Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE & ENGINEERING

STUDENT HANDBOOK

MSc (FHEQ LEVEL 7)

MSc POWER ENGINEERING AND SUSTAINABLE ENERGY *(JANUARY INTAKE)* DEGREE PROGRAMME

SUBJECT SPECIFIC (PART TWO OF TWO)

MODULE AND COURSE STRUCTURE

2021/22

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. **It is likely that the module descriptors for the September-January modules will be updated by module coordinators later in the year.**

COVID-19

As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible.

We are working hard to enable learning to take place in a Covid-aware environment, based on Welsh law and Welsh Government guidance. Delivery of both teaching and assessment will be 'blended' including live and self-directed activities online and on-campus.

Given the changeable situation with COVID-19 it is important that staff and students comply with the procedures that are in place to protect the health of our community. Please familiarise yourself with the Student Charter and follow all of the guidance in place across the University and Faculty of Science and Engineering. As a community we all need to ensure that we keep Swansea University a safe place to study and work.

TERM DATES

The 2021/22 academic year for January start programmes begins on 17th January 2022

Full term dates can be found here

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. You should also refer to the Faculty of Science and Engineering proof-reading policy and this can be found on the Community HUB on Canvas, under Course Documents.

WELCOME

We would like to extend a very warm welcome to all students for the 2021/22 academic year.

We are looking forward to having you on campus for the new academic year. We have been busy making preparations to ensure a COVID aware environment in line with the latest Welsh Government guidelines and with your safety as our top priority.

The campus experience may still be different from an ordinary year. For example, some teaching activities will be online rather than in person, with a 'blended learning' approach.

Given the continued situation with COVID-19 it is important that staff and students comply with the procedures that are in place to protect the health of our community. Please familiarise yourself with the Student Charter and follow all of the guidance in place across the University and Faculty of Science and Engineering. As a community we all need to ensure that we keep Swansea University a safe place to study and work.

We would like to wish you every success with the year ahead.

Faculty of Science and Engineering	
Executive Dean and PVC	Professor Ken Meissner
Deputy Executive Dean	Professor Johann Sienz
Head of Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Paul Holland
School of Aerospace, Civil, Electrical, General and Mechanical Engineering **Head of School: Professor Antonio Gil**	
School Education Lead	Professor Cris Arnold
Head of Electrical and Electronic Engineering	Professor Vincent Teng
Electrical and Electronic Engineering Programme Director	Professor Chris Jobling C.P.Jobling@swansea.ac.uk
MSc Power Engineering and Sustainable Energy Coordinator	Dr Meghdad Fazeli- M.Fazeli@swansea.ac.uk

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 9am-5pm.

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 and also 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 and also 01792 6062522 (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 contains useful information and links to other resources:

https://myuni.swansea.ac.uk/college-of-engineering/coe-student-info/

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 21-22 handbooks to ensure that you have access to the most up-to-date versions. Access to print material in the library may be limited due to CV-19; your reading lists will link to on-line material whenever possible. For Engineering courses, we do not expect you to purchase textbooks, unless it is a specified key text for the course.

Power Engineering and Sustainable Energy
Coordinator: Dr M Fazeli
JANUARY START – PTFEG18J

Jan-June 21-22	September-Jan 22-23
EGLM01 **Wide Band-gap Semiconductors** **10 Credits** **CORE**	**EGIM16** **Communication Skills for Research Engineers 10 Credits** **CORE**
EGLM03 **Modern Control Systems** **10 Credits** **CORE**	**EGLM00** **Power Semiconductor Devices** **10 Credits** **CORE**
EGLM05 **Advanced Power Systems** **10 Credits** **CORE**	**EGLM02** **Advanced Power Electronics and Drives** **10 Credits** **CORE**
EGLM06 **Energy and Power Electronics Laboratory** **10 Credits** **CORE**	**EG-M125** **Advanced Optical Materials and Devices** **10 Credits** **CORE**
EG-M190 **Social, Environmental and Economic context of Research** **10 Credits** **CORE**	**EGTM71** **Power Generation Systems** **10 Credits** **CORE**
EG-M47 **Leadership Development** **10 Credits** **CORE**	**EGTM79** **Environmental Analysis and Legislation** **10 Credits** **CORE**
Research Project – July-September 21-22	
EG-D05 **MSc Dissertation - Electrical Engineering** **60 Credits** **CORE**	
Total 180 Credits	

EG-D05 MSc Dissertation - Electrical Engineering

Credits: 60

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.

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

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: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The College of 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

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr N Wint

Format: 20 hours lecture and workshop time
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

Lecture and workshops

Module Aims: Engineering interventions interact with and shape society, the environment and the economy. Research engineers have a responsibility to explore the potential wider impact of their engineering interventions and processes beyond the technical domain.

This could take the form of an aerospace engineer confronting the fact that components for an essential control system use elements sourced from conflict zones, or it could be a civil engineer using limited financial resources to decide which of several in-need communities benefit from infrastructure upgrades and which do not. There are often no simple answers or perfect solutions to engineering projects which operate within their own cultural and financial constraints. A holistic and sustainable engineering approach is one that characterises potential impacts as fully as possible, so that engineering judgement is applied using this insight.

This module will introduce both quantitative and qualitative research methods, showing how different methodologies are appropriate when targeting various objectives. While quantitative approaches are necessary to determine product safety, not all important factors can be reduced to a numeric quantity and a wider toolbox of techniques is required when engaging with intangible factors. Qualitative approaches can a better way of understanding how end-users appreciate or interact with the end product or process, which in turn may dictate success. Ethical issues concerning negative impacts on environment or society may raise questions of value, duty or morality. This requires the application of moral reasoning rather than scientific reasoning.

Through the introduction of research methods and techniques to explore and characterise wider impacts, this module will equip students with the skills and background research needed to embark on their dissertation research project.

Module Content: 1. Exploring and evaluating sources of knowledge, deductive and inductive approaches to knowledge creation
2. Quantitative and qualitative approaches, validity and reliability
3. Agency and positionality in decision making
4. Root-cause analysis
4. Frameworks for social impact
5. Frameworks for environmental impact
6. Frameworks for economic impact

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)
Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M)
Awareness that engineering activities should promote sustainable development (EL11M)

Assessment: Coursework 1 (30%)
Coursework 2 (30%)
Coursework 3 (40%)

Assessment Description: Assessment One: A critique evaluating either a qualitative or quantitative research framework or methodology on a contemporary sustainability topic in the discipline.

Assessment Two: A reflection based on a role-play scenario of an ethical dilemma.

Assessment Three: An individual report and presentation in the style of a grant application that relates the social, environmental and economic impact of the proposed dissertation research topic.

Coursework Reassessment Instrument: Additional coursework

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: In class feedback.
Feedback on Turnitin

Failure Redemption: Resubmission of individually assessed coursework in the summer worth 100%.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

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EG-M47 Business Leadership for Engineers

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr V Samaras

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)

MEng:
- 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)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)
- Monitor and adjust a personal programme of work on an on-going basis (G3)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

MSc:
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11M)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)
- Monitor and adjust a personal programme of work on an on-going basis (G3)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

Assessment: Group Work - Coursework (80%)
Coursework 1 (20%)

Assessment Description: 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.

The individual assignment will focus on leadership, its main characteristics and entrepreneurial thinking.

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.

Moderation approach to main assessment: Partial second marking

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.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The College of 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.

EGLM01 Wide band-gap Semiconductors

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

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

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

Delivery Method: Lecture either online or face to face, and PC lab based module.
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):

• 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)
• 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)

Assessment: Exam - One day/Take home (80%)
Coursework 1 (10%)
Oral Presentation (10%)

Assessment Description: Examination: one day take home exam (80%), exercise sheet (10%) and oral presentation (10%)

Course work components:
Coursework 1: (Prof. Guy) Problem sheet (exam type questions): Assessment in April - worth 10%. This is an individual piece of coursework.
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 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.

Moderation approach to main assessment: Universal second marking 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%).

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. 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.

• This module is assessed by a combination of examination 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.

EGLM03 Modern Control Systems

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr CP Jobling

Format: Live study: 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:

• Science and Mathematics: SM1m, SM3m, and SM3fl are addressed by the advanced study, modeling, and simulation of dynamic systems (electrical, mechanical, electromechanical) with feedback and dynamic compensation. SM2m, SM5m, and SM1fl are addressed in the study and application of matrix methods, complex numbers, Laplace transforms, and Z-transforms.
• Engineering analysis; aspects of the learning outcomes (EA2m, EA3m, and EA6m; EA1fl) are addressed.
• Design: experience related to dealing with incomplete information (D3m and D1fl); comprehensive knowledge of design processes and methodologies and the ability to apply them (D7m and D2fl); and demonstration of the ability to innovate (D8m and D3fl)
• Engineering Practice: Team Work (EP11m and EP4fl)

The Science and Mathematics learning outcomes are partially assessed via the end-of-module assessment (exam or open-book exam). The Engineering Analysis, Design, and Engineering Practice are partially assessed via the modeling exercise (done in pairs) and the group design exercise.

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

Assessment Description:
This module is assessed by a combination of examination 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.

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 June Examination will be a parameterized personalized paper consisting of one compulsory question and 2 questions from the remaining 3. There will be 25 marks per question. Questions 2-4 will contain an open-ended element (5 marks) requiring a demonstration of design thinking. If an alternative assessment is required, this paper will be delivered as an open book examination and all questions will need to be answered.

The exam is worth 70% of the module marks.

Moderation approach to main assessment: Universal second marking 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.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

This module is assessed by a combination of examination 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.

• 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 College of Engineering has a ZERO TOLERANCE penalty policy for late submission of coursework and continuous assessment.

EGLM05 Advanced Power Systems

Credits: 10

Pre-requisite Modules: EG 241; EG 342

Co-requisite Modules:

Lecturer(s): Dr M Fazeli

Format: Lecture 20-22 Hours
Example 4-6 Hours
Private Study 72 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

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: 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.

Assessment: Examination (100%)

Assessment Description:
Examination (100%)

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Feedback will be given to the class after the examinations on the standard College 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: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. 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 College of Engineering has a ZERO TOLERANCE penalty policy for late submission of coursework and continuous assessment.

EGLM06 Energy and Power Electronics Laboratory

Credits: 10

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:

• Simulation of PV array characteristics.
• Simulation of PV power generation system.
• Simulation of induction machine operation including various 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:

After completing this module you should be able to demonstrate:

• The simulation skills of electrical machine operation.
• The simulation skills of power electronics technique for photovoltaic power generation systems.
• The simulation skills of modern control theory for practical applications of electrical systems.

Assessment: Assignment 1 (60%)
Assignment 2 (40%)

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 delivered by a combination of A1 and A2. In order for the A2 marks to count, you must achieve at least 40% A1. If you achieve less than 40% in A1, then the module mark will be just the mark from A1.

Moderation approach to main assessment: Universal second marking 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: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. 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 College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EG-M125 Advanced Optical Materials and Devices

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr WC Tsoi

Format: 11 weeks, each week 2 hours lecture (+demonstration if possible) + 1 hour example class (+Lab tour if possible)

Both will be online, with a possibility of limited on-site sessions.
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

Lectures, example classes, experimental demonstrations if possible, lab tours if possible.

Module Aims: This module covers advanced printable semiconducting materials for optical devices, with particular focus on their applications for new type of photovoltaic cells and light emitting diodes, and the working principles and engineering of the devices.

Module Content: • Introduction to semiconductors
• Introduction to organic semiconductors
• Introduction to perovskite semiconductors
• Organic and perovskite photovoltaic devices
• Organic and perovskite light emitting diodes
• Light absorption and excitons
• Charge separation and recombination
• Charge transport and injection
• Electroluminescence and outcoupling

Intended Learning Outcomes: After completing this module, students should be able to:
• Define what are organic and perovskite semiconductors
• Identify and describe their optical and electrical properties
• Understand their applications, working principles and engineering for photovoltaic devices and light emitting diodes
• Know the facilities to fabricate and test photovoltaic devices and light emitting diodes

Accreditation Outcomes (AHEP)
- Awareness of developing technologies related to own specialisation (SM4m / SM2fl)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m / EA2fl)

Assessment: Assignment 1 (15%)
Assignment 2 (10%)
Examination (75%)

Assessment Description: 15% Assignment one: online multiple choices test
10% Assignment two: online multiple choices test
75% Exam: Open book

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: The assignments will be marked by the Canvas system immediately after the submissions. The statistics of the performance and the solutions to the questions will be provided shortly after each assignment. Furthermore, oral clarification of issues is available at student¿s request.
Feedback on the written examination will be in a standard format on the College of Engineering Intranet. Information provided includes average mark, maximum and minimum marks, for the examination as a whole and for individual questions. Besides, the common mistakes for each question will be provided, with suggestions on how to improve.

Failure Redemption: Resit in August: This supplementary examination is based on a written examination only, which is worth 100% of the total module mark.

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

Available for Visiting and Exchange Students
PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION.

EGIM16 Communication Skills for Research Engineers

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

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

Format: Lectures (10h), Exercises (20h), 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, visual and group communication will be explored through a series of lectures and formative exercises.

Module Content:

Written Communication: [6 hours]
• 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: [6 hours]
• The usual layout of a research presentation
• Slide design for a research presentation
• Delivery of a presentation, do's and don'ts
• Maintaining the audience's interest.

Other topics: [3 hours]
• Attending & chairing meetings
• Conferences – submissions and attendance
• Submission of papers and peer review.

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)
• Demonstrate an awareness of the other modes of communication of ideas at a research level such as posters and group discussions (assessed in the second assessment component)

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 and ability to apply quantitative techniques where appropriate (EL11M / ET4fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9M / EP2fl)

Assessment: Assignment 1 (10%)
Assignment 2 (10%)
Oral Examination (40%)
Writing (40%)

Assessment Description:
The first sit assessment will consist of 4 assignments.

The first assessment component will be a short written piece, up to two pages long, which will test the students understanding of the concepts with respect to the written work and to allow feedback to the participants in the module prior to the final assessment. This is an individual piece of coursework.

The second component will feature a small number of tasks which are aimed to evaluate the students understanding of the other ideas, beyond the written word and oral presentations, which are covered in the module. This will include the critical review of a written output. Other possible tasks include group meetings and the creation of a poster. The coursework may be done individually or in groups, this will be confirmed at the time of setting the work.

The oral examination will involve the students presenting an example of the work they have undertaken in the past, typically a project, 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, fourth, component will require the student to write a paper 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, details of which are provided in a later section.

Moderation approach to main assessment: Second marking as sampling or moderation

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.
All components are redeemable individually in the event of failure across the module.

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.

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

EGLM00 Power Semiconductor Devices

Credits: 10 Session: 2022/23 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%)

Assessment Description: Examination - 2 hours

Moderation approach to main assessment: Universal second marking 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%.

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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EGLM02 Advanced Power Electronics and Drives

Credits: 10 Session: 2022/23 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 on-line 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 4 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%)

Assessment Description: Due to COVID-19, an alternative assessment has been put in place:

examination (80%) and continuous assessment (20%)

The take-home examination is worth 80% of the module, answer 4 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 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.

Moderation approach to main assessment: Universal second marking 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%).

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 is assessed by a combination of examination 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.

EGTM71 Power Generation Systems

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr M Togneri

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%)

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: Universal second marking as check or audit

Assessment Feedback: Standard college exam feedback form.

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

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

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

AVAILABLE TO visiting and exchange students.

EGTM79 Environmental Analysis and Legislation

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof GTM Bunting

Format: Lectures 25
Directed private study 35
Preparation of assignments 40

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

On Campus

Module Aims: This module presents the principles of life cycle analysis and 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 also reviews the current and planned European legislation that is of relevance to materials and energy and considers its implementation in the UK.

Module Content:

• The concepts of lifecycle analysis and Circular Economy.
• Principle of energy and resource conservation from 'cradle to grave' and ‘cradle to cradle.’
• 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 current environmental legislative framework, especially as it relates to energy and waste, including UN, EU and UK legislation.
• The effects of economic, social and political pressures on sustainable business activities.

Intended Learning Outcomes:

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 significant legislation relevant to circular economy/ sustainability and an understanding of legislation 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.

Accreditation Outcomes (AHEP)

MEng:

- Understanding of the need for a high level of professional and ethical conduct in engineering, a knowledge of professional codes of conduct and how ethical dilemmas can arise (EL1m)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2m)
- Knowledge and understanding of management techniques, including project and change management that may be used to achieve engineering objectives, their limitations and how they may be applied appropriately (EL3m)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues, and an awareness that these may differ internationally (EL5m)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk (EL6m)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)

MSc:

- Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (EL10M)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11M)
- Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (EL12M)
- 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 (EL13M)

Assessment: Assignment 1 (50%)
Assignment 2 (50%)

Assessment Description:

Assignment 1 - a 2500 word report based around information gathering, review and collation.
Assignment 2 - a numerical analysis of an LCA Case Study, coupled with a written report on interpretation of the findings.

Important information: The pass mark for a module at Level 4/M is 50%. In addition, in order to pass the module, students must achieve a minimum of 40% in both components.

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: Universal second marking 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%.

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.

The pass mark for a module at Level 4/M is 50%. In addition to this students must also achieve at least 40% in both components to pass this module.