Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 1 (FHEQ LEVEL 4)

GENERAL 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
BEng General Engineering Programme Director	Dr Michael Clee

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/

Year 1 (FHEQ Level 4) 2023/24
Engineering
BEng General Engineering[H500,H901]
BEng General Engineering with a Year Abroad[H501]

Semester 1 Modules	Semester 2 Modules
EG-114 **Engineering Mathematics 1 (Mech & EEE & Engineering)** **10 Credits** **Dr MR Brown** **CORE**	**EG-116** **Engineering Mathematics 2 (Mech & EEE & Engineering)** **10 Credits** **Dr S Salim** **CORE**
EG-134 **Engineering Mechanics (Mech & Med & Engineering)** **10 Credits** **Dr Y Xia** **CORE**	**EG-130** **Sustainable Integrated Design I** **10 Credits** **Dr EH Jewell/Dr M Togneri** **CORE**
EG-143 **Digital Design** **10 Credits** **Dr M Monfared/Prof MR Jennings** **CORE**	**EG-131** **Strength of Materials (Mech & Med & Engineering)** **10 Credits** **Dr S Azizishirvanshahi** **CORE**
EG-151 **Microcontrollers** **10 Credits** **Dr CP Jobling** **CORE**	**EG-142** **Instrumentation and Control** **10 Credits** **Mrs M Ahmed/Dr RJ Cobley** **CORE**
EG-155 **Circuit Analysis** **10 Credits** **Prof PM Holland** **CORE**	**EGA121** **Introduction to Electromagnetics** **10 Credits** **Dr AE Martinez Muniz** **CORE**
EG-180 **Introduction to Materials Engineering** **10 Credits** **Dr MP Coleman** **CORE**	
EG-138 **Introduction to Mechatronics** **10 Credits** **Dr MJ Clee/Prof D Deganello/Dr AC Tappenden/Dr M Togneri** **CORE**	
Total 120 Credits	

Year 1 (FHEQ Level 4) 2023/24
Engineering
BEng General Engineering with a Year in Industry[H502]

Semester 1 Modules	Semester 2 Modules
EG-114 **Engineering Mathematics 1 (Mech & EEE & Engineering)** **10 Credits** **Dr MR Brown** **CORE**	**EG-116** **Engineering Mathematics 2 (Mech & EEE & Engineering)** **10 Credits** **Dr S Salim** **CORE**
EG-134 **Engineering Mechanics (Mech & Med & Engineering)** **10 Credits** **Dr Y Xia** **CORE**	**EG-130** **Sustainable Integrated Design I** **10 Credits** **Dr EH Jewell/Dr M Togneri** **CORE**
EG-143 **Digital Design** **10 Credits** **Dr M Monfared/Prof MR Jennings** **CORE**	**EG-131** **Strength of Materials (Mech & Med & Engineering)** **10 Credits** **Dr S Azizishirvanshahi** **CORE**
EG-151 **Microcontrollers** **10 Credits** **Dr CP Jobling** **CORE**	**EG-135** **Placement Preparation: Science and Engineering Year in Industry** **0 Credits** **Prof GTM Bunting/Dr SA Rolland/Dr V Samaras** **CORE**
EG-155 **Circuit Analysis** **10 Credits** **Prof PM Holland** **CORE**	**EG-142** **Instrumentation and Control** **10 Credits** **Mrs M Ahmed/Dr RJ Cobley** **CORE**
EG-180 **Introduction to Materials Engineering** **10 Credits** **Dr MP Coleman** **CORE**	**EGA121** **Introduction to Electromagnetics** **10 Credits** **Dr AE Martinez Muniz** **CORE**
EG-138 **Introduction to Mechatronics** **10 Credits** **Dr MJ Clee/Prof D Deganello/Dr AC Tappenden/Dr M Togneri** **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

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 (25%) Coursework 2 (25%) Coursework 3 (25%) Coursework 4 (25%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description:
Coursework:
4 electronic online tests with randomised coefficients will be set during the semester. There will be an opportunity to practice similar exercises before attempting each test. Each test is an individual piece of coursework.

Coursework 1 - Weighting 25%

Coursework 2 - Weighting 25%

Coursework 3 - Weighting 25%

Coursework 4 - Weighting 25%

Note: Students are required to pass each MyMathLab test with 40% or more. If you do not meet the component level requirements for the module you will receive a QF outcome.

If a student does not pass all required components they will be given one further attempt at failed components during the January assessment period. If the January attempt is not passed students will be offered a supplementary examination in August (subject to regulations).

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, Modern Engineering Mathematics, Pearson Education Limited, 2015.ISBN: 9781292080826
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 author., Robert Davison author., Mathematics for engineers / Tony Croft, Robert Davison., Harlow, England : Pearson Prentice Hall, 2015.ISBN: 1292065931
Tony Croft 1957- author., Robert Davison author., Mathematics for engineers / Anthony Croft, Robert Davison., Harlow : Pearson Prentice Hall, 2015.ISBN: 9781292065939
Croft, Tony,, Davison, Robert., Mathematics for engineers : a modern interactive approach / Anthony Croft, Robert Davison., Pearson,, 2008.ISBN: 9781408263235
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, Dexter J Booth, Engineering mathematics / K.A. Stroud with Dexter J. Booth., Industrial Press, 2013.ISBN: 9780831134709
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 (15%)
	Coursework 2 (15%)
	Coursework 3 (15%)
	Coursework 4 (15%)
	Examination 1 (40%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Coursework (Continuous Assessment):
4 electronic online tests with randomised coefficients will be set during the semester. There will be an opportunity to practice similar exercises before attempting each test. These tests will be each worth 25% of the module mark. Each test is an individual piece of coursework.

Specific rules for passing this module:
This module is assessed by coursework (continuous assessment) in the form of 4 online tests. You must pass each test with at least 40% in order to pass the module. If you do not meet the component level requirements for the module you will receive a QF outcome.

If a student does not pass all required components they will be given one further attempt at failed components during the May/June assessment period. If the second attempt in May/June is not passed students will be offered a supplementary examination in August (subject to regulations).

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 author., Robert Davison author., Mathematics for engineers / Tony Croft, Robert Davison., Harlow, England : Pearson Prentice Hall, 2015.ISBN: 1292065931
Tony Croft 1957- author., Robert Davison author., Mathematics for engineers / Anthony Croft, Robert Davison., Harlow : Pearson Prentice Hall, 2015.ISBN: 9781292065939
Croft, Tony,, Davison, Robert., Mathematics for engineers : a modern interactive approach / Anthony Croft, Robert Davison., Pearson,, 2008.ISBN: 9781408263235
K. A. Stroud, Dexter J Booth, Engineering mathematics / K.A. Stroud with Dexter J. Booth., Industrial Press, 2013.ISBN: 9780831134709
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-130 Sustainable Integrated Design I

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr EH Jewell, Dr M Togneri

Format: Lecture
Lab

Delivery Method: Lectures, which may be face-face or recorded online for students to access at their own will during the duration of the module. To put the design projects into context the majority of work will take place in CAD computer design lab sessions and independent working, individually and as a group. Assessment: continual Assessment 100%. A number of short design projects culminating in 100% total.

Module Aims: This module introduces design tools and methodologies requires students to integrate the competencies gained from previous and concurrent modules. Students will be required to critically assess a design brief, and consider the role of sustainability in their design. Students will be set a contextualized group design challenge.

Module Content: 1. Introduction to Design: This module will examine conceptual design, innovation, standardisation, reliability, safety, failure, ergonomics, materials and management. 20 hours nominal study.

2. Design Methodology and basic engineering design.

3. Sustainable design. Introduction to circular economy, e.g. understanding the impacts of sourcing rare earth minerals for components required for integrated systems, and considerations for end of life of components, the right to fix and design for rework, component based design,

4. Best practice for design.

Intended Learning Outcomes: Technical Outcomes
Upon completion of this module students should have:
- A knowledge and understanding of the multidisciplinary nature of design and understand the implications of many design decisions.
- Understand the main stages of embodiment, concept and detail design and be able to contribute to each of these.
- An understanding of the link between design, manufacture and sustainability.
- An ability to apply sustainable analysis tools in the design and manufacture of a product.

Accreditation Outcomes (AHEP)
- Understanding of appropriate codes of practice and industry standards (P6)
- Ability to work with technical uncertainty (P8)
- Communicate their work to technical and non-technical audiences (D6)
- Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (D2)
- Plan and manage the design process, including cost drivers, and evaluate outcomes (D5)

Assessment: Coursework 1 (20%)
Coursework 2 (40%)
Coursework 3 (40%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Coursework 1 : The online quizzes will assess the understanding of the key social imperative, technical and sustainable design principles.
Coursework 2 : Design project 1 will be an exercise where sustainable design and analysis principles are applied to a given product scenario with a submission of a written report.
Coursework 3 : Design project 2 will be a team exercise where key design principles are applied to physical product. Students will examine and understand how the item could be recreated in a more sustainable design philosophy.

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

Assessment Feedback: Lectures will provide feedback through summary presentations during lectures on each element in the allotted time after submission.
Failure Redemption: You would redeem failure by doing a design exercise and submitting a formal report during the normal resit period in summer. In some cases you may be required to re-submit case study work not previously completed satisfactorily
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION NOT AVAILABLE TO VISITING AND EXCHANGE STUDENTS

EG-131 Strength of Materials (Mech & Med & Engineering)

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Azizishirvanshahi

Format: Lectures 2 hours per week
Example classes 1 hour per week
Directed private study 3 hours per week

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

The module is delivered through lectures and example classes. The Canvas site contains course notes, screencasts, example sheets, practice tests, past exam papers and model answers. Lecture recording may be applied. Assessment is conducted though Canvas tests and final examination.

Module Aims: The aim of the module is to gain understanding into how engineering structures and components transmit loads and other external actions by means of internal stresses and how these stresses lead to strains and displacements. The course aims to explain the simple models of beam behaviour, concepts such as Mohr circle of stress and the relationships between stress and strain. Relevant case studies will be used to illustrate the importance of these subject areas.

Module Content:

1 - Introduction to basic concepts: rupture, deformation, stress, strain, brittle and ductile behaviour, elasticity, creep, fatigue, static determinacy. [2]
2 - Basic Beam theory: axial, shear force and bending moments, Euler beam theory, centroid (mass centre) and moment of inertia of sections, deflection of beams, indeterminate beams. [8]
3 - Stress and Strain analysis: principal directions, maximum shear stress, Mohr's circle, stress-strain relationships in linear elasticity. Stresses in pressurised vessels. [6]
4 - Advanced beam theory: combined loading, , Euler torsion theory, shear stresses, shear warping of sections, shear distribution in rectangular and thin sections. [4]
5 - Revision [2]

Intended Learning Outcomes:
Technical Outcomes
Upon completion of this module students should be able to:
- Determine the compatibility conditions for elementary structures.
- Construct partial and full free body diagrams required to obtain reactions, axial forces, bending moments and shear forces in simple rods and beams.
- Apply the equations of static equilibrium to calculate reactions, axial forces, bending moments, shear forces.
- Develop shear force and bending moment diagrams for beams of varying support conditions.
- Determine beam displacements from bending moments that are compatible with the support conditions.
- Propose designs of beam structures to operate within specified loading and material limitations.
- Apply the principle of superposition for structures with complex loading.
- Evaluate section properties of beams and similar structures, such as the second moment of area and centroid location.
- Obtain stress distribution on simple sections from bending moments and shear or axial forces.
- Apply the Mohr Circle principle to obtain principal stresses and maximum shear stress in 2-dimensions. Obtain strains from stresses and vice versa for 2-D elastic materials.
- Demonstrate the understanding of origin of formulae that appear in pressure vessel design codes.
- Make basic design and performance calculations on pressure vessels.
- Evaluate the effect of torsional moments on simple beams and the resultant stresses and deformations.

Accreditation Outcomes (AHEP)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering (SM3b)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2)
- Understanding of the use of technical literature and other information sources (P4)

Assessment:	Assignment 1 (7%) Assignment 2 (7%) Laboratory report (6%) Examination 1 (80%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Final examination in May/June will consist of a mix of multiple choice and written solution questions. All questions are compulsory. The examination is closed-book.

Two assignments consists of a Canvas test.

One will be a laboratory experiment.

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%.
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.
Resits are in the format of a supplementary exam.

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

Assessment Feedback: Students receive feedback from each of the three Canvas tests by being given their scores in each question together with the correct answer. Once the Canvas test has been scored and the exercises done by the lecturer in an example class, students can re-try the tests as many times as desired. Each time the numeric values of the questions change and they can compare their answers against the correct ones until they are satisfied with their understanding of the topic. Feedback from the final examination is via the University feedback form.

Failure Redemption: Through 100% supplementary examination in August.

Reading List: C. T. F. Ross 1935-, John Case 1888-1969.; Henry Chilver Chilver Baron, 1926-2012., Strength of materials and structures Carl Ross, John Case and A.H. Chilver., Arnold, 1999.ISBN: 1281047082
R. C. Hibbeler author., Kai Beng Yap contributor., Mechanics of materials : in SI units / R. C. Hibbeler ; SI conversion by Kai Beng Yap., Harlow : Pearson Education Limited, 2018.ISBN: 9781292178288
D. Gross (Dietmar), Hauger, Werner.; Schroder, Jorg.; Wall, Wolfgang A.; Bonet, Javier., Mechanics of materials / Dietmar Gross ... [et al.]., Springer, 2011.ISBN: 9783642128851

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.

Failure to complete the Canvas tests in time will lead to zero marks being awarded in the relevant exercise.

This version of Strength of Materials is for the Mechanical and Medical cohorts.

EG-134 Engineering Mechanics (Mech & Med & Engineering)

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr Y Xia

Format: Lectures: 2 hours per week,
Example classes : 1 hour per week,
Directed private study: 3 hours per week,

Contact Hours will be delivered through on-campus lectures and example classes.

Delivery Method: The module will employ a blended approach using the Canvas Digital Learning Platform, with on-campus lectures and example classes. The Canvas site contains learning materials such as lecture notes, lecture recordings, example sheets and solutions, online tests, past exam papers and answers.

Lectures: 2 hours per week,
Example classes : 1 hour per week,
Directed private study: 3 hours per week

Module Aims: This module aims to provide the students with the basic knowledge of the fundamental concepts of statics, including force, moment/couple, resultant force and resultant moment of a general force-couple system, equilibrium conditions/equations of a force system, common types of constraints/supports, and free body diagram, and by applying these concepts, the students will be able to solve statically determined truss structures using the methods of joints and sections.

Module Content:

Introduction: Basic concepts; Newton's laws of motion; Units; Idealisations of a real body and forces. [1]
2D Force Systems: Force definition; The principle of transmissibility; Concurrent & non-concurrent forces; Resultant forces; Resolution of forces; Projection; Moments and couples; Varignon's theorem; Simplification of co-planar force-couple systems; [6]
Equilibrium: Equations of equilibrium for a rigid body and assemblage of rigid bodies; Types of supports and connections; Free body diagrams; Externally static determinacy; Practical Examples. [5]
Friction: Characteristics of dry friction; Coulomb friction model; The angle of Friction; Wedge; Practical Examples. [5]
Application - Truss analysis: Definitions; Two-force member; Internally static determinacy; The method of joints; The method of sections; Advanced issues. [6]
3D force systems: Forces with vector representation; Moments; Equilibrium of concurrent and general 3D force systems. [5]
Revision [1] and Assessment [1]

Intended Learning Outcomes:
Technical Outcomes
Upon completion of this module the student should be able to:
- Calculate the resultant force of several forces using vector analysis; compute the moment of a force generated about a point; and determine both the resultant force and the resultant moment of a general force-couple system;
- Correctly identify types of constraints/supports and corresponding reaction forces;
- Correctly draw free body diagrams;
- Establish and solve the equilibrium equations of a rigid body or a group of rigid bodies subject to various loadings and supports.
- Solve simple problems involving dry friction;
- Determine if a give truss structure is statically determinant or not;
- Apply the method of joints and the method of sections to analyse simple/statically determinant truss structures to obtain the axial forces of all the truss members;
- Determine the resultant force of several 3D forces, and calculate the moment vector of a force produced about a point.

Accreditation Outcomes (AHEP)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- 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)

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

Assessment Description: This module is assessed by a combination of examination (80%) and courseworks (20%). Courseworks are in the format of two online tests (10% each) administered via Canvas at the middle and towards the end of semester 1, and 80% from open book examination.

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

Assessment Feedback: Generic feedback on the online tests will be provided, following the tests. The feedback for the final examination will be through the Faculty module feedback procedure.

Failure Redemption: If a student is awarded a re-sit, failure redemption of this module will be by examination worth 100% of the module mark.

Reading List: R. C. Hibbeler author., Engineering mechanics. Statics / R.C. Hibbeler ; SI conversion by Kai Beng Yap., Harlow : Pearson Education Limited, 2017.ISBN: 9781292089294
Bedford, Anthony., Fowler, Wallace L., Ahmad, Yusof., Engineering mechanics. Statics / Anthony Bedford, Wallace Fowler ; SI conversion by Yusof Ahmad., Pearson,, 2008.ISBN: 9789810679392
Meriam, J. L., Kraige, L. G., Bolton, J. N.,, Engineering mechanics / J.L. Meriam, L.G. Kraige and J.N. Bolton. Vol. 1, Statics., Wiley,, 2014.ISBN: 9781118807330

Additional Notes: NA

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-138 Introduction to Mechatronics

Credits: 10 Session: 2023/24 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MJ Clee, Prof D Deganello, Dr AC Tappenden, Dr M Togneri

Format: Lab
Workshop

Delivery Method: Laboratory and workshop

Module Aims: This is a practical module introducing students to fundamental engineering skills including work in the laboratory, basic programming and groupwork in a design challenge. Engineering is more than understanding technical design, it is often the social, environmental and economic context underpinning engineering solutions that determine success or failure. The design challenge/ hackathon will allow you to engage with a real world engineering problem

Module Content: 1. Engineering Mindset
2. Ethics and Professional Responsibilities
3. Climate Crisis
4. Failure and Learning through Mistakes
5. Root cause analysis
6. Teamwork
7. Positionality and Personal Design Perspectives

Intended Learning Outcomes: KU2: Have an appreciation of the wider multidisciplinary engineering context and its underlying principles.
IA1: Apply appropriate quantitative science and engineering tools to the analysis of problems.
PS1: Possess practical engineering skills acquired through, for example, work carried out in laboratories and workshops; in industry through supervised work experience; in individual and group project work; in design work; and in the development and use of computer software in design, analysis and control.
Evidence of group working
and of participation in a major project is expected. However, individual professional bodies may require particular approaches to this requirement.

Appreciate and prioritise designing for the people and context, to ensure appropriateness and sustainability of their ideas. (D1, D2, EL4)
Understand and appreciate their responsibility and the social, economic, and environmental implications of engineering decisions at a local and global level.(EL1)

Assessment: Coursework 1 (15%)
Coursework 2 (35%)
Coursework 3 (50%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Coursework 1: CAD assignment
Coursework 2: Mechanical testing report
Coursework 3: Design week challenge with EWB

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

Assessment Feedback: Students will receive pro-forma marking sheets and feedback through Turnitin

Failure Redemption: Supplementary coursework based on the CAD elements.

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

PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

EG-142 Instrumentation and Control

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Mrs M Ahmed, Dr RJ Cobley

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
Alan S. Morris 1948-, Reza Langari, Measurement and instrumentation : theory and application / Alan S. Morris, Reza Langari., Academic Press, 2012.ISBN: 9780123819604
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
Floyd, Thomas L, Electronic devices / Thomas L. Floyd., Pearson Prentice Hall, 2008.ISBN: 0136155812
Hyperphysics.
Norman S. Nise author, Control systems engineering / Norman S. Nise., Hoboken, New Jersey : John Wiley & Sons, 2015.ISBN: 9781118170519
Nise, Norman S., Control systems engineering / Norman S. Nise., John Wiley & Sons, Inc.,, 2011.ISBN: 9780470646120
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. If tightened restrictions from Covid-19 mean PC labs need to be scaled back, these sessions will switch to Zoom. The course is designed to be delivered in a variety of ways, can switch back and forth between online and in-person, and so will be minimally affected by this.

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 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 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. Students must achieve 30% in coursework 2 in order for coursework 1 and 3 marks to be included in their final module mark. If students do not achieve 30% in coursework 2, their final module mark will be their coursework 2 mark only.

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-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

EG-180 Introduction to Materials Engineering

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MP Coleman

Format: Lectures: 24 hours
Tutorials / Example classes: 12 hours
Directed private study: 36 hours
Preparation for assessment: 28 hours

Delivery Method: Assessment: The module will be assessed via an online course work assessment during the first semester, worth 20% followed by a standard 2 hour multiple choice examination at the end of the teaching block, worth 80%

Module Aims: The module aims to introduce year 1 Engineering students to the understanding of key concepts relating to materials selection and applications. Following completion of this module the student should be able to demonstrate an appreciation of materials selection in relation to the structure/mechanical and physical properties/applications of metallic, ceramic, polymeric and composite materials.

Module Content: Principles of Materials Selection: Classes and typical properties of materials, the role of materials selection in mechanical design [1].
Elastic and Plastic Behaviour of Solids: Stress and strain in solids, elastic behaviour. Plastic behaviour, tensile testing, stress-stain curves [3].
Toughness and Hardness Testing: Impact testing, hardness testing [1].
Atomic Structure: Atomic structure, atomic numbers and weights, electronic structure of atoms, types of atomic bonding including ionic, covalent, metallic, intermediate, Van de Waals, and hydrogen bonding [1].
Crystal Structure of Solids: Types of solid state structure (e.g. crystalline and amorphous), atomic packing in crystals, atomic arrangements (eg FCC, HCP, BCC), crystallography: Plane (Miller) indices, direction indices, crystal structure of ceramics [4].
Solidification: Volume change, nucleation and growth of crystals, grain boundaries, glasses: temperature dependence, silica glass structures, forms of silica glass, soda glass [2].
Cement and Concrete: Portland cement and its manufacture, hydration and its development, strength of concrete [1].
Vacancies and Diffusion: Diffusion and Fick's Law, crystal lattice defects, atomic vibration, probability of diffusion, mechanisms of diffusion [2].
Microstructure of Solids: Examples of microstructures, microstructural features, phases, diagrams (maps), unary diagrams and Gibbs Phase rule, solid solubility, solubility in a binary system, composition in a two-phase region, microstructural development, Lever rule [3].
Polymers and Composites: Polymerisation, skeletal structures, structure of polymers, homopolymers, copolymers, classification of polymers, classification of composites, manufacture routes, fibre-reinforced composites, fibre matrix interface [2].
Steels: Iron-Iron carbide system, eutectoid steel, effect of carbon content, effect of cooling rate, non-equilibrium steels, heat treatment of steels, diffusion, classification of steels: plain carbon steels (e.g. low-carbon, mild, medium-carbon, high-carbon steels) and alloy steels (e.g. high strength low-alloy steels (HSLA), tool/die steels, corrosion/heat-resistant steels) [4].

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should be able to demonstrate a knowledge and understanding of:
- The fundamental concepts across a broad spectrum of material families and mechanical/material properties.
- The basic principles of materials selection in mechanical design, including characterisation of mechanical properties, atomic structure of materials, crystal structures, vacancies and diffusion, microstructure evolution (solidification), phase diagrams, the treatment of plain carbon steels, creep, corrosion and oxidation.

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)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)

Assessment:	Coursework 1 (20%)
	Exam - Multiple choice questions (80%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Online course work assessment - 20%
Formal MCQ in Jan exam period - 80%

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

Assessment Feedback: Feedback on CW1 will be provided during lecture time.

Failure Redemption: A 2 hour multiple choice examination in the supplementary exam period in August will form 100% of the module mark.

Reading List: Shackelford, James F, Introduction to materials science for engineers / James F. Shackelford, University of California, Davis., 2016.ISBN: 9780273793403
Shackelford, James F, Introduction to materials science for engineers / James F. Shackelford., 2014.ISBN: 9780133826654
Callister, William D.; Rethwisch, David G., Materials science and engineering / William D. Callister, Jr., and David G. Rethwisch., 2014.ISBN: 9781118319222
Timings, R. L. (Roger Leslie), Engineering materials. Volume 2 / R.L. Timmings., Longman, 2000.ISBN: 9780582404663
Jean-Pierre Mercier 1932-, Gerald Zambelli; Wilfried Kurz, Introduction to materials science Jean P. Mercier, Gerald Zambelli, Wilfried Kurz., Elsevier, 2002.ISBN: 9780080950716
Budinski, Kenneth G., Budinski, Michael K., Engineering materials : properties and selection / Kenneth G. Budinski, Michael K. Budinski., Pearson,, 2010.ISBN: 9780136109501
Jacobs, James A.,, Kilduff, Thomas F.,, Engineering materials technology : structures, processing, properties, and selection / James A. Jacobs, Thomas F. Kilduff., Pearson/Prentice Hall,, 2004.ISBN: 9780130481856
Ashby, M. F; Jones, David R. H. (David Rayner Hunkin), Engineering materials. 2 : an introduction to microstructures and processing / Michael F. Ashby and David R.H. Jones., Butterworth-Heinemann, 2013.ISBN: 9780080966687

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

PENALTY: THE FACULTY OF SCIENCE AND ENGINEERING HAS A ZERO TOLERANCE FOR LATE SUBMISSION OF ALL COURSEWORK AND CONTINUOUS ASSESSMENT
Available to visiting and exchange students.
Full course notes provided. Additional Reading list provided.

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.