	Exam, coursework	SESG6041, SESM6032, SESM6043, FEEG6012, SESM6040, SESS6070, FEEG6025, CENV6148, CENV6085	SESG6041 <i>FOLLOW BRIEF OF 2 COUNTRY COURSEWORK TO DELIVER A SOCIALLY ACCEPTANCE FUTRURE ENERGY PATHWAY</i>
EL9M	Awareness that engineers need to take account of the commercial and social contexts in which they operate	Exam, coursework	SESG6041, SESM6032, SESS6067, SESM6043, FEEG6012, SESM6034, SESM6040, SESS6070, FEEG6025, CENV6148, CENV6085, CENV6141	SESG6041 <i>ECONOMIC ANALYSIS OF TIDE MILL CONVERSION – ASSESSED BY GROUP PRESENTATION</i>
EL10M	Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation	Exam, coursework	SESG6041, FEEG6008, SESS6067, FEEG6012, SESS6070, CENV6085	SESG6041 <i>APPLYING PRINCIPLES FROM LECTURES TO 2 COUNTRY ANALYSIS 2040 SCENARIO – ASSESSED BY REPORT AND PRESENTATION. ELING TIDE MILL SOLUTION – PRESENTATION.</i>
EL11M	Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate	Exam, coursework	SESG6041, SESM6032, SESS6067, SESM6043, FEEG6012, SESM6040, CENV6148, CENV6085, CENV6141	SESM6032 <i>ENGINEERING OF FUTURE CITIES – TRANSPORT, AIR QUALITY, ENERGY. ASSESSED VIA BLACKBOARD ASSESSMENT</i>
EL12M	Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation	Exam, coursework	SESS6067, FEEG6025, CENV6148, CENV6085	SESG6041 <i>GRID CONNECTION OF ELING TIDE MILL DESIGN – COMPLIANCE WITH CONNECTION STANDARDS – ASSESSED VIA PRESENATATION</i>
EL13M	Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety,	Exam, coursework	SESG6041, FEEG6012, CENV6148, CENV6085	SESG6041 <i>ELING TIDE MILL DEVELOPED SOLUTION – CONSIDERATION OF RISK – ASSESSED VIA PRESENTATION</i>

	environmental and commercial risk.			
	Engineering Practice			
P12	Advanced level knowledge and understanding of a wide range of engineering materials and components	Exam, coursework	SESG6041, FEEG6007, SESM6032, FEEG6008, SESS6067, SESM6043, FEEG6012, SESM6034, SESM6040, FEEG6025, CENV6148, CENV6085	SESM6032 <i>CHP SYSTEMS – ASSESSED VIA BLACKBOARD COURSEWORK</i>
P9m	A thorough understanding of current practice and its limitations, and some appreciation of likely new developments	Exam, coursework	FEEG6007, SESM6032, FEEG6008, SESS6067, SESM6043, FEEG6012, SESM6040, CENV6148, CENV6085, CENV6141	SESM6032 <i>UK ELECTRICITY NETWORK, CARBON TRENDS AND FUTURE ENERGY PATHWAY. ASSESSED VIA DUKES ANALYSIS COURSEWORK VIA BLACKBOARD</i>
P10m	Ability to apply engineering techniques taking account of a range of commercial and industrial constraints	Exam, coursework	SESG6041, FEEG6007, SESS6067, SESM6034, SESS6070, CENV6148	SESG6041 <i>ELING TIDE MILL SOLUTION (GEARBOX, TURBINE, INVERTER ETC) MATERIALS AND COMPONENTS – ASSESSED VIA PRESENTATION. REPORT AND PRESENTATION - 2 COUNTRY ANALYSIS 2040 IS TO ACHIEVE AN 80% RENEWABLE ACROSS ALL SECTORS</i>
P11m	Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader.	Exam, coursework	SESG6041	SESG6041 <i>TIDE MILL AND 2 COUNTRY GROUP WORK TASKS – ASSESSMENT OF GROUP COHESION IN PRESENTATIONS AND REPORT</i>
	Additional general skills			
G1	Apply your skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities	Exam, coursework	SESG6041, FEEG6007, SESM6032, FEEG6008, SESS6067, SESM6043, FEEG6012, SESM6040, SESS6070, FEEG6025, CENV6148, CENV6141	FEEG60012 <i>DISSERTATION SUBMISSION AND POSTER EVENT</i>
G2	Plan self-learning and improve performance, as the foundation for lifelong learning/CPD	Exam, coursework	SESG6041, FEEG6008, SESS6067, FEEG6012, SESM6040, FEEG6025, CENV6141	SESG6041 <i>INDIVIDUAL ESSAY, 2 COUNTRY GROUP WORK CONTRIBUTION – ASSESSED VIA THE WRITTEN SUBMISSIONS</i>
G3	Monitor and adjust a personal programme of work on an on-going basis	Exam, coursework	SESG6041, FEEG6008, SESS6067, FEEG6012, SESM6040, FEEG6025, CENV6141	SESG6041 <i>INDIVIDUAL ESSAY, 2 COUNTRY GROUP WORK CONTRIBUTION – ASSESSED VIA THE WRITTEN SUBMISSIONS</i>
G4	Exercise initiative and personal responsibility, which may be as a team member or leader.	Exam, coursework	SESG6041, FEEG6012	FEEG60012 <i>DISSERTATION SUBMISSION AND POSTER EVENT</i> SESG6041 <i>INDIVIDUAL ESSAY, 2 COUNTRY GROUP WORK CONTRIBUTION – ASSESSED VIA THE WRITTEN SUBMISSIONS</i>

3878 SET MSc AHEP3 Learning Outcomes (MSc level) mapping
LO COUNT - NO MODULES ARE PASSED BY REFERRAL METHOD

Note: A LO IS ONLY CONSIDERED TO BE COVERED IN AN OPTIONAL MODULE IF IT EXISTS IN ALL OPTIONAL MODULES.

WHERE AN LO IS MAPPED IN LESS THAN 3 MODULES – THE MODULE TYPE (PROJECT, CORE) OR REFERRAL METHOD IN MODULE ENSURES THAT LO IS ASSESSED.

MSc		COMPULSORY MODULES								OPTIONAL MODULES						
		AHEP3 LO	S1 SESG6041	S1 FEEG6007	S1 SESM6032	S2 FEEG6008	S2 SESS6067	S2 SESM6043	S3 FEEG6012	S1 SESM6034	S1 SESM6040	S1 SESS6070	S1 FEEG6025	S2 CENV6148	S2 CENV6085	S2 CENV6141
			Introduction to Energy Technologies, Environment and Sustainability	Principles of photovoltaics, fuel cells and batteries	Sustainable Energy Systems: resources and usage	Advanced photovoltaics, fuel cells and batteries	Renewable energy from environmental flows: wind, wave and tide	Applications of Renewable Energy, Storage and Nuclear Energy	MSc Research Project	Advanced Electrical Systems	Thermofluid Engineering for Low Carbon Energy	Offshore Engineering and Analysis	Data Analysis & Experimental Methods for Civil and Environmental Engineering	Energy Performance Assessment of Buildings	Waste Resource Management	Bioenergy
7	SM7M		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
7	SM8M		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
1	SM9M		Y	N	N	N	N	N	N	N	N	N	N	N	N	Y
5	EA6M		Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	N	N	N
6	EA5M		Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N
7	EA7M		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
4	D9M		Y	N	N	N	Y	Y	Y	Y	N	Y	Y	Y	N	N
3	D10M		Y	N	N	Y	Y	N	N	Y	N	N	Y	Y	Y	Y
2	D11M		Y	N	N	N	Y	N	N	Y	Y	N	N	N	N	N
4	EL8M		Y	N	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y	N
5	EL9M		Y	N	Y	N	Y	Y	Y	N	Y	Y	N	Y	Y	Y
3	EL10M		Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N
5	EL11M		Y	N	Y	N	Y	Y	Y	N	Y	N	N	Y	Y	Y
2	EL12M		N	N	N	N	Y	N	Y	N	N	N	Y	Y	Y	N
2	EL13M		Y	N	N	N	N	N	Y	N	N	N	N	Y	Y	N
7	P12M		Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N
5	P9M		N	Y	N	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y
3	P10m		Y	Y	N	N	Y	N	N	Y	N	Y	N	Y	N	N
1	P11m		Y	N	N	N	N	N	N	N	N	N	N	N	N	N
7	G1		Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y
4	G2		Y	N	N	Y	Y	N	Y	N	Y	N	Y	N	N	Y
4	G3m		Y	N	N	Y	Y	N	Y	N	Y	N	Y	N	N	Y
3	G4		Y	N	N	Y	N	N	Y	N	N	N	N	N	N	N

REFERL. LO

CORE

Appendix 3

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		Students 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 species permissible models from time to time and these may be purchased from any source.
Stationery		You will be expected to provide your own day-to-day stationary items, e.g. pens, pencils, notebooks, etc). · The third year module FEEG3003 Individual Project requires you to print an AI portrait poster on paper. The typical cost for this is in the range £5 to £20.
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	Design equipment and materials:	We provide a wide range of resources to support project based modules and activities and these will allow you to complete your assessed exercises to the highest standard. However, you may wish to customise your project by purchasing additional resource e.g. alternative manufacturing materials, electronic components, etc. You may also incur additional costs for printing e.g. large format drawings. Standard construction/modelling materials will be provided where appropriate, unless otherwise specified in a module profile. For customisation of designs/models calling for material other than standard construction/ modelling materials, students will bear the costs of such alternatives. FEEG6012 Reasonable expenses for travel and materials of up to £300 may be reclaimed through the School of Engineering 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. http://www.southampton.ac.uk/engineering/undergraduate/modules/feeg6012_msc_research_project.page?

Main Item	Sub-section	PROGRAMME SPECIFIC COSTS
	Field Equipment and Materials:	none
IT	Computer discs	Available from UoS shop as required
Clothing		
	Fieldcourse clothing:	You will need to wear suitable clothing when attending fieldcourses, e.g. waterproofs, walking boots. You can purchase these from any source.
Printing and Photocopying Costs		<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. Students are expected to cover the costs associated with the printing of drawings and graphic presentations. These are typically expected to be of the order of £20 - 50 per student.</p> <p>The third year module FEEG3003 Individual Project requires you to print an A1 portrait poster on paper at a typical cost of £20.</p> <p>Reasonable expenses for travel and materials of up to £300 may be reclaimed through the School of Engineering 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. (equipment).</p>
Optional Visits (e.g. museums, galleries)		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. For costs related to study abroad please see the relevant module profile.
Travel and Subsistence		For additional costs related to travel and subsistence for the Industrial Placement Year, please refer to the module profile for FEEG 3009