Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE TAUGHT STUDENT HANDBOOK

YEAR 1 (FHEQ LEVEL 4)

ELECTRONIC AND ELECTRICAL ENGINEERING DEGREE PROGRAMMES

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 Antonio Martinez Muniz

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 first-year student studying *Electronic and Electrical Engineering* at Swansea University you are starting a journey which we hope will end with Engineering Council registration as either an Incorporated Engineer (IEng) or Chartered Engineer (CEng).

Each of the Bachelor of Engineering (BEng) programmes covered by this handbook has been accredited by the Institution of Engineering and Technology (IET) on behalf of the Engineering Council for the purpose of fully meeting the academic requirement for registration as an Incorporated Engineer (IEng) and partially meeting the academic requirement for registration as a Chartered Engineer (CEng).

Each of the Integrated Masters (MEng) programmes covered by this handbook has been accredited by the Institution of Engineering and Technology (IET) on behalf of the Engineering Council for the purpose of fully meeting the academic requirement for registration as a Chartered Engineer (CEng).

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

Progression routes

There are some options you may want to consider if you are currently enrolled on one of the Electronic and Electrical Engineering undergraduate programmes. After the completion of the Year 2, you could trade up to MEng and/or add an optional year: Year in Industry or Study Abroad. Please discuss this with your Academic Mentor and your family or other supporters and if you wish to proceed contact the Faculty Student Support Team (studentsupport-sciencengineering@swansea.ac.uk).

Figure 1 shows the progression routes.

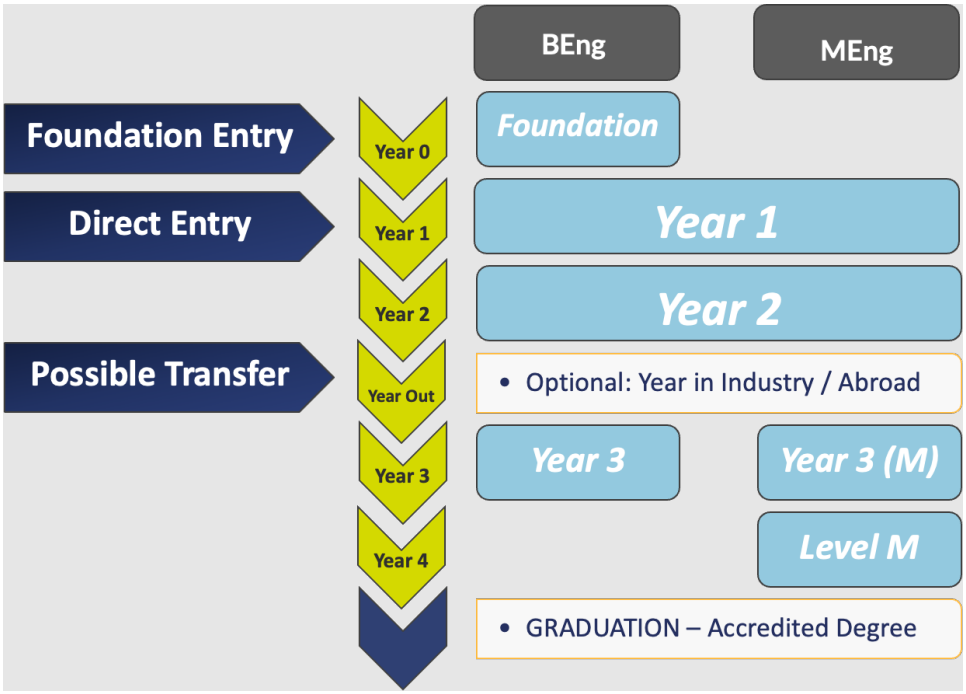

Figure 1 *The progression routes*

Trading up to MEng

If you are currently enrolled on one of the BEng programmes and would like to become a Chartered Engineer, the easiest way to satisfy the academic requirements at Swansea University is to transfer from the BEng to the equivalent MEng programme. This option is open to you until the end of Year 2, providing that your overall average is (or is predicted to be) at least 55%.

Trading up to Year in Industry

If you are currently enrolled on one of the BEng or MEng programmes and would like to have an industry experience, you can opt to Year in Industry. The Employability Team will assist you on finding a placement and support you through the year.

Trading up to a Year Abroad

If you wish to study abroad, you may want to consider transferring from a regular BEng or MEng programme to a programme which includes a year abroad.

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.

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 and progression awards

The Faculty of Science and Engineering awards prizes to the best student in each year and progression awards to students who achieve high averages in each year's programme of studies. These prizes are awarded at a special ceremony and dinner held each year.

Year 1 (FHEQ Level 4) 2023/24
Electronic and Electrical Engineering

BEng Electronic and Electrical Engineering[H602,H605]
BEng Electronic and Electrical Engineering with a Year Abroad[H603]
MEng Electronic and Electrical Engineering[H606]
MEng Electronic and Electrical Engineering with a Year Abroad[H600]

Semester 1 Modules	Semester 2 Modules
EG-114 **Engineering Mathematics 1 (Mech & EEE & Engineering)** **10 Credits** **Dr MR Brown/Dr N Jamia** **CORE**	**EG-116** **Engineering Mathematics 2 (Mech & EEE & Engineering)** **10 Credits** **Dr S Salim** **CORE**
EG-133 **Engineering for People Hackathon** **10 Credits** **Prof JC Arnold/Dr WG Bennett/Mr D Butcher/Dr JW Jones/...** **CORE**	**EG-142** **Instrumentation and Control** **10 Credits** **Y Hou** **CORE**
EG-143 **Digital Design** **10 Credits** **Dr M Monfared/Prof MR Jennings** **CORE**	**EG-150** **Signals and Systems** **10 Credits** **Dr CP Jobling** **CORE**
EG-151 **Microcontrollers** **10 Credits** **Dr CP Jobling** **CORE**	**EG-152** **Analogue Design** **10 Credits** **Dr AE Martinez Muniz/Mr AG Francis** **CORE**
EG-155 **Circuit Analysis** **10 Credits** **Prof PM Holland** **CORE**	**EGA107** **Power Engineering** **10 Credits** **Dr M Monfared** **CORE**
EGA108 **Electrical and Magnetic Properties of Materials** **10 Credits** **Dr AE Martinez Muniz** **CORE**	**EGA121** **Introduction to Electromagnetics** **10 Credits** **Dr AE Martinez Muniz** **CORE**
Total 120 Credits	

Year 1 (FHEQ Level 4) 2023/24
Electronic and Electrical Engineering
BEng Electronic and Electrical Engineering with a Year in Industry[H604]
MEng Electronic and Electrical Engineering with a Year in Industry[H601]

Semester 1 Modules	Semester 2 Modules
EG-114 **Engineering Mathematics 1 (Mech & EEE & Engineering)** **10 Credits** **Dr MR Brown/Dr N Jamia** **CORE**	**EG-116** **Engineering Mathematics 2 (Mech & EEE & Engineering)** **10 Credits** **Dr S Salim** **CORE**
EG-133 **Engineering for People Hackathon** **10 Credits** **Prof JC Arnold/Dr WG Bennett/Mr D Butcher/Dr JW Jones/...** **CORE**	**EG-135** **Placement Preparation: Science and Engineering Year in Industry** **0 Credits** **Prof GTM Bunting/Dr SA Rolland/Dr V Samaras** **CORE**
EG-143 **Digital Design** **10 Credits** **Dr M Monfared/Prof MR Jennings** **CORE**	**EG-142** **Instrumentation and Control** **10 Credits** **Y Hou** **CORE**
EG-151 **Microcontrollers** **10 Credits** **Dr CP Jobling** **CORE**	**EG-150** **Signals and Systems** **10 Credits** **Dr CP Jobling** **CORE**
EG-155 **Circuit Analysis** **10 Credits** **Prof PM Holland** **CORE**	**EG-152** **Analogue Design** **10 Credits** **Dr AE Martinez Muniz/Mr AG Francis** **CORE**
EGA108 **Electrical and Magnetic Properties of Materials** **10 Credits** **Dr AE Martinez Muniz** **CORE**	**EGA107** **Power Engineering** **10 Credits** **Dr M Monfared** **CORE**
	EGA121 **Introduction to Electromagnetics** **10 Credits** **Dr AE Martinez Muniz** **CORE**
Total 120 Credits	

EG-114 Engineering Mathematics 1 (Mech & EEE & Engineering)

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MR Brown, Dr N Jamia

Format: Lectures 30 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: This module will consist of lectures and examples classes, which concentrate on understanding the concepts of mathematical theory and the application in solving engineering problems. Besides, self-directed e-learning and e-assessment system MyMathLab developed by Pearson, which concentrate on practising the calculation techniques, will be available through the Canvas Digital Learning Platform.

Module Aims: This module (in combination with Engineering Analysis 2B) provides the essential grounding in mathematical analysis techniques for engineering students. This module ensures that all students have a suitable level of analytical skills for subsequent engineering modules.

Module Content: Module content:

• Number systems: numbers, algebra and geometry.
• Functions: inverse and composite functions, polynomial functions, rational functions, circular functions, exponential,
logarithmic and hyperbolic functions, continuous and discontinuous functions.
• Introduction to complex numbers: The number j, real and imaginary components, Cartesian form, complex conjugate
and polar form.
• Differentiation: basic ideas and definition, elementary functions, rules of differentiation, parametric and implicit
differentiation, higher derivatives, optimum values.
• Integration: basic ideas and definition, definite and indefinite integrals, techniques of integration, integrals of partial
fractions, integration by parts, integration by substitution.
• Linear Algebra: simultaneous equations, Gauss elimination, matrices, rules of matrix algebra, rank and linear
dependence, calculation of determinates and eigenvalue problems.

Intended Learning Outcomes:
Technical Outcomes
On successful completion of this unit students will be expected, at threshold level, to be able to:
- Demonstrate knowledge of the fundamentals of mathematics, which underpin their engineering degree. (Evaluated in the MyMathLab continuous assessments and the examination.
- Demonstrate a comprehension of the fundamentals of mathematics, which underpin their engineering degree, using the following specific techniques: manipulate algebraic expressions, differentiation (including optimisation of functionals), integration, matrices and Gauss elimination (Evaluated in the examination).

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)

Assessment:	Coursework 1 (10%) Coursework 2 (10%) Coursework 3 (10%) Coursework 4 (10%) Examination 1 (60%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Coursework:
4 electronic online tests with randomised questions will be set during the semester, in total worth 40% of the final mark. There will be an opportunity to practice similar exercises before attempting each test. Each test is an individual piece of coursework.

Examination:
A closed book 2 hour examination will take place in January (worth 60% of the final mark).

Specific rules for passing this module:
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 40% 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 40%.

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

Assessment Feedback: Feedback will be provided electronically for each of the assessed tests.

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

Reading List: Glyn James author., P Dyke (Phil), author.; John Searle author.; Matthew Craven author.; Yinghui Wei author., Modern engineering mathematics / Glyn James, Phil Dyke, and John Searl, Matthew Craven, Yinghui Wei., Harlow : Pearson Education Limited, 2020.ISBN: 9781292253534
Glyn James author., Modern engineering mathematics., Harlow, United Kingdom : Pearson Education Limited, 2015.ISBN: 9781292080734
Tony Croft 1957- author., Robert Davison (Math Professor) author., Mathematics for engineers / Anthony Croft, Robert Davison., Harlow : Pearson Education Limited, 2019.ISBN: 9781292267661
Tony Croft 1957- author., Robert Davison author., Mathematics for engineers / Anthony Croft, Robert Davison., Harlow : Pearson Prentice Hall, 2015.ISBN: 9781292065939
K. A. Stroud author., Dexter J. Booth author., Engineering mathematics / K.A. Stroud with Dexter J. Booth., London : Red Globe Press, 2020.ISBN: 9781352010282
K. A. Stroud author., Dexter J. Booth author., Engineering mathematics / K.A. Stroud and Dexter J. Booth., Basingstoke : Palgrave Macmillan, 2013.ISBN: 9781137031204

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

EG-116 Engineering Mathematics 2 (Mech & EEE & Engineering)

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Salim

Format: Lectures 30 hours. Directed private study 70 hours.

Delivery Method: This module will consist of lectures and examples classes, which concentrate on understanding the concepts of mathematical theory and the application in solving engineering problems. Besides, self-directed e-learning and e-assessment system MyMathLab developed by Pearson, which concentrate on practising the calculation techniques, will be available through the Canvas Digital Learning Platform.

Module Aims: Module Aims: this module (in combination with Engineering Analysis 1B) provides further grounding in mathematical analysis techniques for Engineering students. The module extends the understanding into more complex analytical methods, focusing on complex numbers, multi-variable functions, series and sequences and differential equations.

Module Content: • Ordinary differential equations: classification of differential equations, solutions to first order ODE's including separable, linear and more specialised types. Solution to second order ODE's with constant coefficients.
• Functions of more than one variable: visualisation, partial differentiation, integration of lines, surfaces and volumes.
• Further complex numbers: manipulation of complex numbers, Cartesian, polar and exponential forms, Euler's formula, relationship between trigonometric and hyperbolic functions, De Moivre's theorem.
• Sequences and Series: review of arithmetic and geometric sequences and series, limit of a sequence, infinite series and tests of convergence, binomial series, and power series of common functions.
• Vectors: Physical meaning, components in Cartesian, cylindrical and spherical coordinates magnitude, scalar product, cross product, equations of lines and planes.

Intended Learning Outcomes:
Technical Outcomes
On successful completion of this unit students will be expected, at threshold level, to be able to:
- Demonstrate knowledge of the mathematics, which underpin their engineering degree.
- Demonstrate a comprehension of the mathematics, which underpin their engineering degree, through the use of the following specific techniques: work with complex numbers, manipulate vectors (in Cartesian, cylindrical and spherical coordinates), perform partial differentiation, integrate lines, surfaces and volumes, solve first and second order differential equations and expand real functions into series.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)

Assessment:	Coursework 1 (10%)
	Coursework 2 (10%)
	Coursework 3 (10%)
	Coursework 4 (10%)
	Examination 1 (60%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Component Descriptions
4 electronic online tests with randomised questions will be set during the semester, in total worth 40% of the final mark. There will be an opportunity to practice similar exercises before attempting each test. Each test is an individual piece of coursework.

Examination:
A closed book 2 hour examination will take place in May/June (worth 60% of the final mark).

Specific rules for passing this module:
This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.

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

Assessment Feedback: A feedback form for the examination will be available electronically.

Feedback will be provided electronically for each of the assessed tests.

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

Reading List: Glyn James author., P Dyke (Phil), author.; John Searle author.; Matthew Craven author.; Yinghui Wei author., Modern engineering mathematics / Glyn James, Phil Dyke, and John Searl, Matthew Craven, Yinghui Wei., Harlow : Pearson Education Limited, 2020.ISBN: 9781292253534
Glyn James author., Modern engineering mathematics., Harlow, United Kingdom : Pearson Education Limited, 2015.ISBN: 9781292080734
Tony Croft 1957- author., Robert Davison (Math Professor) author., Mathematics for engineers / Anthony Croft, Robert Davison., Harlow : Pearson Education Limited, 2019.ISBN: 9781292267661
Tony Croft 1957- author., Robert Davison author., Mathematics for engineers / Anthony Croft, Robert Davison., Harlow : Pearson Prentice Hall, 2015.ISBN: 9781292065939
Stroud, K. A. author., Booth, Dexter J., author., Engineering mathematics, Red Globe Press, 2020.ISBN: 9781352010282
K. A. Stroud author., Dexter J. Booth author., Engineering mathematics / K.A. Stroud and Dexter J. Booth., Basingstoke : Palgrave Macmillan, 2013.ISBN: 9781137031204

Additional Notes: Delivery is in-person

AVAILABLE TO visiting and exchange students.

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

EG-133 Engineering for People Hackathon

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof JC Arnold, Dr WG Bennett, Mr D Butcher, Dr JW Jones, Dr S Salim, Dr W Zhang

Format: One or two lectures per week: 11 hours 2-hour group session each week for each discipline: 20 hours
Tutorial hours: 9 hours.

Delivery Method: The delivery method is primarily on-Campus, although the 1 hour lecture each week will be recorded and be made available for on-line review. Students are required to participate in the group work sessions and this will require on-campus participation.

Module Aims: Engineering is more than understanding technical design, it is often the social, environmental and economic context underpinning engineering solutions that determine success or failure,

This has never been more relevant since the world is currently planning a radical transition to a low carbon economy while facing increased risks due to climate crisis which will bring with it unprecedented change to the world. Engineers will be at the forefront of this, and need to be equipped to tackle open-ended, unstructured and complex problems in collaboration with others.

The module will allow students to explore these issues within their chosen discipline with the following structure:

Each week there will be a 1-hour lecture, introducing engineering thinking and contemporary issues in global engineering design. Most activity will then take place in group-work sessions (3 hours per week), where groups of around 6 students will work in a facilitated way towards a Engineering design solution. Students will be presented with a range of Global Challenges (e.g. access to water/ off-grid energy), and over the course of the term will work to research, design and critique possible engineering solutions.

The groups with the best performance in this module may have opportunities to represent Swansea University in the national Engineers without Borders UK competition.

Module Content: 1. Engineering Mindset/ Self Awareness
2. Ethics and Professional Responsibilities and Sustainability
3. Failure and Learning through Mistakes/ Design mindset
4. Design Method
5. Teamwork
6. Positionality and Personal Design Perspectives
7. Reflection

Intended Learning Outcomes: The main learning outcomes of this module are:

D2 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

EL1 Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct

EL4 Understanding of the requirement for engineering activities to promote sustainable development

Supported learning outcomes are:

D1 Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics

P11 Awareness of team roles and the ability to work as a member of an engineering team

Assessment:	Coursework 1 (10%) Coursework 2 (10%) Coursework 3 (70%) Coursework 4 (10%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Coursework 1: (10%)
Team work building tasks - puzzles

Coursework 2: (10%)
Professional development assignments

Coursework 3: Presentation (70%)
The final poster with show all stages of project conception and development:
-need identification
-evaluation criteria
-long list of options
-short list of options

The mark will be given to the group and peer assessment will be used

Coursework 4: A group reflection task (10%)

Moderation approach to main assessment: Partial moderation

Assessment Feedback: Formal feedback from online test

10% of marks are available for completion of specified professional development course units. There are 5 units for students to complete.
To complete a unit a student must gain 8/10 in the unit test, and they get 5 attempts to sit each unit test. A student can gain 2% for each unit they pass.
When they complete a test canvas will let the students know how many marks out of 10 they have gained. If they have not gained 8/10 they will need to take the test again.

Regular informal feedback given throughout the term, with structured group feedback sessions at intervals, reflecting on progress, including some peer feedback.
Formal feedback on presentation and reflection task will be provided on Canvas.

Failure Redemption: Supplementary Assessment to be submitted in August.

Reassessment: Design Reflection & Report (100%)

Additional Notes: Delivery of teaching will be mainly via on-site lectures and group sessions, with assessment being a mix of on-line and on-campus.

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EG-135 Placement Preparation: Science and Engineering Year in Industry

Credits: 0 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof GTM Bunting, Dr SA Rolland, Dr V Samaras

Format: 11 hours consisting of a mix of seminars and workshops and drop-in advice 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

This module is delivered through directed and self-directed learning, careers resources, interactive workshops, reflective learning practice and drop-in advice sessions. The module is delivered on the Bay Campus.

Module Aims: This generic cross-disciplinary module is for all students who have enrolled (or transferred) onto the Faculty of Science and Engineering Year in Industry scheme. The module focuses on the underpinning and fundamental requisites required to gain, enter and progress effectively through an industrial placement. Learners will be introduced to a) sourcing placements, CV writing and application techniques; (b) interview techniques - how to pitch yourself and be successful; (c) workplace fundamentals and IP awareness, behaviours and expectations; and (d) key employability skills; getting the most from your Industrial Placement.

Module Content: The module will focus on the key requirements to gain and be successful whilst on a placement. Directed and self-directed activity will address the following topics;

1) Industrial Placements - what they are, how to search and how to apply.
2) CV writing, cover letters and application processes.
3) Assessment centres, interview techniques and mock interviews.
4) Recognising and developing employability skills.
5) Reflecting and maximising the placement experience

Intended Learning Outcomes: By the end of this module, students should be able to:

1) Demonstrate the essential skills needed to apply for and secure placement opportunities.
2) Perform effectively in an interview process and apply the tools and attributes that make a good interview.
3) Discuss and share what is expected within the workplace including behavioural and professional conduct.
4) Identify personal employability skills and how these will be used in a workplace setting.
5) Express a reflective view of the placement demonstrating the ability to maximise the placement experience in future career decisions

Assessment: Participation Exercise (100%)

Assessment Description: Not assessed

Moderation approach to main assessment: Not applicable

Assessment Feedback: Not assessed

Failure Redemption: Not assessed

Additional Notes: Module to support students on the Year in Industry programmes.

EG-142 Instrumentation and Control

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Y Hou

Format: Lectures: 20 hours
Example classes: 3 hours
Revision classes : 2 hours
Directed private study: 25 hours
Personal revision: 50 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

Lecture based delivery with PowerPoint notes provided. Additional resource material available on Canvas.

Module Aims: This module introduces the fundamentals of sensors, measurement, instrumentation and control in typical engineering applications.

Module Content: Sensors, clipper circuits, rectification, ripple factor, zener diodes, voltage dependent resistors, ac and dc bridges, component tolerances, non-ideal components, operational amplifier circuits, real properties of the op-amp and how that effects instrumentation systems, control, feedback, time and frequency representation of signals, PID controllers, sampling theory, quantisation error, analogue and digital conversion.

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to:
• Choose the correct sensor for the required physical input, understand the choices, and be able to describe the sensor and its physical method of operation
• Design circuits required to interface sensors in to electrical circuits
• Analyse the performance of sensor circuits in terms of ideal vs non-ideal behaviour, the effect of unwanted impedances, error analysis and linearity
• Design a range of operational amplifier circuits useful for instrumentation systems
• Understand the purpose of Laplace transforms in control systems, to understand the difference between open and closed loop control systems, to understand transient response, and be able to select an appropriate type of control system.
• Understand analogue and digital conversion and be able to perform simple calculations around analogue to digital conversion, including quantisation error and data rate.

Accreditation Outcomes (AHEP)
-Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b/SM1p) - Assessed by Examination.
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b/SM2p) - Assessed by both Assignment and Examination
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2/EA2p) - Assessed by Examination.

Assessment: Examination 1 (70%)
Coursework 1 (30%)

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

Assessment Description:
• Examination: Written final exam.
• Coursework: An individual assignment containing a mix of exam style calculation questions and the design of a solution to a given instrumentation problem.

Specific rules for passing this module:

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% 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 40%.

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

Assessment Feedback: - Written final exam - standard university feedback sheet completed for exam
- Assignment: individually marked and returned to the student electronically

Failure Redemption: Failure redemption of this module will be by examination only (100%).

Reading List: Morris, Alan S., 1948- author., Langari, Reza, author., Measurement and instrumentation : theory and application , Elsevier, 2020.ISBN: 9780128171417
Alan S. Morris 1948- author., Reza Langari author., Measurement and instrumentation : theory and application / Alan S. Morris, Reza Langari., Amsterdam : Elsevier, 2016.ISBN: 0128011327
Morris, Alan S., 1948-, Langari, Reza., Measurement and instrumentation theory and application, Academic Press, 2012.ISBN: 9780123819628
Allan R. Hambley author., Narendra Kumar contributor.; Ashish R. Kulkarni contributor., Electrical engineering : principles and applications / Allan R. Hambley ; contributions by Narendra Kumar, Ashish R, Kulkarni., Upper Saddle River, New Jersey : Pearson, 2013.ISBN: 9780273793250
Floyd, Thomas L, Electronic devices : conventional current version / Thomas L. Floyd. Pearson New International Edition., Pearson Education Limited, 2013.ISBN: 1292025646
Floyd, Thomas L.,, Electronic devices : conventional current version / Thomas L. Floyd., Pearson,, 2012.ISBN: 9780132668880
Hyperphysics.
Nise, Norman S. author., Control systems engineering, John Wiley & Sons, Inc., 2019.ISBN: 9781119474210
Norman S. Nise author, Control systems engineering / Norman S. Nise., Hoboken, New Jersey : John Wiley & Sons, 2015.ISBN: 9781118170519
Edward Hughes 1888- author., Hughes electrical and electronic technology / Edward Hughes ; revised by John Hiley, Keith Brown & Ian McKenzie Smith., Harlow : Pearson Education Limited, 2016.ISBN: 9781292093086
Edward. Hughes, John Hiley; Keith Brown 1962-; Ian McKenzie Smith, Hughes electrical and electronic technology / Edward Hughes ; revised by John Hiley, Keith Brown, and Ian McKenzie Smith., Pearson Education, 2012.ISBN: 9780273755104
Edward Hughes 1888-, John Hiley; Keith Brown 1962-; Ian McKenzie Smith, Hughes electrical and electronic technology / Edward Hughes ; revised by John Hiley, Keith Brown, and Ian McKenzie Smith., Pearson/Prentice Hall, 2008.ISBN: 9780132060110

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

• Swansea students should have taken EG-152 in order to take this module.
• LIMITED AVAILABLITY to visiting and exchange Students. Visiting and exchange students should have studied a basic electrical circuits course, which covers circuit analysis, current and voltage calculations and resistor networks. A basic understanding of operational amplifier (op-amp) circuits is useful but not essential.
• The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

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 30% in the exam component. If you achieve less than 30% in the exam, then the module mark will be just the exam mark.

EG-143 Digital Design

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr M Monfared, Prof MR Jennings

Format:
Lectures: 10 hours
Example classes: 2 hours
Laboratory work: 20 hours
Directed private study: 20 hours
Personal revision: 48 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 lecture content for this course is available on the Canvas Digital Learning Platform. Students work through the self-guided content, taking mini-quizes after each component, which unlock the next lecture. At two points in the course, digital design assessments are released that correspond to the material studied up to that point. These are done using the Multisim software, available on College computers, and available for students to download and use on their own Windows computer. Assignments are submitted through Canvas. At the end, a final Canvas online assessment is delivered.

All instructional and assessment components are delivered online through Canvas, and with the software Multisim. Students can chose to work entirely remotely, and make use of Zoom office hour and support sessions online. Or students may come to socially-distanced in-person drop-in sessions held each week in a PC room. You can use these to ask for help, receive instruction, or, if you bring a pair of headphones with a 3.5 mm jack, you can use these PC lab sessions as protected time to work through the online lectures, quizes and assessments, with in-person support available. Or, students can mix and match between the two.

Module Aims: To introduce the fundamentals of logic design methods and, implement, test and compare these designs using simulators.

Students who are re-sitting, please note, this module has been re-designed to use a fully blended-learning approach.

Module Content: Combinatorial logic design:
• Number systems
• Logic operations
• Truth tables
• Boolean algebra
• Karnaugh maps
• De Morgan's theorem
• Practical logic elements
• PLD implementation of logic
• PLCs and ladder diagrams
• Timing

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to:
• use decimal, binary and hexadecimal numbers, and convert between them
• apply the basic laws of Boolean algebra to manipulate and simplify logic expressions
• construct the simplest expression for a network output variable
• describe the properties of basic logic and apply them to the implementation of a simple logic network
• use integrated circuit elements to realise a logic network
• to identify potential timing hazards and alter designs to reduce or remove them
• create, test and evaluate logic circuits
• create, test and evaluate ladder logic diagrams
• produce a report comparable with that required of a professional engineer
• to compare and contrast different forms of implementing logic circuits (including discrete logic, silicon, FPGAs, PLDs and PLCs) and select the most appropriate, based on cost and appropriateness to the required design brief

Accreditation Outcomes (AHEP)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2p)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3p)
- Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (D1p)
- Plan and manage the design process, including cost drivers, and evaluate outcomes (D5p)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (ET2p)
- Ability to apply relevant practical and laboratory skills (EP3p)

Assessment:	Coursework 1 (30%) Coursework 2 (40%) Coursework 3 (30%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Coursework 1 and 2 are digital design exercises, carried out in Multisim, submitted online through Canvas.

Coursework 3 is an online Canvas test.

Specific rules for passing this module:
This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in Coursework 3, and a minimum of 40% 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 40%. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to complete the coursework.

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

Assessment Feedback: Individual feedback on CW1 and CW2. General feedback on CW3.

Failure Redemption: Failure redemption will be by submission of replacement assignment covering CW1 and CW2.

Reading List: Roth, Charles H; Kinney, Larry L, Fundamentals of logic design / Charles H. Roth, Jr., Larry L. Kinney., Cengage Learning, 2014.ISBN: 9781133628484
Pappas, Nicholas L, Digital design / Nicholas L. Pappas., Createspace, 2014.ISBN: 9781499266764
M. Morris. Mano, Michael D Ciletti; B. R Chandavarkar, Digital design : with an introduction to the Verilog HDL / M. Morris Mano and Michael D. Ciletti., Pearson, 2013.ISBN: 9780273764526

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

• NOT AVAILABLE TO Visiting and Exchange Students due to Number Restriction
• Penalty for late submission of continual assessment assignments: ZERO TOLERANCE

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in Coursework 3, and a minimum of 40% 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 40%. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to complete the coursework.

EG-150 Signals and Systems

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-114; EG-116

Lecturer(s): Dr CP Jobling

Format:
Lectures 20 hours
Example classes 6 hours
Revision classes 2 hours
MATLAB lab classes 12 hours
Directed private study 60 hours

Contact Hours will be delivered through
on-campus, lectures, example classes and MATLAB lab sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform which supports live on-campus teaching and MATLAB laboratories and self-directed online activity. There will be two hours of lectures and a one-hour examples class and a two-hour MATLAB labs will be given in alternate weeks. On-campus lectures and examples classes will be recorded for study, but attendance at the MATLAB laboratories is mandatory.

Lectures- 20 hours
Example classes- 8 hours
Revision classes: 2 hours
MATLAB Labs: 12 hours
Directed private study- 60 hours

Module Aims: The module introduces mathematical description of signals in the time domain. and frequency domains. Basic properties of deterministic signals and systems are defined. The concept of frequency and frequency domain description of signals is introduced using Laplace transform of continuous time signals. The modelling and simulation of systems using transfer functions and block diagrams is introduced.

Module Content:

• Signals in time domain: analogue and digital signals, periodic and aperiodic signals, even and odd symmetry signals.
• Waveforms: sines, cosines, exponentials, steps, rectangular and squares, impulses and ramps.
• Time domain operations on waveforms: time scaling, time reversal and time shifting.
• Calculation of waveform properties: energy, power, mean value, R.M.S. value and crest factor.
• Introduction to systems: basic properties.
• Using the Laplace transform for the representation of signals and systems in the complex frequency domain.
• Describe qualitatively the performance of a linear time-invariant system from knowledge of its poles.
• The application of the Laplace transforms in electrical circuit analysis.
• Modelling systems with block diagrams and transfer functions and the concept of feedback.

Intended Learning Outcomes: Technical Outcomes
After completing this module, you should be able to:
• understand concepts of signal and system modelling which is often encountered in other modules
• understand mathematical abstraction such as being able to read, analyze and evaluate mathematical expressions
• define and recognize common waveforms such as impulse and step signals, exponential and rectangular signals
• define properties of systems
• calculate basic properties of deterministic signals in the time domain
• compute the complex-exponential and trigonometric Laplace transform of signals and systems
• predict the behaviour of a linear time-invariant system from knowledge of its poles
• use block diagram models, transfer functions and simulation for the computation of system responses

Accreditation Outcomes (AHEP)
- Apply knowledge of mathematics, statistics, natural science and engineering principles to well-defined problems
- Apply a systematic approach to the solution of well-defined problems
- Plan and record self-learning and improve performance, as the foundation for lifelong learning/CPD

Assessment:	Examination 1 (70%) Laboratory work (6%) Laboratory work (6%) Laboratory work (6%) Laboratory work (6%) Laboratory work (6%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description:
Examination: Standard 2 hour exam:

Practical: MATLAB lab exercises. There will be five assignments worth six marks each. Full details will be published in the assignment brief published on Canvas.

Specific rules for passing this module:

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% 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 40%.

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

Assessment Feedback: Continuous feedback during lectures, by announcements on Canvas, feedback from the grading of the coursework exercises. and general feedback after the exam.

Failure Redemption: If a student is awarded a resit, failure redemption of this module will be by examination only (100%).

Reading List: Jobling, C.P., EG-150 Signals and Systems, Swansea University, January 2024.
Schaum's Outline of Signals and Systems, Third Edition, McGraw-Hill Professional, 2014.ISBN: 0071829466
Karris, Steven T., Signals and systems with MATLAB computing and Simulink modeling, Orchard Publications, 2012.ISBN: 9781934404232
Matthew N. O. Sadiku author., Warsame Hassan Ali author., Signals and systems : a primer with Matlab / Matthew N.O. Sadiku, Warsame H. Ali., Boca Raton : CRC Press, 2016.ISBN: 9781482261516

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

• AVAILABLE TO Visiting and Exchange students.

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

EG-151 Microcontrollers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr CP Jobling

Format: Live on-campus classroom lectures and online office hours 20 hours. On-campus Laboratory work 44 hours. Directed private study and assessment 36 hours. Contact Hours will be delivered through a blend of live activities on-campus and online, and will include lectures and practical sessions.

Delivery Method: EG–151 will employ a blended approach to delivery using the Canvas Digital Learning Platform for on-campus and self-directed online activity, with live on-campus activities each week.

Live learning activities

See the Canvas calendar for timings of the live activities.

Lectures and Office Hours

There will be one lecture a week on the architecture of the target microcontroller. This will be delivered on-campus and will be supported by on-demand after-class formative tests which aim to reinforce the knowledge gained in lectures by means of retrieval practice.

In addition, there will be an online office hour for group activities in support of the lecture course which is designed to address the areas of difficulty that have been identified by the formative tests.

The resources for the lecture course are arranged by week in modules on Canvas and start at Welcome and Introduction to Data Representation.

Laboratory activities

There will be two two-hour lab sessions per week. Lab sessions are compulsory, and should you need a Supplementary (resit) assessment in August you must have achieved 80% attendance to qualify for a resit attempt.

Laboratory introduction

Laboratory sessions during the first four weeks of term (University weeks 2-5) will be used for a laboratory introduction exercise.

The laboratory introduction is COMPULSORY and must be passed before you can continue to work in the laboratory.

Components of the laboratory introduction are as follows:

* Health and safety and safe working in the electronics laboratory
* Breadboard construction exercise
* Circuit simulation exercise using National Instruments Multisim
* Soldering exercise

The maximum mark for the laboratory introduction is 15 awarded as follows:

* Testing of circuit using plug-in breadboard and National Multisim and answers to questions at the end of the laboratory introduction script – Max. 10 marks - Assessed by Lab Diary and a Canvas quiz.
* Construction of Tic-Tac(R) box continuity tester – Max. 5 marks.

Marking is done and feedback is given by the module coordinator and the chief electronics technician.

The course materials and guidance for the lab introduction module start at module EG-151: Laboratory Introduction on Canvas.

Microcontroller programming laboratories

There will be two two-hour microntroller programming lab sessions per week, and these will begin once the lab introduction has been completed which will be the end of week 4 (University week 5) at the latest.

The laboratory work will be assessed by means of a lab diary worth 20% of the module marks. The lab diary is to be updated during the lab sessions and will be submitted via a TurnitIn submission point in November.

The Microcontroller laboratories are found in the Microcontrollers Laboratory module on Canvas.

Mini project

There will be a mini project which is worth 30% of the marks and will be assessed by a demonstration of the completed project and a short report. The project is designed to be carried out using the resources of the laboratory kit, however additional components e.g. LEDs, resistors, push buttons and so on can be requested from the staff. Example programs will be provided as a starting point, and you will be required to add additional features as suggested in the project briefing. The mini project will be published in the Mini projects 2023-2024 module on Canvas.

We anticipate starting the mini project at the start of week 9 (University week 10).

On-demand learning activities

Knowledge and understanding will be increased via retrieval practice based on weekly formative tests delivered in Canvas.

Class test

The lecture course and the laboratory work will be assessed by an online class test worth 35%. We anticipate that the class test will be held in Week 10 (University week 11) with a resit being held in Week 12 (University week 13).

Module Aims: This module introduces basic microcontroller structure and operation. It consists of a lecture course on the architecture and operation of the target microcontroller, a formal laboratory introduction, and a series of laboratories, culminating in a mini-project in which students will apply their experience to a simple practical problem.

Module Content: Microprocessor fundamentals: Architecture; instruction execution; basic instructions; simple software design; software development tools.

Practical work: A progressive series of exercises will be carried out, in support of the taught material, leading to a mini project.

Intended Learning Outcomes: Technical Outcomes
- Identify, classify and describe the performance of systems and components (EA2p): operation of a microcontroller; computer instructions and their execution are assessed by Class Test.
- Practical and laboratory skills (EP3p): safe-working; social distancing; use of electronic instrumentation; simulation, implementation, and commissioning of an embedded system are assessed by Lab Introduction (Practical).
- Investigate and define the problem: health and safety (D2p); design simple programs in both assembly language and C; design the hardware and software for a simple application. (Assessed by the Lab Introduction (Practical), Lab Exercises and Project)
- Ability to apply computational methods in order to solve engineering problems (EA3p): implement and commission an embedded system; demonstrate the application of the skills developed in the module to design the hardware and software for a simple application is assessed by the Project.

Accreditation Outcomes (AHEP)
Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2p)
Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3p)
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 (D2p)
Ability to apply relevant practical and laboratory skills (EP3p)

Assessment:	Online Class Test (35%) Project (30%) Laboratory work (20%) Practical (15%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: • Practical: This is the laboratory introduction exercise, valued at 15% of the whole module.

• Laboratory work: students will be given a laboratory introduction exercise followed by four laboratory-based exercises to learn the use of the integrated development environment (IDE), skills in programming, and problem-solving. These exercises will involve simple assembly-level programmes with Arduino IDE, followed by an introduction to embedded "C" programming. The exercises will be assessed by a review of a lab diary which is to be kept by each student during the practical sessions and submitted as a complete document in November. There are 20 marks in total for the lab assessment.

• Mini-Project: Each student will be given a practical task to perform with the target microcontroller. They will be required to write a program in "C" language using the Arduino IDE, and test it on the microcontroller boards provided. Assessment will be on how well the task has been achieved, and on a brief report written in a specified format. The mini-project is valued at 30% of the module.

• Class Test: This test will be based on the theoretical component from the weekly on-demand and live online activities, and also on experience gained from the laboratory work. The questions will be a mixture of multiple-choice and single line answers, for example predicting the numerical output of a series of microcontroller instructions. The test will be delivered through the Canvas VLE and is valued at 35% of the module and is an individual assessment.

Specific rules for passing this module:

This module is assessed by a combination of Class Tests and practical assessments.

For the practical assessment marks to count, you must achieve 40% in the Class Test. If you achieve less than 40% in the Class Test, then the module mark will be just the Class Test mark. You will have one attempt to redeem a failure in the class test before the end of semester 1.

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

Assessment Feedback: For the formative tests, students receive immediate feedback. For the Class Test, students will receive immediate marks and overall feedback will be delivered in one of the online live sessions within two weeks of the test. For the lab exercises, feedback will be given to students at the time of assessment. Students can always make an appointment with the lecturer to receive personal feedback.

Failure Redemption: Failure redemption of this module will be by online Canvas test only (100%).

The failure redemption is only available to students who record sufficient engagement (lab attendance, attendance at scheduled on-line events, and engagement with on-demand materials and during the teaching semester).

Reading List: Jobling, Christopher Paul, EG-151 Microcontrollers 2023-2024, Swansea University, September 2023.
Atmel Corporation, Atmel ATmega328 Datasheet.
Microchip Technology Inc., AVR Instruction Set Manual, Microchip Technology Inc., 2020.
James M. Fiore, Embedded Controllers Using C and Arduino, Dissendents, August 2020.ISBN: 978-1796854879
James M. Fiore, Embedded Controllers Using C and Arduino: Lab Manual, Dissedents, 18 April 2020.ISBN: 978-1796836226
C Programming, Wikibooks, 12 July 2020.
Brian W. Kernighan, Dennis M. Ritchie 1941-, The C programming language / Brian W. Kernighan, Dennis M. Ritchie., Prentice Hall, 1988.ISBN: 9780131103627
Al. Kelley, Ira Pohl, A book on C : programming in C / Al Kelley, Ira Pohl., Benjamin Cummings Publishing Company, 1995.ISBN: 0805316779

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

• Laboratory classes or their on-line equivalent are compulsory. Students must have sufficient attendance at laboratory classes or their on-line equivalent 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-152 Analogue Design

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-142; EG-155; EG-168

Lecturer(s): Dr AE Martinez Muniz, Mr AG Francis

Format: Laboratory work 44 hours
Directed private study 56 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

Assessment: 100% Continuous Assessment.
Laboratory work 44 hours
Directed private study 56 hours

Module Aims: The module covers aspects of Engineering Applications for Level 1 students and all aspects of the design process for analogue circuits. It includes preparation, performance and reporting on a structured series of experiments supporting the taught modules at this level and gives practice in using IT packages to assist with report writing.

Module Content:
With the aid of the commercial simulation package, Multisim, the practical laboratory work in this module develops topics such as:
• practical op-amp circuits;
• real circuit components;
• circuit response in the time and frequency domain;
• transient behaviour ;
• filters and oscillator circuits.
• The sequence of practical laboratories will lead to design, construction and testing of a waveform generator.

Practical work includes:
• the preparation, performance and reporting on a structured series of experiments supporting the taught modules at this level;
• practice in using IT packages to assist with report writing and presentations;
• the use of Multisim for circuit design and analysis;
• the construction of a function generator, which is then tested against a specification.

Intended Learning Outcomes:
Technical Outcomes
On successful completion of this module students will be expected, at threshold level, to be able to:
- Analyse the response of resistors, capacitors, inductors and op-amps to the application of ac and dc signals.
- Apply Multisim software in the design and analysis of circuits.
- Design circuits to modify or manipulate voltages and currents.

Accreditation Outcomes (AHEP)
- Ability to identify, classify and describe the performances of analogue components and circuits using analytical methods - assessed by Formal Report and Assignment 1 (EA2p)
- Ability to apply quantitative methods and simulation in order to solve and analyse analogue circuits - assessed by Formal Report and Assignment 1 (EA3p)
- Understanding of, and the ability to apply, an integrated or systems approach to solving and analysing analogue circuits - assessed by Assignment 1 (EA4p)
- Communicate their work to technical and non-technical audiences (D6p)
- Knowledge of characteristics of analogue components and circuits - assessed by Assignment 1 (EP2p)
- Understand of the use of technical literature, such as lab workbook - assessed by Formal Report and Assignment 1 (EP4p)

Assessment:	Report (30%) Assignment 1 (70%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Students will be assessed on the following components:
i) Report: Formal Report (30%) - Individual assessment
ii) Assignment 1: Lab Diary (60%) - Group assessment
iii) Assignment 2: Printed Circuit Board (10%) - Group assessment
iii) Laboratory work: Pass/Fail - Record of attendance at labs

This module is assessed by three assignments. In order for your Report and Assignment 2 to be included in your module mark you must have achieved a mark of 30% or above in Assignment 1. Re-assessment is by a single piece of coursework.

Laboratory classes are compulsory. Students must have at least 80% attendance at laboratory classes or online equivalents in order to be allowed to be assessed for the module.

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 40%.

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

Assessment Feedback: Students will receive feedback through the Faculty Feedback Summary Sheet, which provides both the statistics and analysis of each question.

Failure Redemption: If a student is awarded a re-sit at least one piece of coursework will be set.

The failure redemption is only available to students who have at least 80% attendance at laboratory classes during the teaching semester.

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

NOT AVAILABLE TO Visiting and Exchange Students due to number restriction.

• Laboratory classes are compulsory. Students must have sufficient 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.

This module is assessed by three assignments. In order for your Report and Assignment 1 to be included in your module mark you must have achieved a mark of 30% or above in Assignment 2. Re-assessment is by a single piece of coursework.

EG-155 Circuit Analysis

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof PM Holland

Format: There will be a double in-person lecture once per week and an additional examples class once per week.

Delivery Method: Delivery of teaching will be in-person. The double lecture will be recorded while the examples class may be recorded depending upon the nature of the teaching space. Circuit Analysis will employ a blended approach to delivery. The Canvas Digital Learning Platform will be used to host additional supplementary learning activities. Such learning activities will include text-based theory pages; short theory videos; text-based examples; short video-based examples; online formative practice quizzes and other materials.

Assessment: 80% Multiple Choice Quiz Examination and 20% Continual Assessment. The 20% continual assessment will consist of 2 Canvas Tests worth 10% each.

Module Aims: Provides an introduction to analog electrical circuits analysis.

Module Content:

• Introduction to circuit characteristics and analysis: resistance, voltage, current, power, a.c. d.c. capacitance, inductance, series and parallel configurations, Ohm's law, Kirchoff's laws, superposition theorem and nodal analysis.
• Ideal operational amplifier circuits including inverting, non-inverting, comparator, differentiator and the integrator.
• Analysis of simple LCR networks energised by AC sources. This will inlcude analysis in the time domain and using complex numbers and phasors in the frequency domain.
• Simplification techniques suitable for both DC and AC analysis such as Thevenin and Source Transformations.
• Practical work supported by EG-152 for EEE students.

Intended Learning Outcomes:

Technical Outcomes
- To understand and mathematically describe the physical concepts and parameters associated with voltage, current, resistance, capacitance, inductance, energy and power.
- Simplify and analyse electrical circuits using a range of techniques including resistor reduction, delta-y, Kirchhoff's Laws, Thevenin's theorem, source transformations, superposition and nodal analysis.
- Be able to identify and analyse a range of operational amplifier circuits.
- Determine the transient response of capacitors and inductors.
- Determine the behaviour of LCR circuits energised by AC sources in time domain and frequency domain forms.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b/SM2p)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1p)

Assessment:	Examination 1 (80%)
	Class Test 1 - Coursework (10%)
	Class Test 2 - Coursework (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: The two Canvas Quiz assignments are worth 10% of the module marks each such that the total continual assessment is worth 20% of the module. The tests are delivered in teaching weeks five and nine. The Canvas tests are computer marked and will provide automatic feedback. Students will answer a variety of questions ranging from multiple-choice, fill in the BLANK to full calculations, numerical value entry and hot spot. The component values in some questions may be randomised to encourage individual understanding.

The in-person examination is worth 80% of the module. It is a multiple-choice question paper consisting of 14 questions. Questions 1-3 are worth 1 mark, questions 4-6 are worth 2 marks, questions 7-9 are worth 3 marks, questions 10-12 are worth 4 marks and questions 13 and 14 are worth 5 marks. Negative marking is applied to questions 13 and 14 where an incorrect answer will lead to a deduction of 3 marks from the exam total. Students are not required to enter an answer for any of the questions and may choose to not answer questions 13 and 14 if unsure so as to avoid losing marks. The examination topics will be those presented directly in the module.

Specific rules for passing this module:
This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% 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 40%.

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

Assessment Feedback: For the two Canvas quiz assignments, students will be able to see their computer marked assignment with feedback that has been written by the module owner for both correct and incorrect answers. The module coordinator solves the quiz questions in subsequent example classes sessions to help students check their understanding and give feedback on their attempt. They will also receive a generic feedback form at the end of the semester.

For the examination, the students will receive a generic form that tells the student what the common mistakes were. It also lists the mean mark and the number of 1st class, 2:1 class, 2:2 class, 3rd class and fails achieved by the group.

Failure Redemption:
If a student is awarded a re-sit, failure redemption of this module will be by examination worth 100% of the module. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to complete the coursework.

Reading List: James William Nilsson author., Susan A. Riedel author., Electric circuits / James W. Nilsson, Susan A. Riedel., Harlow : Pearson Education Limited, 2020.ISBN: 1292261048
James William Nilsson author., Susan Riedel author., Electric circuits / James W. Nilsson, Susan A. Riedel., Harlow : Pearson Education Limited, 2015.ISBN: 9781292060545
Thomas L. Floyd author., David M. Buchla author., Electronics fundamentals : circuits, devices and applications / Thomas L. Floyd, David L. Buchla., Harlow, Essex : Pearson Education Limited, 2014.ISBN: 9781292025681
Robert L. Boylestad, Introductory circuit analysis / Robert L. Boylestad., Pearson Education, 2016.ISBN: 9781292098951

Additional Notes: Delivery of teaching will be in-person. The double lecture will be recorded while the examples class may be recorded depending upon the nature of the teaching space. Circuit Analysis will employ a blended approach to delivery. The Canvas Digital Learning Platform will be used to host additional supplementary learning activities.

• AVAILABLE TO to visiting and exchange students.
• PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

EGA107 Power Engineering

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-114; EG-116

Lecturer(s): Dr M Monfared

Format: Lectures: 22 hours
Examples: 10 hours
Independent study: 60 hours

Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures and seminars.

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 will employ lectures with assessment by coursework and examination.

Module Aims: This module will provide an introduction to the fundamental topics in electrical power systems.

Module Content:

Section 1 – Introduction to Module
Module administration, brief history of electrical engineering, international system of units.

Section 2 – Fundamentals of Electric Circuits
Definitions, Kirchhoff's current and voltage laws, electric power and sign convention, power balance.

Section 3 – Solution of electric circuits
Nodal analysis, Thevenin and Norton equivalents.

Section 4 – Dynamic elements and transients
Energy storage elements, Analysis of circuits containing dynamic elements.

Section 5 – Single-phase power
Single-phase systems configuration, power factor, single-phase power definition.

Section 6 – Three-phase power
Three-phase systems configuration, power factor, three-phase power definition.

Intended Learning Outcomes: Technical Outcomes
Upon completion of the module, students should be able to:
• Solve RLC circuits in steady-state.
• Analyse first-order circuits supplied by dc sources in transient operation.
• Solve ac circuits in steady-state operation (both single-phase and three-phase).
• Calculate active and reactive power in single-phase and three-phase circuits.
• Calculate power factor in a circuit and learn methods to improve power factor value.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (assessed by exam). (SM1p)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (assessed by online assignment). (SM2p)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (assessed by online assignment and exam). (EA1p)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (assessed by exam). (EA2p)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (assessed by online assignment and exam). (EA3p)

Assessment:	Coursework 1 (5%) Coursework 2 (5%) Coursework 3 (10%) Coursework 4 (5%) Coursework 5 (5%) Examination 1 (70%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: 5% Coursework 1: Section 2 and Section 3
5% Coursework 2: Section 4
10% Coursework 3: Section 5
5% Coursework 4: Section 6
5% Coursework 5: MATLAB onramp
70% Examination

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% 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 40%.

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

Assessment Feedback: Formal feedback lecture following the first assignment; feedback provided during office hour; standard feedback through College of Engineering intranet. Information provided includes average marks, maximum and minimum marks for the exam as a whole and for individual questions.

Failure Redemption: Failure Redemption of this module will be by 100% Examination .

Reading List: Edward. Hughes, John Hiley; Keith Brown 1962-; Ian McKenzie Smith, Hughes electrical and electronic technology / Edward Hughes ; revised by John Hiley, Keith Brown, and Ian McKenzie Smith., Pearson Education, 2012.ISBN: 9780273755104

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

• Penalty for late submission: ZERO tolerance

EGA108 Electrical and Magnetic Properties of Materials

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr AE Martinez Muniz

Format: Lectures 20 hours
Tutorials / Example classes 5 hours
Directed private study 40 hours
Preparation for Assessment 30 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

On Campus/online

Module Aims: This module covers the underlying physical principles behind the physical properties of electronic materials. It provides the atomistic background to understanding electrical and magnetic properties of solids. It offers an understanding of Ohm's law and conduction in metals and semiconductors. It provides a microscopic understanding of Dielectrics, Piezoelectrics and magnetics materials and their application in technology. The principles developed are used to explore the behaviour of semiconductor devices such as diode, junction transistor and solar cells.

Module Content: 1) The quantum theory of matter (waves and particles), photoelectric effects, hydrogen atom spectra (hydrogen-like atoms).
2) One particle in a box, two particles in a box, spin, Pauli exclusion principle.
3) The atomic chemical elements and interatomic bonding.
4) Drude's theory of electrical conduction and 'classical' point of view.
5) The quantum free electron theory of conduction in metals (Sommerfeld). Many particles in a box, Fermi energy.
6) The modern band theory of conduction for semiconductors. Band gap. The relationship between conductivity and temperature is explored.
7) Junctions between different semiconductors (p-n junctions), band diagrams
8) Photovoltaic effect, photocell, solar cell (efficiency) and blackbody radiation.
9) Junction Transistor, band diagram, function and amplification
10) Dielectrics and Piezoelectrics.
11) Magnetic properties of materials: Diamagnetism, Paramagnetism and Ferromagnetism

Intended Learning Outcomes:
Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1p)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2p)
- Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues (ET5p)

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

Assessment Description:
The module is assessed with a one day take home exam (or written examination) worth 80%. There will be Canvas assessments worth 20%.

Specific rules for passing this module:

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% 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 40%.

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

Assessment Feedback:
Standard examination feedback form available for all students after the examination.
Feedback sheets are completed for each assignment. General feedback for the class test will be uploaded to Canvas.

Failure Redemption: If a student is awarded a re-sit (supplementary) Failure Redemption of this module will be by 100% exam.

Reading List: Turton, Richard, The physics of solids / Richard Turton., Oxford University Press,, 2000.ISBN: 9780198503521
Fulay, Pradeep P.,, Electronic, magnetic, and optical materials / Pradeep Fulay., Taylor & Francis,, 2010.ISBN: 9780849395642
Callister, William D., Jr., 1940- author., Rethwisch, David G., author., Materials science and engineering : an introduction., Wiley, 2020 - 2020.ISBN: 9781119453918
Jiles, David., Introduction to the electronic properties of materials / David Jiles., Nelson Thornes,, 2001.ISBN: 9780748760428
Kasap, S. O. (Safa O.), Principles of electronic materials and devices / S.O. Kasap., McGraw-Hill, 2006.ISBN: 9780071244589

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

EGA121 Introduction to Electromagnetics

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-114; EG-116

Lecturer(s): Dr AE Martinez Muniz

Format: Lectures 15 h
Example classes 10 h
Directed private study 75 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

On Campus

Module Aims: To introduce the student to the basic laws of electromagnetism and their application to electrical engineering.

Module Content:

• Vectors Analysis: Vector algebra, orthogonal coordinate system, the transformation between coordinate systems, the gradient of a scalar field, the divergence of a vector field, curl of a vector field. Divergence theorem and Stoke's theorem.
• Maxwell's equation and Lorentz force.
• Electrostatics: Electric forces, charge and current distributions, Electric scalar potential, Gauss's Law, conductors, dielectrics, capacitances, Electrostatic potential energy.
• Magnetostatics: Magnetic forces and torques, The Biot-Savart law, Ampère's Law, Maxwell magnetostatic equations.
• Electromagnets, inductance, magnetic energy.
• Inductive sensors.
• Dynamics Fields: Faraday's Law and Maxwell's equations. Stationary loop in a time-varying field. Transformer and generators, Technological applications. , Lumped elements Derivation of Kirchhoff laws. Maxwell's equations and Pointing's theorem. The Electromagnetic wave.

Bibliography: Chapter: 3,4,5 and 6 of "Fundamental of Applied Electromagnetics" From Ulabi
vol 2 of "The Feynman Lectures on Physics, Richard P. Feynman

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to:
• Solve basic problems using vector algebra. Represent vectors in different coordinate systems such as spherical and cylindrical.
• Explain the meaning of Div, Grad and Curl and the divergence and Stoke's Theorems. Use these concepts and theorems in computations.
• Apply Gauss, Ampère and Faraday's laws to concrete examples and understand how they relate to the Maxwell's equations.
• Calculate capacitances and inductances for different geometries.
• Use the concept of electric and magnetic fields to understand the functioning of generators and motors and the field interpretation of Kirchhoff's laws.
• Understand the technical underpinning of modern technology applications such as fingerprint imager, magnetic levitation trains, magnetic recording and wireless charging.
• Describe the properties of simple electromagnetic waves and how they derive from Maxwell's equations. Apply the Maxwell equations to wave guides.

Accreditation Outcomes (AHEP)
Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b/SM1p)
Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b/SM2p)

Assessment:	Examination (80%) Online Class Test (20%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description:
Written Examination - 80%
Canvas Assessment - 20%. The assessment will be split in two assessments, each worth 10 % of the module.

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% 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 40%.

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

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

Failure Redemption:
If a student is awarded a re-sit: Failure Redemption of this module will be by Examination only (100%).

Reading List: Ulaby, Fawwaz T. (Fawwaz Tayssir); Ravaioli, Umberto, Fundamentals of applied electromagnetics / Fawwaz T. Ulaby, University of Michigan, Ann Arbor, Umberto Ravaioli, University of Illinois, Urbana-Champaign., 2015.ISBN: 9781292082455
Umberto Ravaioli author., Fundamentals of applied electromagnetics, Boston, Massachusetts : Pearson, 2015.ISBN: 9781292082448

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

• AVAILABLE TO to visiting and exchange students.