Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

POSTGRADUATE TAUGHT STUDENT HANDBOOK

MSc (FHEQ LEVEL 7)

MSc POWER ENGINEERING AND SUSTAINABLE ENERGY DEGREE PROGRAMME

SUBJECT SPECIFIC
PART TWO OF TWO
MODULE AND COURSE STRUCTURE
2023-24

DISCLAIMER

The Faculty of Science and Engineering has made all reasonable efforts to ensure that the information contained within this publication is accurate and up-to-date when published but can accept no responsibility for any errors or omissions.

The Faculty of Science and Engineering reserves the right to revise, alter or discontinue degree programmes or modules and to amend regulations and procedures at any time, but every effort will be made to notify interested parties.

It should be noted that not every module listed in this handbook may be available every year, and changes may be made to the details of the modules. You are advised to contact the Faculty of Science and Engineering directly if you require further information.

The 23-24 academic year begins on 25 September 2023

Full term dates can be found here

DATES OF 23-24 TERMS

25 September 2023 – 15 December 2023

8 January 2024 – 22 March 2024

15 April 2024 – 07 June 2024

SEMESTER 1

25 September 2023 – 29 January 2024

SEMESTER 2

29 January 2024 – 07 June 2024

SUMMER

10 June 2024 – 20 September 2024

IMPORTANT

Swansea University and the Faculty of Science of Engineering takes any form of **academic misconduct** very seriously. In order to maintain academic integrity and ensure that the quality of an Award from Swansea University is not diminished, it is important to ensure that all students are judged on their ability. No student should have an unfair advantage over another as a result of academic misconduct - whether this is in the form of **Plagiarism**, **Collusion** or **Commissioning**.

It is important that you are aware of the **guidelines** governing Academic Misconduct within the University/Faculty of Science and Engineering and the possible implications. The Faculty of Science and Engineering will not take intent into consideration and in relation to an allegation of academic misconduct - there can be no defence that the offence was committed unintentionally or accidentally.

Please ensure that you read the University webpages covering the topic – procedural guidance here and further information here. You should also read the Faculty Part One handbook fully, in particular the pages that concern Academic Misconduct/Academic Integrity.

Welcome to the Faculty of Science and Engineering!

Whether you are a new or a returning student, we could not be happier to be on this journey with you.

At Swansea University and in the Faculty of Science and Engineering, we believe in working in partnership with students. We work hard to break down barriers and value the contribution of everyone.

Our goal is an inclusive community where everyone is respected, and everyone's contributions are valued. Always feel free to talk to academic, technical and administrative staff, administrators - I'm sure you will find many friendly helping hands ready to assist you. And make the most of living and working alongside your fellow students.

During your time with us, please learn, create, collaborate, and most of all – enjoy yourself!

Professor David Smith
Pro-Vice-Chancellor and Executive Dean
Faculty of Science and Engineering

Faculty of Science and Engineering	
Pro-Vice-Chancellor and Executive Dean	Professor David Smith
Director of Faculty Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Laura Roberts
School of Aerospace, Civil, Electrical, General and Mechanical Engineering	
Head of School	Professor Antonio Gil
School Education Lead	Professor Cris Arnold
Head of Electronic and Electrical Engineering	Professor Vincent Teng
Electronic and Electrical Engineering Programme Director	Dr Karin Ennser
Year Coordinators	Dr Thierry Maffeis

STUDENT SUPPORT

The Faculty of Science and Engineering has two **Reception** areas - Engineering Central (Bay Campus) and Wallace 223c (Singleton Park Campus).

Standard Reception opening hours are Monday-Friday 8.30am-4pm.

The **Student Support Team** provides dedicated and professional support to all students in the Faculty of Science and Engineering. Should you require assistance, have any questions, be unsure what to do or are experiencing difficulties with your studies or in your personal life, our team can offer direct help and advice, plus signpost you to further sources of support within the University. There are lots of ways to get information and contact the team:

Email: studentsupport-scienceengineering@swansea.ac.uk (Monday–Friday, 9am–5pm)

Call: +44 (0) 1792 295514 (Monday-Friday, 10am–12pm, 2–4pm).

Zoom: By appointment. Students can email, and if appropriate we will share a link to our Zoom calendar for students to select a date/time to meet.

The current student **webpages** also contain useful information and links to other resources:

https://myuni.swansea.ac.uk/fse/

READING LISTS

Reading lists for each module are available on the course Canvas page and are also accessible via http://ifindreading.swan.ac.uk/. We've removed reading lists from the 23-24 handbooks to ensure that you have access to the most up-to-date versions.
We do not expect you to purchase textbooks, unless it is a specified key text for the course.

THE DIFFERENCE BETWEEN COMPULSORY AND CORE MODULES

Compulsory modules must be **pursued** by a student.

Core modules must not only be **pursued**, but also **passed** before a student can proceed to the next level of study or qualify for an award. Failures in core modules must be redeemed.

Further information can be found under "Modular Terminology" on the following link - https://myuni.swansea.ac.uk/academic-life/academic-regulations/taught-guidance/essential-info-taught-students/your-programme-explained/

Supporting Your Studies

- Centre for Academic Success
- Faculty of Science and Engineering- Student Support

Supporting Your Professional Development

As a student studying MSc Power Engineering and Sustainable Energy at Swansea University you are continuing your educational journey which we hope will end with Engineering Council registration as a Chartered Engineer (CEng).

The Master of Science (MSc) programme Power Engineering and Sustainable Energy has been accredited by the Institution of Engineering and Technology (IET) on behalf of the Engineering Council as meeting the requirements for Further Learning for registration as a Chartered Engineer (CEng). Candidates must hold a CEng accredited BEng/BSc (Hons) undergraduate first degree to comply with full CEng registration requirements.

What this means for you is that the learning outcomes of each year of your programme of study has been carefully designed to align with Version 3 of the Engineering Council's Accreditation of Higher Education Programmes (AHEP) which forms the educational foundation for the UK Standard for Professional Engineering Competence (UK-SPEC).

The knowledge and skills you will have demonstrated by completing your programme of study are defined by achieving a set of learning outcomes distributed across the following key areas of competence:

- Science and mathematics
- Engineering analysis
- Design and innovation
- The engineer and society
- Engineering practice

To find out more about Professional Registration and what the AHEP competences are, please refer to the Engineering Council's Student Guide to Professional Registration and the Accreditation of Higher Education Programmes collated learning outcomes.

The IET – Your Professional Home for Life

As a student at Swansea University, you are privileged to be associated with one of the small groups of universities that have been selected to be Academic Partners of the IET. The most tangible benefit of this is that you can register as a student member of the IET at no cost to yourself for the duration of your study. And as a student member of the IET, you can take *full advantage* of the benefits that membership of the IET offers. These include an impressive range of services supporting *Networking*, *Professional Development*, *Learning Resources* and *Membership Benefits*. A summary of these is shown on the Get more from your partnership page.

As well as these benefits, as an Academic Partner of the IET, the University can offer you access to the IET's Graduate Advantage Scheme: that is, we will pay for your first year of full Membership of the IET,

and you can use the post-nominals MIET straight after graduation for no cost. This will be especially useful as you start to gain and evidence the UK-SPEC competences you will need to complete your IEng or CEng professional registration.

IET on Campus

IET On Campus is designed to support everyone in the Department of Electronic and Electrical Engineering with students at the heart of it. The IET gives you access to tailored practical, technical, and career-related resources and helps you to create links with industry and other universities, building a platform for you to demonstrate your skills and raise your profile. At Swansea, the local branch of IET on Campus is run by the Electrical & Electronic Engineering Society (EEESoc) and is supported by the IET South Wales Local Network.

For more information, please join EEESoc and access their social media channels.

IET Student Advisor

Dr Chris Jobling (MIET, CEng) is the *IET Student Advisor* for Swansea University. Please get in touch with him if you want to find out more about the AHEP and UKSPEC, the IET, IET student membership, IET Scholarships, Graduate Advantage, IET Communities, or opportunities to get involved with Wales Southwest Local Network as an IET young professional volunteer. He will be happy to help.

Other members of staff associated with the IET at Swansea include:

- Dr Timothy Davies (MIET, CEng)
- Dr Augustine Egwebe (MIET)
- Dr Karin Ennser (MIET, CEng)
- Prof Lijie Li (FIET)
- Mr David Moody (MIET)

UK Electronics Skills Foundation

Swansea University is an academic partner from the UK Electronics Skills Foundation. The partnership means that you can benefit from the UKESF scholarship scheme, competitions, awards, and internship programme, which connects the most capable Electronics undergraduates with leading companies in the sector.

UKESF offers opportunities for undergraduates to take advantage of an industry placement, develop their employability skills, generous financial support, and the opportunity to network with professionals in the Electronics sector. Dr Karin Ennser is the *UKESF Student Advisor* for Swansea University. Please contact her if you want to find out more.

Faculty prizes

The Faculty of Science and Engineering awards graduation prizes to the best MSc Power Engineering and Sustainable Energy student in each graduating year.

MSc (FHEQ Level 7) 2023/24
Power Engineering and Sustainable Energy
MSc Power Engineering and Sustainable Energy

Semester 1 Modules	Semester 2 Modules
EGIM16 **Communication Skills for Research Engineers** **10 Credits** **Dr SA Rolland/Dr T Lake** **CORE**	**EG-M190** **Social, environmental and economic context of research** **10 Credits** **Dr SA Rolland/Prof JC Arnold** **CORE**
EGLM00 **Power Semiconductor Devices** **10 Credits** **Prof MR Jennings** **CORE**	**EG-M47** **Business Leadership for Engineers** **10 Credits** **Unknown** **CORE**
EGLM02 **Advanced Power Electronics and Drives** **10 Credits** **Dr Z Zhou** **CORE**	**EGLM01** **Wide band-gap Semiconductors** **10 Credits** **Dr TGG Maffeis/Prof OJ Guy** **CORE**
EGLM07 **Power Systems with Project** **10 Credits** **Dr M Fazeli** **CORE**	**EGLM03** **Modern Control Systems** **10 Credits** **Dr M Monfared** **CORE**
EGTM71 **Power Generation Systems** **10 Credits** **Prof I Masters** **CORE**	**EGLM05** **Advanced Power Systems** **10 Credits** **Dr M Fazeli** **CORE**
EGTM79 **Sustainability and Environmental Assessment** **10 Credits** **Prof GTM Bunting/Mr MH Green** **CORE**	**EGLM06** **Sustainable Energy and Power Electronics Laboratory** **10 Credits** **Dr Z Zhou** **CORE**
Dissertation	
EG-D05 **MSc Dissertation - Electrical Engineering** **60 Credits** **Dr M Fazeli** **CORE**	
Total 180 Credits	

EG-D05 MSc Dissertation - Electrical Engineering

Credits: 60 Session: 2023/24 June-September

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr M Fazeli

Format: Typically 1 hour per week i.e 10-15 hrs total contact time. Each student is to be supervised in accordance with the University's Policy on Supervision, with a minimum of three meetings held. A careful record should be kept, agreed between supervisor and student, of all such formal meetings, including dates, action agreed and deadlines set.

Delivery Method: The module is delivered primarily as an individual research project. The student is expected to liaise with the supervisor on a regular basis, with a minimum University requirement of three formal meetings for full-time students. In the case of part-time students it is recommended that a minimum of four meetings are held. Ideally, contact should be more regular, with at least one meeting a week to discuss the development and progress of the project. Depending on the project the student would be expected to carry out this research individually and to complete the necessary risk assessments and training required to work on an industrial site or within laboratory facilities of the University.

Module Aims: The module aims to develop fundamental research skills. It comprises the development of supervised research work leading to a dissertation in the field of the Master's degree programme. The specific research topic will be chosen by the student following consultation with academic staff.

Module Content: Study for the dissertation, which may be based on practical, industrial, or literature work, or any combination of these, is primarily carried out over a period of about 12 weeks, with the dissertation being submitted at the end of September. Preparatory work on the dissertation may take place during Part One of the programme but students will only be permitted to submit their dissertation following successful completion of Part One.

In conducting the research project and dissertation the student will be exposed to all aspects of modern information retrieval processes, the organisation and resourcing of research and the organising and presentation of experimental data. The student must make inferences on conclusions, based on the evidence provided and supported by the research work. Furthermore they must assess the significance of this work in relation to the field and make suggestions about how further work could improve or clarify the research problem. The results of the project will be disseminated in a substantial dissertation demonstrating the student's ability to research a subject in depth.

The student will meet regularly with the supervisor to ensure that the project is well developed and organised. Progress will be monitored.

Intended Learning Outcomes: On completion of this module, students should have the ability to:
• Investigate a research topic in detail;
• Formulate research aims;
• Devise and plan a research strategy to fulfil the aims;
• Carry out research work - undertake a literature search, a laboratory based or computer based investigation or a
combination of these;
• Gather, organize and use evidence, data and information from a variety of primary and secondary sources;
• Critically analyse information;
• Make conclusions supported by the work and identify their relevance to the broader research area;
• Resolve or refine a research problem, with reasoned suggestions about how to improve future research efforts in the field;
and
• Produce a report (dissertation), with the findings presented in a well organised and reasoned manner.

Accreditation Outcomes (AHEP)
• A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
• A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
• 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 (SM3fl)
• Ability to use fundamental knowledge to investigate new and emerging technologies (EA2fl)
• 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 (D1fl)
• Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D2fl)
• Ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D3fl)
• Awareness of the need for a high level of professional and ethical conduct in engineering (ET1fl)
• Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (ET3fl)
• Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (ET5fl)
• 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 (ET6fl)
• A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)
• Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints (EP3fl)

Assessment:	Report (100%)

Assessment Description: The research project and dissertation forms Part Two of the Masters degree.

Students should refer to:
https://www.swansea.ac.uk/academic-services/academic-guide/postgraduate-taught-awards-regulations/standard-taught-masters/

In particular, section 14 will provide further Information about dissertation preparation and submission.

The word limit is 20,000. This is for the main text and does not include appendices (if any), essential footnotes, introductory parts and statements or the bibliography and index.

Each student is to submit an electronic copy of their dissertation through the Turnitin link on Canvas. The online system will automatically check the similarity of the report. The dissertation must contain:

• A statement that it is being submitted in partial fulfilment of the requirements for the degree;
• A summary of the dissertation not exceeding 300 words in length;
• A statement, signed by you, showing to what extent the work submitted is the result of your own investigation. Acknowledgement of other sources shall be made by footnotes giving explicit references. A full bibliography should be appended to the work;
• A declaration, signed by you, to certify that the work has not already been accepted in substance for any degree, and is not being concurrently submitted in candidature for any degree; and
• A signed statement regarding availability of the thesis.

The dissertation is marked by the supervisor and another member of staff and sent to an External Examiner for moderation. An Internal Exam Board is then held to confirm the mark. Finally, all marks are ratified at the University Postgraduate Taught Examination Board.

Deadlines as follows:

MSc Electrical Engineering (without resits) - September 30th

MSc Electrical Engineering (with resits) - December 15th

Moderation approach to main assessment: Universal Double Blind Marking of the whole cohort

Assessment Feedback: Informal feedback will be given during regular meetings with supervisors. The supervisor will also provide an assessment of the project drafting skills during the planning of the dissertation. Work will be returned according to specified deadlines and accompanied by constructive comment.

A Feedback session will be given to any student who fails their dissertation and is permitted by the Award Board to resubmit their work.

Failure Redemption: Candidates who fail the dissertation are given an opportunity to resubmit the dissertation within 3 months of the result of the examination if a full-time student or 6 months for part-time students. Such students will be given one formal feedback session, including written feedback on the reasons for failure, immediately following confirmation of the result by the University Postgraduate Taught Examination Board. The opportunity to resubmit will only be offered to students who submit a dissertation and are awarded a fail. Those candidates who do not submit a dissertation will not be offered a resubmission opportunity.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
If an extension is deemed appropriate a Postgraduate Taught Masters ‘Application for Extension to the Submission Deadline/ Period of Candidature’ Form will need to be submitted as follows:
• 30 September – deadline for Part Two students (non-resit students)
• 15 December– deadline for Part Two Students (students who had resits)

EG-M190 Social, environmental and economic context of research

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr SA Rolland, Prof JC Arnold

Format: 30 formal contact hours
10 x 1 hour lectures
10 x 2 hour interactive workshops

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Lecture and workshops

Module Aims: There is an increasing need for engineers to work towards complex, so called 'wicked problems', for example the secure supply of energy. This necessitates a holistic approach and involves making decisions based on a range of different factors, and consideration for economic, ethical, social, political and environmental, as well as technical limitations.

Obtaining and making sense of such information involves types of knowledge and the use of tools and techniques that have not always been traditionally used within engineering disciplines. For example, ethical issues concerning negative impacts on environment or society may raise questions of value, duty or morality and requires the application of moral reasoning rather than scientific reasoning.

During this module we will make use of a variety of engineering case studies which exemplify the need to consider non-technical aspects of engineering projects. We will use qualitative research approaches and ethical frameworks to help in our engineering decision making. We will also consider the role of the engineer in policy making.

Module Content: Different types of knowledge and research approaches used to obtain different types of knowledge and information
The use of moral reasoning and ethical frameworks
Policy process and the role of the engineer in informing policy

Intended Learning Outcomes: Technical Outcomes
By the end of this module students should be able to:
Knowledge of the stages of a research project and how to select appropriate research methods.

Accreditation Outcomes (AHEP)
Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M / ET1fl)
Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M/ ET2fl)
Awareness that engineering activities should promote sustainable development (EL11M / ET4fl)

Assessment: Coursework 1 (60%)
Coursework 2 (40%)
Participation Exercise (0%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Assessment One: Selection of a contemporary engineering topic/project. Outline of the role of different types of knowledge and information needed to inform project. Ethical, economic, social and environmental evaluations of the engineering issues involved.
Assessment Two: A policy brief (choice of contemporary engineering topic)

PASS/FAIL COMPONENT Minimum attendance and contribution to workshop sessions
Note, that this module cannot be passed if this pass/fail element is not passed. If you do not meet the requirements of the Pass/Fail component, you will receive a QF outcome. This means that you will be required to repeat the failed component(s), even if your module mark is above 50%

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit
Assessment Feedback: Formative and peer feedback will be given in group/workshop sessions Feedback during Q&As in lecture and example classes. Lecturer available for ad-hoc feedback during office hours. Written feedback on all coursework submitted
Failure Redemption: Students will be provided with the opportunity to resubmit failed components. If engagement in group project activities is below required level, no supplementary will be possible and module will have to be resat in the following year.
Reading List: Singh, Pooja ; Singh, Lalit Kumar, Instrumentation and control systems design for nuclear power plant: An interview study with industry practitioners, Elsevier B.V, 2021-11.ISBN: 17385733 Szopiska-Mularz, Monika, Adaptive reuse of modern movement car parking structures for controlled environment agriculture: Results from an interview study for the innovative design process in cities, 2021.ISBN: 18779166 Zhu, Runhe ; Lucas, Gale M ; Becerik-Gerber, Burcin ; Southers, Erroll G, Building preparedness in response to active shooter incidents: Results of focus group interviews, Elsevier Ltd, 2020-09.ISBN: 22124209 Kim, Ji-Eun ; Kessler, Larry ; McCauley, Zach ; Niiyama, Itsumi ; Boyle, Linda Ng, Human factors considerations in designing a personalized mobile dialysis device: An interview study, Elsevier Ltd, 2020-05.ISBN: 00036870
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. .

EG-M47 Business Leadership for Engineers

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s):

Format: Lectures/Workshops - 22 hours
Open door tutorials/workshops - 8 hours
Directed private study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Combination of interactive lectures/workshops/case studies and self-study.

Module Aims: At the end of this course students will be able to recognise and understand key characteristics of leadership as well as a wide range of strategic business skills, ideas and theories with emphasis on innovation and “entrepreneurial thinking” which is essential for the current multidisciplinary engineering environment. The course delivery integrates practical project work and academic rigour.

Module Content: Workshop 1 – Introduction & Leadership Part 1
Workshop 2 – Leadership Part 2
Workshop 3 – Team Formation, Development and Communication
Workshop 4 - Entrepreneurial Thinking
Workshop 5 – Change Management
Workshop 6 – Strategic Management
Workshop 7 – Innovation and Business Thinking, Group Assignment Part 1
Workshop 8 – Innovation and Business Thinking, Group Assignment Part 2
Workshop 9 – Group Assignment Workshop
Workshop 10 – Group Assignment Workshop

Intended Learning Outcomes:
Technical Outcomes
On successful completion of this module students will be expected, at threshold level, to be:
- Demonstrate an understanding of current leadership issues. Critically appraise theories and approaches to leadership and at the same time reflect on personal leadership aspects.
- Knowledge to assess the basic factors that must be considered for a business formation. Use of basic level strategy and innovation methods in order for an organisation to gain competitive advantage. Critically evaluate the rationale for utilising methods for idea generation/innovation.
- Have awareness of theoretical perspectives and approaches to change management in organisational environments. Synthesise the relationship between the external context of an organisation and its internal context and their impact on its strategic direction.
- Demonstrate and appraise, entrepreneurial way of working, team development and communication skills

Accreditation Outcomes (AHEP)

- Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (D2)
- Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D8m)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation, (ET3fl)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate, (ET4fl)
- 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. (ET6fl)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction. (ET7m)

Assessment:	Group Work - Coursework (80%) Online Class Test (10%) Online Class Test (10%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Online Test 1 Assessment level marking - PGTM March 10%
Online Test 2 Assessment level marking - PGTM March 10%
Group Work Coursework Assessment level marking - PGTM April 80%

The group (5/6) assignment will require application of the "key skills" and innovation development tools to generate solutions for real-world scenarios – report (40 pages) and development of Business Canvas.

This module is assessed by a combination of group-based and individual assignments (quiz-1 and quiz-2). In the main exam, the marks students get in quiz -1 and quiz-2 will add to the marks the individual gets in the group assignment project. For the resit exam, the quiz-1 and quiz-2 marks will not add to the project.

Moderation approach to main assessment: Partial moderation

Assessment Feedback:
Continuous group feedback on "out-comes" of workshops, after submission of coursework 1 at request during open-tutorials.

Failure Redemption:
Exam resits according to University regulations.
100% coursework.

Reading List: Birley, Sue., Muzyka, Daniel F., Mastering enterprise : your single-source guide to becoming an entrepreneur / edited by Sue Birley, Daniel F. Muzyka., FT/Pitman,, 1997.ISBN: 0273630318
Simon. Bridge, Ken O'Neill (Producer), Understanding enterprise : entrepreneurship and small business / Simon Bridge and Ken O'Neill., Palgrave Macmillan, 2013.ISBN: 9780230308091

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment

Related assignments are used to assess this module.

This module is assessed by a combination of group-based and individual assignments. In order for the individual assessment marks to count, you must achieve at least 40% in the group-based assignment. If you achieve less than 40% in the group-based assignment, then the module mark will be just the group-based assignment mark.

EGIM16 Communication Skills for Research Engineers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr SA Rolland, Dr T Lake

Format: Lectures (15h), Exercises (15h), Reading / Private Study (30h), Preparation for Assessment (40h)

Delivery Method: The module will be delivered on campus and partially online.

Module Aims: Communication at a research level differs from that at the undergraduate level in that it is usually driven by an output or result rather than the requirement to show knowledge or understanding. The skill of a good communicator at research level lies in efficiently and rigorously conveying the ideas behind the theory and proof of the research output. Verbal, written and visual communication will be explored through a series of lectures and formative exercises.

Module Content: Background to Communication:
• Academic misconduct and research publication ethics.
• Fundamentals of communication.
• Critical thinking in research.

Written Communication:
• The usual layout of reports, theses, journal & conference papers.
• How to write a good abstract for a research output.
• What should be in the introduction?
• Contents of the main body of a research output.
• Effective conclusions
• Writing style
• Cross-referencing, captions, references
• Critical review of self and others
• Design concepts for research posters

Oral Communication:
• The usual layout of a research presentation
• Slide design for a research presentation
• Delivery of a presentation
• Audience engagement.

Intended Learning Outcomes: Technical Outcomes:
By the end of this module the student will be able to:
• Write a paper or equivalent employing the structure and rigour required at research level (assessed by assignments 1 and 4)
• Efficiently communicate the concepts associated with complex ideas (assessed by the first written assignment and the oral presentation)
• Critically evaluate a written output (assessed within the second assessment component)
• Verbally present a complex idea using the presentation structure, slide content and delivery techniques expected of a research engineer (assessed through the oral presentation)

Accreditation Outcomes (AHEP)
- Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M / ET1fl)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M / ET2fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9M / EP2fl)

Assessment: Assignment 1 (30%)
Oral Examination (50%)
Writing (20%)

Assessment Description: The first sit assessment will consist of 3 assignments.

The first assessment component will be a written piece, which will test the students' understanding of the literature-based research process, test their ability to articulate the findings, and draw relevant, well-supported conclusions. This is an individual piece of coursework. This assignment is a precursor to assignment 3 (article).

The oral examination will involve the students presenting the outcome of their chosen research topic (literature-based only, no original research requirement in the module), through an oral presentation. The target duration of the oral presentation will usually be between 8 to 10 minutes. The exact duration will be specified in the assignment descriptor. This is an individual piece of coursework.

The final, third, component will require the student to write a technical article or equivalent. This paper will be between four to five pages in length and will be written to a format described in the assignment descriptor. This is an individual piece of coursework.

The pass mark for a module at Level 4/M is 50%. In addition to this Students must achieve at least 40% in the Oral Examination AND 40% in the Writing assessment to pass the module.

The reassessment will consist of 2 assignments, detailed in a further section.

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: CANVAS will be used to provide individual feedback to the students on all the components that contribute to the final mark. For the first assessment component a class feedback document is also generally included on CANVAS.

As part of the practical sessions the students will receive verbal feedback on their performance. These sessions do not contribute to the final mark.

Failure Redemption: Candidates shall be given one opportunity to redeem a failure in the module during the summer supplementary period.

In addition, the 40 % oral and written assignments of the first must be passed individually to pass the module, and will have to be redeemed even if a pass mark is achieved for the module overall on first sit. A pass mark on both main assessment components will be required to pass the module.

All components are redeemable individually in the event of failure across the module. Students may be required to take supplementary examination of examined components they have already passed if the combination of marks is such that the module may be failed.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

All lectures and course material will be provided on CANVAS.

The pass mark for a module at Level 4/M is 50%. In addition to this Students must achieve at least 40% in the Oral Examination AND 40% in the Writing assessment to pass the module.

The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EGLM00 Power Semiconductor Devices

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof MR Jennings

Format: Formal contact hours: 20 hours
Directed private study: 80 hours

Delivery Method: Module exam 100%

Module Aims: Power semiconductor technology is a key enabling technology leading to more efficient power conversion. Historically, the development of electronic power devices can be traced to the early 1950s when thyristors capable of operating at high current and voltages were introduced. In the years to come, the most important development has been the introduction of power devices with high-input-impedance gate such as VDMOSFETs and IGBTs. This allowed a large reduction in system size and cost, leading to many new application for power electronics in domestic appliances and automotive and aviation electronics, for example.

Module Content:

• Power electronics and energy management in the New Millennium.
• Semiconductor fundamentals.
• Power diodes
- Bipolar devices.
• Power MOSFET.
- Insulated Gate Bipolar Transistors (IGBT).
- Device switching.
- Device losses.
- Device fabrication of practical devices.
• RESURF and super-junction devices.
• Power electronics applications.
- Advanced concepts, lifetime control, junction termination, high voltage (smart) power ICs.
- Wide bandgap semiconductors and devices. An insight into silicon carbide and gallium nitride, its advantages and potential (high voltage, high frequency and high temperature devices) and its problems (cost, immaturity, processing issues).
- Packaging and reliability of power semiconductor devices.

Intended Learning Outcomes: By the end of the module the student should be able to...
• Apply advanced concepts through the use of device physics in the context of device design (forward, reverse characteristics and switching) for use within a power converter.
• Design a power semiconductor device for a specific application.
• Conduct complex packaging and reliability analysis of power semiconductor devices.
• Analyse systematically new materials for power semiconductor devices; silicon carbide and gallium nitride.

Accreditation Outcomes (AHEP)
MEng
- Awareness of developing technologies related to own specialisation (SM4m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2m)
- Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and to implement appropriate action (EA3m)
- Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D7m)
- Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D8m)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (ET4m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP9ml)

MSc
- A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
- 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 (SM3fl)
- Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA1fl)
- Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D2fl)
- Ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D3fl)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (ET4fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)

Assessment: Examination (100%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Examination - 2 hours

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: An exam feedback form will be produced noting common errors and good practice. This will be uploaded to the College of Engineering Community page.

Failure Redemption: Resit examination in August worth 100%.

Reading List: B. Jayant. Baliga author., SpringerLink (Online service), Fundamentals of Power Semiconductor Devices by B. Jayant Baliga., Cham : Springer International Publishing : Imprint: Springer, 2019.ISBN: 9783319939889
Baliga, B. Jayant,, Modern power devices / B. Jayant Baliga., Krieger,, 1992.ISBN: 0894647997
Taylor, P.D., Thyristor Design and Realisation, Wiley, 1986.ISBN: 0 471 93572 7
Sze, S. M., 1936- author., Li, Yiming (Professor of electrical engineering) author.; Ng, Kwok Kwok, 1952- author.; Sze, S. M., 1936-, Physics of semiconductor devices., Wiley, 2021.ISBN: 9781119429111
S. M. Sze 1936-, Kwok Kwok Ng 1952-, Physics of semiconductor devices S.M. Sze and Kwok K. Ng., Wiley-Interscience, 2007.ISBN: 9780470068304
Benda, Vtezslav., Gowar, John,, Grant, Duncan Andrew., Power semiconductor devices : theory and applications / Vtezslav Benda, John Gowar and Duncan Grant., Wiley,, 1999.ISBN: 047197644x
Murari, B., Bertotti, F., Vignola, G. A., Andreini, A., Smart Power ICs : technologies and applications / B. Murari, F. Bertotti, G.A. Vignola, eds. ; contributions by Andreini A. ... [et al.]., Springer,, 2002.ISBN: 9783540432388
IEEE, Electron Devices Society Staff Corporate Author, 1996 IEEE International Symposium on Power Semiconductor Devices and ICs, Place of publication not identified IEEE, 1996.ISBN: 0780331060

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

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EGLM01 Wide band-gap Semiconductors

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr TGG Maffeis, Prof OJ Guy

Format: 23 h lecture/on demand
55 hours private study
20 hours assessment preparation

Delivery Method: Lecture either online or face to face.
Assessment: 80% final exam, 20% continual assessment (2x10%).

Module Aims: State-of-the-art wide band gap semiconductor materials and technology will be considered with emphasis on diamond, silicon carbide, gallium nitride and metal oxides. The course will cover everything from materials growth through device processing technology, to devices and applications. Current commercial devices and anticipated devices will be highlighted and discussed. The semiconductor physics needed for devices simulation and an introduction to device simulation will be covered. Metal oxide wide band gap semiconductors and their applications in renewable energy generation will be discussed.

Module Content:

• Introduction to wide band-gap materials: structure and material properties of diamond, silicon carbide & gallium nitride.
• Materials Growth.
• Electronic properties and applications.
• Basic requirements of power devices.
• Types of wide bandgap devices.
• Diodes: Schottky diodes & PiN diodes.
• Field Effect Transistors (FETs): MOSFETs, MESFETs.
• Device processing technology: Material analysis, Contact formation, Implantation, Dielectrics, Etching.
• Semiconductor physics background.
• Device testing & characterisation; State of the art device technology.
• Electronic materials for renewable energy generation.
• Solar power and photo-voltaics.

Intended Learning Outcomes: Technical outcomes:
• A detailed knowledge and comprehensive understanding of wide band gap materials including the techniques for the design, fabrication and characterisation of devices
• A comprehensive understanding of the semiconductor physics governing device behaviour
• A critical awareness of the pros and cons of novel wide band gap materials.
• An ability to identify the key differences between simulation and experiment
• How to design and fabricate devices.

Accreditation outcomes (AHEP):

MEng
- A comprehensive knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1m)
- Awareness of developing technologies related to own specialisation (SM4m)
- Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes (EA1m)
- Communicate their work to technical and non-technical audiences (D6m)
- Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D7m)
- Knowledge of characteristics of particular equipment, processes, or products, with extensive knowledge and understanding of a wide range of engineering materials and components (EP2m)
- Understanding of the use of technical literature and other information sources (EP4m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP9m)

MSc
• A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
• A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
• Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA1fl)
• Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D2fl)
• Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)
• A thorough understanding of current practice and its limitations, and some appreciation of likely new developments. (EP2fl)
• The ability to apply engineering techniques, taking into account of a range of industrial and commercial constraints (EP3fl)
• 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 (EP4fl)

Assessment:	Examination 1 (80%) Online Class Test (10%) Oral Presentation (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Assessments: Exam (80%), Canvas Quiz (10%) and oral presentation (10%)

Course work components:
Canvas Quiz: (Dr. Maffeis)
Groupwork Coursework: (Prof. Guy) Oral presentations - PowerPoint presentations given by small groups on course. related topics: Assessment in April - worth 10%. This is an individual piece of coursework.

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 40% in the examination component, and a minimum of 50% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 50%.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: - Written feedback on formal exam.
- Oral feedback on CA.

Failure Redemption: If rules allow - standard University provisions with marks capped. Any re-examination of this module will be by written examination only (100%).

Reading List: Sima Dimitrijev 1958-, Principles of semiconductor devices / Sima Dimitrijev., Oxford University Press, 2012.ISBN: 9780199896349
Dimitrijev, Sima,, Principles of semiconductor devices / Sima Dimitrijev., Oxford University Press,, 2006.ISBN: 0195161130
Cooke, M. J., Semiconductor devices / M.J. Cooke., Prentice Hall,, 1990.ISBN: 0138061831
Zetterling, Carl-Mikael., Process technology for silicon carbide devices / edited by Carl-Mikael Zetterling., INSPEC,, c2002..ISBN: 9780852969984
Choyke, Wolfgang J., Matsunami, Hiroyuki, Pensl, Gerhard, Silicon carbide : recent major advances / edited by W.J. Choyke, H. Matsunami, G. Pensl., Springer,, cop. 2004..ISBN: 9783540404583

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

• There is a zero tolerance towards late submission of coursework.

• Advanced semiconductor materials like diamond, silicon carbide and gallium nitrate are necessary to increase energy
efficiency of electronic devices to reduce carbon emissions. These new materials are expected to replace silicon in
aerospace, energy and automotive (hybrid electric vehicles) sectors in the near future.

EGLM02 Advanced Power Electronics and Drives

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr Z Zhou

Format: On demand online teaching: 16 hours
On demand example and coursework support 6 hours
Directed private study: 78 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on campus This module is delivered by a combination of campus-based teaching and continual assessment.

In order for the continual assessment marks to count, you must achieve at least 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

Assessment: open-book examination (80%) and continuous assessment (20%) The examination is worth 80% of the module. Answer 3 questions. Each question answered will be worth 25%. The examination topics will be those presented directly in the lectures. The continuous assessment is worth 20% of the module. This is based on an assignment related to the simulation and analysis of power electronics converter circuits.

Module Aims: This module introduces advanced circuit topologies of power electronics systems for high power applications; the power quality issues will also be addressed by covering passive and active power filters, front end active circuit topologies and harmonic standards. An introduction to modern variable speed AC and DC drives for industrial applications will also be introduced.

Module Content:

- Power converter circuit topologies for renewable energy systems.
- Multi pulse rectifiers.
- Multilevel converters for high power applications.
- Power quality issues at the Point of Common Coupling (PCC).
- Harmonics analysis of converters
- An introduction to grid interface of power electronics converters as well as AC and DC drives

Intended Learning Outcomes:
After completing the module you should be able to:

Design:
• Power electronics circuit topologies for medium power applications including renewable energy systems and electrical AC/DC drives.
• Multi-pulse rectifiers and multi-Level inverters for high power applications as well as design grid interface of power electronics converters.

Analyse:
• Power electronics circuit topologies for medium to high power applications including renewable energy systems and AC/DC drives.
• Harmonic content of systems and compliance to international standards.

Accreditation Outcomes (AHEP)
Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA1fl)
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 (D1fl)
Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D2fl)
Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)
Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues (ET5p)

Assessment:	Examination (80%) Assignment 1 (20%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Closed book in-person examination (80%) and continuous assessment (20%)

The closed book in-person examination is worth 80% of the module and answers 3 questions. Each question answered will be worth 25%. The examination topics will be those presented directly in the lectures.

The continuous assessment is worth 20% of the module. This is based on an assignment related to the simulation and analysis of power electronics circuits.

This module is assessed by a combination of examination and assignment (coursework). In order for the assignment marks to count, you must achieve at least 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: For the examination, the students will receive an examination feedback summary sheet giving details of the common mistakes that were identified from the assessed exam scripts. It also lists the maximum, minimum and means marks for each question and the number of students attempting it. Feedback specific to each question is additionally provided to aid the students.

For the continuous assessment, the students will receive feedback giving details of the common mistakes that were identified from the submitted coursework. Individually students can make an appointment with the lecturer to receive individual feedback on the assignment if this is required.

Failure Redemption: If rules allow - standard University provisions with marks capped. Any re-examination of this module will be by written examination only (100%).

Reading List: Mohan, Ned., Undeland, Tore M., Robbins, William P., Power electronics : converters, applications, and design / Ned Mohan, Tore M. Undeland, William P. Robbins., Wiley,, c2003..ISBN: 0471226939
Hodge, B. K., Alternative energy systems and applications / B.K. Hodge., Wiley,, c2010..ISBN: 9780470142509

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

AVAILABLE TO visiting and exchange students

EGLM03 Modern Control Systems

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr M Monfared

Format: On-campus: examples and problem solving: 20 hours;
Support for modelling and design exercises: 10 hours;

Delivery Method: A blended learning approach to class contact will be used in which the key concepts and readings will be introduced
and understanding tested using on-demand readings, short lectures and concept reinforcement quizzes before each live class event.

This leaves time to practice the mathematical techniques that are causing the most difficulties during the class contact time (two hours per week).

Live teaching sessions will be reinforced by making worked solutions available after class.

Each week will require around 2-3 hours of student engagement to review all the on-demand materials, complete the formative assessments and engage in class discussions.

An online textbook will be available and OneNote Class Notebook will be used as a class notes and handouts delivery platform, shared whiteboard and host for discussion and worked examples. In addition, there will be PC lab-based laboratory sessions used to introduce MATLAB, the Control System Toolbox and modelling and simulation in Simulink. A modelling exercise (performed in pair) and a design exercise (performed in groups of 4-5) will provide hands-on experience of the application of the design approaches covered in class. Provision will be made to ensure that the practical exercises can be completed even if social distancing is in place. This will be supported by around 10 hours of lab support - in class or via Zoom.

The course will be designed "online first" so that the learning outcomes will be achieved even if completely online delivery is needed. This can easily be adjusted to adapt to a blended delivery with variable amounts of on-campus teaching.

Module Aims: This module introduces ideas in modern control systems and their applications.

Module Content: This module will be focused on the study of a particular control problem:
• Modelling: single-input single-output (SISO) systems, revision of transfer functions, state-space modelling, nonlinear systems, multiple-input-multiple-output (MIM0) systems.
• Simulation: simulation as a design tool, continuous systems simulation, discrete event systems, simulation of digital systems, simulation of mixed continuous and discrete systems.
• Design: Control system performance specification and achievement of performance specification by dynamic compensation.
• Digital systems and the z-transform. Digital compensation: digital to continuous equivalence, direct digital design.
• State-space methods: modelling, transformations, pole-placement methods of control, construction and use of observers. The Linear Quadratic Regulator.
• Applications (study for project work): motor drives, mechatronics, aerospace flight control, process monitoring and control.

Intended Learning Outcomes: Technical Outcomes
At the end of the course you should be able to:
• Model a system in the electrical engineering domain and run simulations.
• Analyse the linearized models for such systems and devise a control strategy based on conventional or state-space methods.
• Implement such control systems as digital controllers.

The following AHEP 3 Programme Learning outcomes at C.Eng (m) and Partial C.Eng by Further Learning (fl) are partially addressed by this module:
Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems. (SM2m)
Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques. (EA2m)
Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and to implement appropriate action.(EA3m)
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 (EA3fl)
Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations. (D2fl)
Ability to generate an innovative design for products, systems, components or processes to fulfil new needs. (D3fl)
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 (EP4fl)

Assessment:	Examination 1 (70%) Coursework 1 (10%) Coursework 2 (20%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 40% in the examination component, and a minimum of 50% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 50%.

There are three assignments for this course:

* Coursework 1 is a Simulink Modelling Exercise to be done in pairs. 10% of the marks will be for this component.
* Coursework 2 is a Control Systems Design Exercise to be tackled in groups of 4-5 using Matlab, the Control Systems, Toolbox and Simulink assessed by the submission of an executive summary report. 20% of the marks will be for this component.

The exam is worth 70% of the module marks.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: In-class feedback is used throughout the course both with audience response systems and PostIt notes for queries and questions. There is also a discussion board on Canvas and in Teams that can be used to elicit information from the lecturer. Feedback on the modeling exercise is done using video screencasting supported by the Rubric Tool and the individual feedback feature of the Canvas SpeedGrader. Feedback on the Group Design Exercise is via Canvas and makes use of the rubric tool and the SpeedGrader individual feedback feature. Feedback on the examination is via the standard engineering examination feedback form which will be posted on Canvas. The Canvas announcement and discussion tools are used for general feedback on all aspects of the formal and informal feedback for the module.

Failure Redemption: If permitted within the regulations, a 100% resit examination will be offered to students.

Reading List: Norman S. Nise, Control systems engineering / Norman S. Nise., John Wiley & Sons, Inc., 2011.ISBN: 9780470646120
Control Systems.
Dr Chris P. Jobling, Control Systems Design (Handout).
Norman S. Nise, Case Studies from Nise, John Wiley, 2011.
Prof. Bill Messner at Carnegie Mellon, Prof. Dawn Tilbury at the University of Michigan, Control Tutorials for Matlab and Simulink.
Richard C. Dorf author., Robert H. Bishop 1957- author., Modern control systems / Richard C. Dorf, Robert H. Bishop., Harlow : Pearson Education, 2017.ISBN: 9781292152974
D'Azzo, John Joachim., Houpis, Constantine H.; Sheldon, Stuart N., Linear control system analysis and design with MATLAB, M. Dekker, 2003.ISBN: 9780203911426
Calculus.
Linear Algebra.
Signals and Systems.
Digital Signal Processing.
Joseph J. DiStefano III author., Feedback & control systems / Joseph J. DiStefano., New York, NY : Schaum's Outline Series, 2012.ISBN: 9780071829489
DiStefano, Joseph J., Stubberud, Allen R., Williams, Ivan J., Schaum's outline of theory and problems of feedback and control systems / Joseph J. DiStefano, III, Allen R. Stubberud, Ivan J. Williams., McGraw-Hill,, c1995..ISBN: 9780070170520
Franklin, Gene F., author., Powell, J. David, 1938- author.; Emami-Naeini, Abbas, author., Feedback control of dynamic systems, Pearson, 2015.ISBN: 9781292068916
Franklin, Gene F., Powell, J. David,, Emami-Naeini, Abbas., Feedback control of dynamic systems / Gene F. Franklin, J. David Powell, Abbas Emami-Naeini., Addison-Wesley,, 1986.
Franklin, Gene F., Powell, J. David,, Workman, Michael L., Digital control of dynamic systems / Gene F. Franklin, J. David Powell, Michael L. Workman., Addison Wesley,, 1998.ISBN: 0201820544
Prof. Jonathan P. How, Prof. Emilio Frazoli, Feedback Control Systems/MIT Course Number 16.30-16.31.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

• AVAILABLE TO visiting and exchange students.
• This module makes full use of the e-learning support tools provided by Canvas, Teams and the OneNote Class Notebook.
• The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of coursework and continuous assessment.

EGLM05 Advanced Power Systems

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG 241; EG 342

Co-requisite Modules:

Lecturer(s): Dr M Fazeli

Format: Lecture (Class, Examples, and tutorial): 30 hours. Self-study: at least 75 hours.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Classroom sessions (lectures, interactive discussions and examples classes)
100% examination.

Module Aims: This module will study Power Networks control including active power-frequency control, voltage-reactive power control and fault analysis. Integration of Renewable resources (including wind and solar) within the grid will be also discussed, which leads to the introduction of of distributed generation, microgrids and smart grids.

Module Content: • Introduction: Synchronous generators, Per Unit calculations.
• Symmetrical component and faults calculation.
• Protection systems in a power network.
• Stability studies.
• Voltage and frequency control.
• Integration of renewable generation, challenges and opportunities.

Intended Learning Outcomes: Technical Outcomes
On successful completion of this module students will be expected, at threshold level, to be able to:
• Evaluate rotor angle stability using Swing Equation and Equal Area Criterion, which demonstrates a comprehensive knowledge and understanding of power system stability (assessed by exam).
• Design the control system for a current-controlled voltage source converter in different operating modes, which demonstrates awareness of developing technologies in renewable energy control (assessed by exam).
• Evaluate the performance of different substation layouts, which demonstrates understanding of engineering principles (assessed by exam).
• Propose appropriate protection system for different components and applications in power systems, which demonstrates the ability to identify, classify and describe the performance of different protection relays (assessed by exam).
• Evaluate and explain different methods of controlling/supporting voltage and frequency, and apply economic dispatch criterion in a power systems, which demonstrate knowledge and understanding of commercial and economic context of engineering processes.

Accreditation Outcomes (AHEP)
A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
Ability to use fundamental knowledge to investigate new and emerging technologies (EA2fl)
Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)
A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)

Assessment: Examination (100%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description:
Examination (100%)

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Feedback will be given to the class after the examinations on the standard Faculty Examination Summary Sheet.

Failure Redemption: If rules allow - standard University provisions with marks capped. Any re-examination of this module will be by written examination only (100%).
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. • AVAILABLE TO visiting and exchange students. • This module makes full use of the e-learning support tools provided by Canvas. • The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of coursework and continuous assessment.

EGLM06 Sustainable Energy and Power Electronics Laboratory

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr Z Zhou

Format: On-demand 22 hours of online simulation labs
Directed private study 78 hours

Contact Hours will be delivered through a blend of live activities online and may include, for example, lectures, simulation classes, seminars and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity.

Assessment: 100% Continuous Assessment.
Laboratory work: 22 hours
Directed private study: 78 hours

Module Aims: The module covers main aspects of Engineering Applications for the MSc students in electrical & electronics engineering. It includes preparation, performance and reporting on a structured series of simulation supporting the taught modules at this level and gives the simulation experience of power electronics converters, electrical machine and photovoltaic (PV) system operation, practice in using simulation software and IT packages to assist with the laboratory work and report writing.

Module Content: • Photovoltaic system electrical characteristics.
• Maximum power point tracking method for PV system
• Power electronics converter and control for PV system
• Design and development of simulation circuit of solar energy-based battery charging systems
• Single-phase induction machine operation and starting techniques.

Work includes:
• The preparation for the simulation labs.
• The use of software tools for system design and simulation.
• Construction of simulation circuits for a PV system and electrical machine.
• Information recording and analysis.
• Practice in using IT packages to assist with report writing and presentations.

Intended Learning Outcomes: Technical Outcomes,
After completing this module, you should be able to:

• Design and develop simulation circuit of power electronics converter circuit and controller for photovoltaic (PV) energy storage systems.
• Design maximum power point tracking algorithm (MPPT) for PV systems
• Specify the parameters of the passive components for power electronics converters.
• Analyse the electrical characteristics and starting performance of the single-phase induction machine.

The following AHEP 3 Programme Learning outcomes are partially addressed by this module:

• A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
• 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. (SM3fl)
• Ability to use fundamental knowledge to investigate new and emerging technology (EA2fl)
• Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems (EA4m)
• 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. (D1fl)
• Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations. (D2fl)

Assessment:	Assignment 1 (60%) Assignment 2 (40%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description:
Students need to submit a simulation lab report for each continuous assignment. The first continuous assignment (A1) is worth 60%, the second assignment (A2) is worth 40%.

This module is assessed by two assignments. In order to pass the module students must achieve a minimum of 40% in Assignment 1, and a minimum of 50% overall for the module. If students do not meet the Assignment 1 and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 50%.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Students will receive feedback from the module lecturer and demonstrator during the designate feedback session.

Failure Redemption: Failure redemption of this module will be by resit continuous assignment in August (100%). The failure redemption is only available to students who record sufficient engagement (80% lab attendance, attendance at scheduled online or lab events).

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online using ZOOM.

AVAILABLE TO a limited number of Visiting and Exchange Students due to number restriction.

LABORATORY (simulation) CLASSES ARE COMPULSORY. Students must have at least 80% attendance at laboratory classes in order to be allowed to be assessed for the module.

The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EGLM07 Power Systems with Project

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr M Fazeli

Format: Lecture (class, examples, and tutorial): 30 Hours. at least 100 hours of self-study.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Classroom sessions.
75% Examination
25% Assignment (Project)

Module Aims: This module aims to introduce the component of a Power Network and discuss their operation in both balanced and unbalanced conditions. The students are required to self-study Load Flow analysis using the provided lecture notes (and other sources). Load Flow analysis will be assessed by a project (not in the final exam), which is 25% of the final mark.

Module Content: • Self-study: Load Flow analysis.
• Introduction: 3-phase systems, Electromagnetism.
• Transmission lines.
• Synchronous generators.
• Per Unit Calculations.
• Symmetrical component and fault calculations.

Intended Learning Outcomes: Technical Outcomes
On successful completion of this module students will be expected, at threshold level, to be able to:
• Model and analyse different components of a power system including transmission lines, synchronous generators and transformers in different operating modes, which demonstrate the comprehensive understanding of power systems operation (assessed by exam).
• Utilise Per Unit calculation to analyse power systems for both 1-phase and 3-phase systems, which demonstrate understanding of mathematical methods necessary to analyse power systems (assessed by exam).
• Construct the operating chart of a synchronous generator and utilise it to calculate active and reactive powers, power factor, etc. for different operating points, which demonstrate a through understanding of current practice and its limitations (assessed by exam).
• Apply symmetrical components to analyse an unbalanced power system and calculate the fault current, which demonstrate the ability to apply appropriate engineering analysis for solving complex problems (assessed by exam).
• Apply the Load Flow analysis in a power system, which demonstrate the ability to collect and analyse research date and to use appropriate engineering analysis tools (assessed through the project).

Accreditation Outcomes (AHEP)
A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA1fl)
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 (EA3fl)

Assessment:	Project (25%)
	Examination (75%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: 75% Final Examination (will not include Load Flow Analysis in the main sit). 25% Coursework (Project) on Load Flow Analysis.

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 40% in the examination component, and a minimum of 50% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 50%.

The re-sit will be only examination that also includes Load Flow Analysis.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Feedback will be in a standard format via the College exam feedback proforma. Information provided includes average mark, maximum and minimum marks for the examination as a whole and for individual questions.

Failure Redemption: If rules allow - standard University provision with marks capped at 40%. Any re-examination of this module will be by 100% written examination only.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

AVAILABLE TO visiting and exchange students provided they know the pre-requisites modules.
Zero Tolerance for late submission.

EGTM71 Power Generation Systems

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof I Masters

Format: Lectures and directed private study

Delivery Method: Seminar style lectures which include Q&A, informal discussion and class debate sessions. Assessment 100% Exam.

Module Aims: This module will provide a detailed introduction to the technology, politics and economics of power generation and its distribution, with an emphasis on the UK network. The main topics include power for transport applications and electricity generation. Case studies of traditional power plant (including coal, oil, gas, nuclear) will be followed by an assessment of current and future low carbon and sustainable technologies (wind, wave, tidal, solar, biomass).

Module Content: Definitions of energy, work and power; energy conversion.
Steam engines, internal combustion and diesel engines; aeroengine variants, low emissions vehicles.
Conventional power generation: Fundamentals and nuclear reactor types.
Hydroelectric, geothermal, wind, solar, biomass, wave, tidal and other energy sources.
UK energy policy.
Changing patterns of energy requirements in the UK and the world; climate change.

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should be able to demonstrate:
- Comprehensive knowledge of existing power generation systems.
- Awareness of future energy requirements, constraints and emerging generation systems.
- Power generation systems for transport and electricity supply.
- An ability to (thinking skills): Evaluate alternative power systems in light of social, economical and environmental concerns.
- An ability to (key skills): Present a coherent (even personal) view of energy requirements, supply and use on regional, national and international scales.

Accreditation Outcomes (AHEP)
MEng:
- LO1 Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (D2)
- LO2 Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- LO3 Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- LO4 Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)

MSc:
- LO5 Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M)
- LO6 Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11M)

Assessment: Examination 1 (100%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Formal Exam. 100%. All learning Outcomes. Questions based on course notes and the "Energy Plans" given in the textbook "Sustainable energy without the hot air".

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Standard Faculty exam feedback form.

Failure Redemption: A supplementary examination will form 100% of the module mark

Reading List: MacKay, David J. C., Sustainable energy--without the hot air / David J.C. MacKay., UIT,, 2009.ISBN: 9780954452933
Johnson, Kate; Dalton, Gordon; Masters, Ian, Building industries at sea : 'blue growth' and the new maritime economy / editors: Kate Johnson, Gordon Dalton, Ian Masters, 2017.ISBN: 8793609264

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

AVAILABLE TO visiting and exchange students.

EGTM79 Sustainability and Environmental Assessment

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof GTM Bunting, Mr MH Green

Format: Lectures 25; Directed private study35; Preparation of assignments 40;
Contact Hours will be delivered through a blend of on-site lectures and workshops, supported by online learning resources on the Canvas site.

Delivery Method: Delivery of teaching will be via on-campus lectures, supported by tutorials and on-line learning resources using the Canvas Digital Learning Platform.

Module Aims: This module covers the principles and practice of the assessment of sustainability of engineering activities, including life cycle analysis and the benefits of a Circular Economy. It covers the assessment of resource conservation by optimal use of resources, including consideration of primary extraction processes, design/manufacturing/fabrication, improving product life and end of life usage. It includes training and practice in how to undertake a quantitative environmental impact assessment.

Module Content: •The concepts of lifecycle analysis and Circular Economy.
•Principle of energy and resource conservation from 'cradle to grave' and ‘cradle to cradle.’
•Sustainability and the understanding of how societal, economic and environmental concerns interact. A review of the methods of assessing societal impacts.
•A review of the methodology of LCA, including inventory analysis, data sources and environmental impact assessment.
•Case studies from various sectors of engineering and waste management will be covered.
•The effects of economic, social and political pressures on sustainable business activities.

Intended Learning Outcomes: Accreditation Learning Outcomes
On successful completion of this module students will be expected, at least at threshold level, to have met the following AHEP4 Learning Outcomes:

• M2 Formulate and analyse complex problems to reach substantiated conclusions (L7/EQF).
• M4 Select and critically evaluate technical literature and other sources of information to solve complex problems (L7/EQF).
• M7 Evaluate the environmental and societal impact of solutions to complex problems (to include the entire life-cycle of a product or process) and minimise adverse impacts (L7/EQF).
• M15 Apply knowledge of engineering management principles (L6/EQF).
• M17 Communicate effectively on complex engineering matters with technical and nontechnical audiences, evaluating the effectiveness of the methods used (L7/EQF).

Technical Outcomes
- An understanding of the principles of life cycle analysis and the different approaches that have been used.
- An appreciation of the application of LCA to industry.
- Familiarity of the approach of circular economy to address sustainability concerns and an understanding of engineering as a key driver for sustainable business activities.
- An understanding of the circular economy and how it relates to new opportunities for industry.
- An appreciation of the complexity of legislative, social and political pressures on technological development.

Assessment:
Assignment 1 (10%)
Assignment 2 (90%)
Coursework reassessment instrument (100%)

Assessment Description: Both assignments will involve working in groups.

Assignment 1 – completion and analysis of results from an Excel based model evaluating circular economy design opportunities.

Assignment 2 – evaluation of opportunities for circularity and reduction in environmental impact of a particular product. This will build on the work performed for assignment 1 and will involve a numerical analysis using circularity indicators and LCA, coupled with a written report on interpretation of the findings and proposed methods to reduce environmental impacts. This will robustly assess Learning Outcomes M2, M7 and will include aspects of M17.

Important information: The pass mark for a module at Level 4/M is 50%. In addition, in order to pass the module, students must pass both assessment components with a minimum of 50%.

If you do not meet the component level requirements for the module you will receive a QF outcome. This means that you will be required to repeat the failed component(s), even if your module mark is above 50%.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Each student will receive the mark and individual feedback comments on each piece of submitted coursework, via Canvas.

Failure Redemption: Submission of additional assignment worth 100% (capped at 50%).

Reading List: Braungart, Michael, McDonough, William, Cradle to cradle : remaking the way we make things, Vintage, 2009.ISBN: 0099535475
Henrikke. Baumann, Anne-Marie Tillman, The hitch hiker's guide to LCA : an orientation in life cycle assessment methodology and application / Henrikke Baumann & Anne-Marie Tillman., Studentlitteratur, 2004.ISBN: 9789144023649
Ciambrone, David F., Environmental life cycle analysis / David F. Ciambrone., Lewis Publishers,, 1997.ISBN: 9781566702140
Frankl, Paolo., Rubik, Frieder., Life cycle assessment in industry and business : adoption patterns, applications and implications / Paolo Frankl, Frieder Rubik ; with contributions by Matteo Bartolomeo ... [et al.]., Springer,, c2000..ISBN: 3540664696
Webster, Ken, author., The circular economy : a wealth of flows, Ellen MacArthur Foundation Publishing, 2017.ISBN: 9780992778460

Additional Notes: Delivery of both teaching will be primarily via on-site lectures, supported with on-line learning resources. Assessments will be via coursework submitted to the Canvas system.

Available to visiting and exchange students.

The pass mark for a module at Level 4/M is 50%, and students must achieve this pass mark in both assessment components to pass this module.