Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 2 (FHEQ LEVEL 5)

MECHANICAL 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 Mechanical Engineering	Dr Eifion Jewell
Mechanical Engineering Programme Director	Dr Will Newton w.newton@swansea.ac.uk
Year 2 Coordinator	Dr Michael Togneri m.togneri@swansea.ac.uk

STUDENT SUPPORT

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

Standard Reception opening hours are Monday-Friday 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 2 (FHEQ Level 5) 2023/24
Mechanical Engineering
BEng Mechanical Engineering[H300,H307]
BEng Mechanical Engineering with a Year Abroad[H308]
MEng Mechanical Engineering[H304]
MEng Mechanical Engineering with a Year Abroad[H309]
MEng Mechanical Engineering with a Year in Industry[H306]

Coordinator: Dr M Togneri

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-261 **Thermodynamics 2** **10 Credits** **Dr RS Ransing** **CORE**	**EG-243** **Control Systems** **10 Credits** **Dr A Egwebe** **CORE**
EG-264 **Computer Aided Engineering** **10 Credits** **Mr R Rees** **CORE**	**EG-260** **Dynamics 1 (Mech & Aero)** **10 Credits** **Prof H Haddad Khodaparast** **CORE**
EG-269 **Design of Machine Elements** **10 Credits** **Dr CA Griffiths** **CORE**	**EG-262** **Stress Analysis 1** **10 Credits** **Dr L Prakash** **CORE**
EGA265 **Fluid Mechanics 2** **10 Credits** **Dr EH Jewell** **CORE**	**EG-284** **Manufacturing Technology II** **10 Credits** **Prof TC Claypole** **CORE**
	EGA214 **Mechanical Engineering Design 2** **10 Credits** **Dr W Harrison/Dr PJ Dorrington/Dr B Morgan/Dr JS Thompson** **CORE**
EG-268 **Experimental Studies - Mechanical** **10 Credits** **Dr H Arora/Dr A Coccarelli/Mr W Jarrett/Dr EH Jewell/Dr B Morgan** **CORE**	
EG-277 **Research Project Preparation** **0 Credits** **Dr AC Tappenden/Dr M Fazeli/Mrs KM Thomas**	
Total 120 Credits	

Optional Modules
Choose exactly 20 credits
Design Pathway

EG-231	Heat Transfer	Dr A Coccarelli/Dr DR Daniels	TB1	10 (CORE)
EG-255	Circuit Analysis	Prof PM Holland	TB1	10 (CORE)

Or
Choose exactly 20 credits
Manufacturing Pathway

EG-231	Heat Transfer	Dr A Coccarelli/Dr DR Daniels	TB1	10 (CORE)
EG-255	Circuit Analysis	Prof PM Holland	TB1	10 (CORE)
EGA266	Digital Manufacturing	Mr AJ Morgan	TB1	10 (CORE)

Year 2 (FHEQ Level 5) 2023/24
Mechanical Engineering
BEng Mechanical Engineering with a Year in Industry[H305]
MEng Mechanical Engineering with a Year in Industry

Coordinator: Dr M Togneri

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-261 **Thermodynamics 2** **10 Credits** **Dr RS Ransing** **CORE**	**EG-243** **Control Systems** **10 Credits** **Dr A Egwebe** **CORE**
EG-264 **Computer Aided Engineering** **10 Credits** **Mr R Rees** **CORE**	**EG-260** **Dynamics 1 (Mech & Aero)** **10 Credits** **Prof H Haddad Khodaparast** **CORE**
EG-269 **Design of Machine Elements** **10 Credits** **Dr CA Griffiths** **CORE**	**EG-262** **Stress Analysis 1** **10 Credits** **Dr L Prakash** **CORE**
EGA265 **Fluid Mechanics 2** **10 Credits** **Dr EH Jewell** **CORE**	**EG-284** **Manufacturing Technology II** **10 Credits** **Prof TC Claypole** **CORE**
	EGA214 **Mechanical Engineering Design 2** **10 Credits** **Dr W Harrison/Dr PJ Dorrington/Dr B Morgan/Dr JS Thompson** **CORE**
EG-233 **Placement Preparation: Engineering Industrial Year** **0 Credits** **Prof GTM Bunting/Dr SA Rolland/Dr V Samaras**	
EG-268 **Experimental Studies - Mechanical** **10 Credits** **Dr H Arora/Dr A Coccarelli/Mr W Jarrett/Dr EH Jewell/Dr B Morgan** **CORE**	
EG-277 **Research Project Preparation** **0 Credits** **Dr AC Tappenden/Dr M Fazeli/Mrs KM Thomas**	
Total 120 Credits	

Optional Modules

Choose exactly 20 credits
Design Pathway

EG-231	Heat Transfer	Dr A Coccarelli/Dr DR Daniels	TB1	10 (CORE)
EG-255	Circuit Analysis	Prof PM Holland	TB1	10 (CORE)

Or

Choose exactly 20 credits
Manufacturing Pathway

EG-231	Heat Transfer	Dr A Coccarelli/Dr DR Daniels	TB1	10 (CORE)
EG-255	Circuit Analysis	Prof PM Holland	TB1	10 (CORE)
EGA266	Digital Manufacturing	Mr AJ Morgan	TB1	10 (CORE)

EG-231 Heat Transfer

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr A Coccarelli, Dr DR Daniels

Format: In-person lectures 30 hours, office hours 10 hours, independent study 60 hours.

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

Module Aims: The module aims to provide a comprehensive introduction to heat transfer principles and its applications. The encountered problems will involve mechanisms of conduction, convection and radiation.

Module Content: - Conduction: heat equation, Fourier's law, one-dimensional conduction, composite materials, thick cylinders, insulation, heat generation. [6]
- Convection: forced and natural convection, dimensional analysis, convective heat transfer coefficient derivation, flow in and outside tubes and planes, overall heat transfer coefficient, internal and external flow over banks of tubes, phase change effects. [5]
- Heat Exchangers: counter and co-current flow, log mean temperature difference, types of heat exchanger and applications, epsilon-NTU method. [6]
- Unsteady state heat transfer: heating and cooling fluid in confined domain. [2]
- Radiation: mechanism, Stefan-Boltzmann law, emissivity, wavelength and emissive power dependency, radiation into a large enclosure, radiative heat transfer coefficient. [4]
- Combined heat transfer mechanisms: net energy transfer. [2]

Intended Learning Outcomes: Technical Outcomes
Upon completion of this module, the student should be able to:
• Explain the fundamental concepts and mechanisms of heat transfer and identify them for a broad variety of representative problems, from everyday practical situations to mechanical and process engineering;
• Analyze and solve conductive and convective heat transfer problems including composite planar surfaces, thin and thick-walled pipes, spherical objects;
• Identify heat transfer coefficients by using experimentally-derived correlations;
• Design and analyze thermal performances of basic process equipment including heat exchangers and tanks;
• Analyze and solve problems involving radiative heat transfer from source to surroundings;
• Analyze, deconstruct and solve heat transfer problems involving combined heat transfer mechanisms.

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 identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2).

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

Assessment Description: 2 Canvas quizzes (10% each) and final exam 80%

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.

Failure Redemption: Supplementary exam.

Reading List: Holman, J.P. (Jack Philip), author., White, P. R. S., author., Heat transfer, McGraw-Hill Book Company, 1992 - 1992.ISBN: 0071126449 Cengel, Yunus A., author., Ghajar, Afshin J. (Afshin Jahanshahi), 1951- author., Heat and mass transfer : fundamentals and applications, McGraw-Hill Education, 2020.ISBN: 9789813158962 Cengel, Yunus A., Ghajar, Afshin J. (Afshin Jahanshahi), 1951-, Heat and mass transfer : fundamentals & applications, McGraw Hill Education, 2015.ISBN: 9780073398181 Incropera, Frank P., Principles of heat and mass transfer, Wiley, 2013.ISBN: 9780470646151 John H. Lienhard IV & John H. Lienhard V, A Heat Transfer Textbook.
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.

EG-233 Placement Preparation: Engineering Industrial Year

Credits: 0 Session: 2023/24 September-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. 11 one hour drop-in advice sessions. Review of CV and cover letter.
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 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; (d) key employability skills; getting the most from your Industrial Placement; and (e) health and safety in the workplace.

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) Engineering 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.
6) One to one meeting with careers and employability staff.
7) Health and safety in the workplace.

Intended Learning Outcomes:
Technical Outcomes
By the end of this module, students will:
- Know how to find and apply for placements, create a CV and complete a placement application.
- Understand the interview process and gain interview experience.
- Discuss and share what is expected within the workplace including behavioural and professional conduct.
- Identify personal employability skills and how these will be used in a workplace setting.

Accreditation Outcomes (AHEP)
EL5b Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues
EL6b Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk,

Assessment: Placements (100%)

Assessment Description:
Students are required to attend the health and safety lecture. Students who do not attend and have no valid reason will not be permitted to continue on an Engineering Industrial Placement Year programme of study.

Moderation approach to main assessment: Not applicable

Assessment Feedback:
N/A: students will however be able to discuss and seek feedback/advice on their search for an industrial placement, during the drop-in sessions.

Failure Redemption: Successful completion of this module depends upon attendance at, and engagement with, the health and safety lecture. Therefore there will normally be no opportunity to redeem failure. However, special provision will be made for students with extenuating or special circumstances.
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. This module is only available for students enrolled on the Engineering Year in Industry scheme.

EG-243 Control Systems

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr A Egwebe

Format: Lectures: 22 hours
Example classes: 10 hours
Directed private study: 68 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

Lectures with assessment by coursework and examination

Module Aims: The module introduces the topic of feedback control systems and presents methods of modelling that lead to transient, steady-state, and stability performances in control systems. An emphasis is placed on links between time responses and complex frequency domains. Principal topics are feedback systems, focusing on the system characteristic equation and its solution. There is an emphasis on the root-locus approach in studying stability conditions and compensation design. The overall aim is to understand and be able to apply basic techniques, using relevant software tools, for the analysis and design of feedback control systems.

Module Content: • Dynamic systems generally;
• Examples of feedback systems and practical performance criteria;
• Time and frequency response analysis;
• Differential equations and the implications of feedback;
• Open and closed loop control system configurations;
• Closed loop characteristics from open-loop transfer functions;
• Stability in the context of negative feedback;
• Complex frequency domain representations;
• Solutions of the characteristic equation, Bode, Nyquist and root-locus techniques;
• Design to meet stability and error performance criteria;
• Proportional, integral and differential (PID) compensation and their role in designs to meet a specification.

Intended Learning Outcomes:
Technical Outcomes
- Upon completion of this module the student should be able to demonstrate a knowledge and understanding of:
- The influence of feedback on dynamic systems;
- The characteristic equation and its importance in feedback systems;
- The link between open-loop and closed-loop transfer functions;
- Stability criteria;
- Steady-state accuracy;
- Time and frequency responses.

Accreditation Outcomes (AHEP)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b/EA3p)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4b)
- 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)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support the study of their own engineering discipline (SM3b/SM3p)
- Work with information that may be incomplete or uncertain and quantify the effect of this on the design (D3b/D3p)

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

Assessment Description:
Coursework:
Three electronic online tests with randomised coefficients/questions 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 10%

Coursework 2 - Weighting 10%

Coursework 3* - Weighting 10%

* Coursework 3 will include a one-hour continuous professional development course that students must complete online. It will be assessed by submitting a completion certificate and a reflective blog.

The closed-book examination is worth 70% of the module. The examination consists of 3 questions and students are expected to answer all questions. Question 1 is weighted 30%, and the 2 other questions each weigh 20%. The examination topics will be those presented in the lectures.

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: Partial moderation

Assessment Feedback: Standard University procedure via a generic form. Information is given on popularity of the individual questions, relative performances across the cohort and common mistakes.Other information includes the class grade for each question (1st class, 2:1 class, 2:2 class, 3rd class and fail) achieved by the cohort.

Individual students can make appointments with the lecturer to receive general feedback on the examination where this is requested.

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

Reading List: 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
Richard C. Dorf author., Robert H. Bishop 1957- author., Modern control systems / Richard C. Dorf, Robert H. Bishop., Harlow : Pearson Education, 2017.ISBN: 9781292152974
Mulgrew, Bernard,, Grant, Peter M., Thompson, John,, Digital signal processing : concepts and applications / Bernard Mulgrew, Peter Grant and John Thompson., Palgrave,, 2002.ISBN: 0333963563
Stefani, Raymond T., author., Bahram. Shahian author.; C. J. Savant author.; Gene H. Hostetter author., Design of feedback control systems / Raymond T. Stefani, Bahram Shahian, Clement J. Savant and Gene H. Hostetter., New Delhi : Oxford University Press, 2002.ISBN: 9780195682830
Arthur G. O. Mutambara author, Design and analysis of control systems / Arthur G.O. Mutambara., Boca Raton, Fla : CRC Press, 1999.ISBN: 084931898X

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

EG-255 Circuit Analysis

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof PM Holland

Format: In-person or Zoom 22 hours
Discussion forum/email 11 hours
Canvas study 22 hours
Independent 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: 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.

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)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4b)

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 only (100%). Assignment marks are ignored. Level 2 supplementaries (re-sits) will be capped at 40%.

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
Irwin, J. David,, Nelms, R. M., Irwin, J. David,, Engineering circuit analysis / J. David Irwin, R. Mark Nelms., Wiley (Asia) Pte.,, c2011..ISBN: 9780470873779
James A. Svoboda, Richard C Dorf, Introduction to electric circuits / James A. Svoboda, Richard C. Dorf., Hoboken, NJ : John Wiley and Sons, Inc., 2013.ISBN: 9781118560600
Richard C. Dorf author., James A. Svoboda author., Introduction to electric circuits / Richard C. Dorf, University of California, James A. Svoboda, Clarkson University., Hoboken, NJ : John Wiley & Sons, Inc., 2014.ISBN: 9781118321829

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-260 Dynamics 1 (Mech & Aero)

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-116; EG-120; EG-155; EG-166

Co-requisite Modules:

Lecturer(s): Prof H Haddad Khodaparast

Format: Lectures 2 hours per week
Example classes 1 hour per week
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

Classroom based teaching. Lecture notes and recordings will be made available on Canvas.

Module Aims: Elements of vibrating systems; simple harmonic motion; use of complex exponential representation. One-degree-of-freedom systems; natural frequency; effect of damping; harmonic excitation; rotating out-of-balance; vibration transmission. Transient dynamics; frequency domain analysis; impulse response function. Undamped multi-degree-of-freedom systems; Calculation of natural frequencies and mode shapes of two degree of freedom systems.

Module Content: • Introduction: Elements of vibrating systems. Basic concepts. Natural frequency. Simple harmonic motion.
• One-Degree-of-Freedom Systems: Application of Newton's second law to translating and rotating systems for the determination of differential equations of motion. Calculation of natural frequency. Effect of damping.
• Harmonic Excitation of Damped One-Degree-of-Freedom Systems: governing differential equations. Physical significance of complementary function and particular integral. Resonance. Examples including rotating out-of-balance, vibration isolation and transmission.
• Transient response on undamped and damped One-Degree-of-Freedom Systems: impulse response function, frequency response function, impact response, convolution integral.
• Undamped Multi-Degree-of-Freedom Systems: Method of normal modes. Analytical determination of natural frequencies (eigenvalues) and mode shapes (eigenvectors). Harmonically forced vibration.
• Lagrange's Equation: Derivation, physical interpretation, simple examples of its application.

Intended Learning Outcomes: Technical Outcomes
On successful completion of this unit students will be expected, at threshold level, to be able to:
- Gain a knowledge and understanding of the importance of natural frequencies and resonance; the role of damping; the concept of degrees of freedom. (Assessed through examination and assignment 1)
- Estimate resonances of simple systems; derive the equations of motions of systems using Newton's second law and Lagrange's equation (assessed through examination and assignment 2)
- Apply the methods presented in the course to develop simple models of real structures; analyse these models to calculate natural frequencies and evaluate the response to harmonic forces (assessed through examination and assignment 3).
- Analyse the free vibration of undamped two degrees of freedom systems (assessed through examination and assignment 3)

Accreditation Outcomes (AHEP)
Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3b)
Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
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:	Assignment 1 (5%) Assignment 2 (5%) Assignment 3 (5%) Examination 1 (85%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: A combination of examination and assignments assesses this module. Final exam in May/June will have 85% weighting.

The final exam consists of two parts:
- Part 1: Multiple Choice Questions (MCQs). Part 1 contributes 50% to the final marks of the module
- Part 2: 1 written question. Part 2 contributes 35% to the final marks of the module.

There will be 3 Canvas assignments; each of the assignments contributes 5% to the module's final marks. Each of these three assignments will include 5 MCQs and students will have 3 days.

The first assignment covers free vibration of single degree of freedom (chapter 1), (Canvas)
The second assignment includes questions on harmonic forced vibration (chapter 2) (Canvas)
The third assignment consists of questions from Chapters 3 and 4. (Canvas)

Resits in August will have a 100% weighting and is similar to the May/June exam. i.e. two parts, part 1: MCQs (50*100/85) and part 2: 1 written question (35*100/85).

Part 1 of the final exam will be conducted in person and will be a closed-book test. Part 2 of the final exam, on the other hand, will be held online and will be open-book. These two parts of the exam will be scheduled at separate times.

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

Assessment Feedback: Via model answers for the assessments and overview of generic issues from written examinations. For the 3 assignments Feedback will be left on Canvas after deadline.

Failure Redemption: An opportunity to redeem failures will be available within the rules of the University. A supplementary exam will form 100% of the module mark.

Reading List: D. J. Inman author., Ramesh Chandra Singh contributor., Engineering vibration / Daniel J. Inman ; international editions contributions by Ramesh Chandra Singh., Harlow : Pearson Education Limited, 2014.ISBN: 9780273768449

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
Available to visiting and exchange students.
Office hours will be posted on Canvas and will be also included in introductory lecture notes.
Submission of the assignments will be via Canvas ONLY. Email submissions will NOT be accepted.
All notes and other teaching materials will be delivered via Canvas ONLY.

EG-261 Thermodynamics 2

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-161

Co-requisite Modules:

Lecturer(s): Dr RS Ransing

Format: 3 lectures per week that includes example classes and one office hour per week. Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, example classes, practical sessions, and office hours.

Delivery Method: Thermodynamics 2 is developed as a blended learning module. There will be a self-contained asynchronous course in Canvas that students will study for 2-3 hours per week. The asynchronous course will be supported by three hours of timetabled in-person or Zoom synchronous class. Canvas pages will host the asynchronous learning activities in the Canvas course, organised into weekly modules. Learning activities will include access to power point slides; text-based examples and solutions; short video-based solutions to examples; online formative and summative quizzes and other online supplementary materials sourced from creative commons resources. The synchronously delivered hour will consist of a series of different activities including class discussions; icebreakers; consolidation of theory and examples; problem-solving and review/preview of the week completed and the week ahead respectively. The basis for the design of Thermodynamics 2 is to apply the principles of active learning. Students have access to a real jet engine The intention is to encourage as much interaction with, and between the students as possible using different learning activity types.

Module Aims: In the second-year engineering course on thermodynamics, students delve into the profound field of harnessing thermal energy for power generation. As we navigate a resource-constrained world in the year 2050, prioritizing energy efficiency becomes crucial. However, simply focusing on efficiency is insufficient. We must also explore innovative pathways to unlock the complete work potential of thermal energy. This is where the invaluable insights derived from the laws of thermodynamics come into play.

The primary objective of this module is to familiarize students with two key concepts: thermodynamic efficiency and irreversibility. These concepts are applied to various energy conversion processes that involve the transfer of heat to work and vice versa. Throughout the course, students will encounter practical engineering examples, involving steady and unsteady flow systems, which encompass heat, work, and/or mass transfer.

By gaining a deep understanding of thermodynamics, students will be equipped with the knowledge and tools necessary to tackle the challenges of optimizing energy utilization in a world with limited resources.

Module Content: Teaching Week 1 – Teaching Week 5 (5 Weeks):
Power Generation with Gas Turbines and Jet Engines

Week 1: Gas power plants with reheating, regeneration and intercooling.
Most of the gas power plants and large gas turbine engines to produce power would probably be phased out over next couple of decades as we move away from carbon-based economy. However, reheating, regeneration and intercooling concepts are useful and it provides a good example in learning now inspirations from Carnot cycles can be used to improve efficiency of a Brayton cycle!

Did you know that the reversible adiabatic expansion and compression processes in a Carnot engine produce zero nett work but are the only processes for producing nett work output in combustion engines?

Week 2: Combustion of fuel
We all know that oxygen, heat, and fuel is needed to start and sustain combustion of hydro-carbon fuels. We are ignoring the speed of air though!

You will learn how to calculate minimum oxygen, and hence air, required to burn hydro-carbon fuels from its chemical composition. You can understand lean, stoichiometric, and rich air to fuel ratios. You will be able to undertake volumetric and gravimetric analysis as well as dry and wet exhaust gas analysis.

When you measure the air to fuel ratio in the jet engine experiment, you will learn why one needs to be mindful of units used!

Week 3: Performance analysis of a stationary jet engine under ideal conditions.
A compressor pressure ratio and the maximum temperature of products of combustion that a turbine blade can withstand are among the important design decisions. You will learn how ideal analysis is useful in predicting jet engine thrust as well as velocity and temperature values for combustion gases at exit. You will learn limitations of ideal assumptions, discover reasons for deviations and compare your predicted values with experimentally measured values.

A live – in person – demonstration of the jet engine is a highlight of this module.

Week 4: Flow through nozzle and combustion chamber under choked flow condition.
You will understand how a set of commonly used ideal equations give a valuable insight that the maximum air velocity one can achieve with a converging nozzle is sonic velocity. This is referred to as choked flow condition. You will learn why once you cross this stage, you need to increase the cross-sectional area, like a diffuser, to increase the velocity of air to supersonic speeds.

Similarly, we know that in a combustion chamber, as fuel is burnt and the pressure, temperature, and velocity values of products of combustion increase. The combustion chamber for a Jet engine is almost a constant cross-sectional area duct. You will learn that for a duct of constant cross-sectional area by adding heat to the air, the maximum velocity that you can increase is the sonic velocity. You will also learn from ideal equations, that as the sonic velocity condition is approached, the increase in the speed of air results in the drop of temperature of air. You will learn that for effective combustion, the speed of air needs to be in a subsonic region.

Have you ever wondered how supersonic jets manage to get subsonic flow before air enters the combustion chamber?

Have you noticed why commercial flights never tend to exceed Mach number 0.85?

Week 5: Performance analysis of a cruising jet engine under choked flow condition.
Thermodynamic analysis, energy efficiency and minimisation of irreversibility during any energy transfer process needs to be undertaking alongside of heat transfer and fluid mechanics analysis. You will apply concepts learnt in Weeks 1-4 to a jet engine problem assessing its performance under cruising conditions. You will learn why the jet engine flow is almost always choked under cruising conditions. You will understand the limitations of using a simple momentum equation to calculate thrust and why estimation of jet engine thrust is a complex problem.

Have you ever wondered why jet engine is almost always positioned ahead of a commercial aircraft wing!

Teaching Week 6 – Teaching Week 8 (3 Weeks):
Irreversibility applied to a variety of energy conversion processes involving heat to work transfer and vice a versa.

Week 6: Irreversibility and Second law analysis of compressors.

You will learn that there are three parts of irreversibility: work loss in a work transfer process, unaccounted heat dissipation in a heat transfer process and less commonly known – loss of Carnot work opportunity as heat is transferred across finite temperature difference. You will also learn how the entropy generation term is a measure of generation of all three parts of irreversibility during an energy transfer process. Many of you may need to ‘unlearn’ the current interpretation of entropy as an exclusive measure of molecular disorder and chaos – even if it is taught in A level chemistry books by various exam boards.

The term isentropic efficiency of compressors is commonly used in thermodynamics analysis. However, this definition is not useful in estimating reversible work if the compressor loses heat. You will understand the difference between reversible and internally reversible work input to compressor. This understanding will help you to imagine solutions that can potentially achieve the reversible work input.

Did you know whenever we transfer heat across a finite temperature difference, we are losing an opportunity to create Carnot (reversible) work?

Have you ever wondered why the work input to an internally reversible and isothermal compressor is not same as the reversible isothermal compressor work input?

Week 7-8: Second law analysis of engineering problems when working fluid changes phase.
Quantifying irreversibility when heat is input to the control volume by burning natural gas (methane), electric resistance heaters or heat pumps is an interesting problem that you will learn. When working fluid changes phase in a rigid tank, it adds to the complexity. You will understand terms that contribute to reversible work input to achieve the necessary heat transfer. You should be able to feel confident in applying the second law of thermodynamics to many engineering processes.

Next time a salesperson claims that electric heaters are the best as they are almost 100% efficient, you would know they need a course on thermodynamics!

Teaching 9 – Teaching 11 (3 Weeks):
Satisfying our heating and cooling needs.
Week 9-10: Air Conditioning with psychrometric chart.

You will learn how to achieve desired humidity and temperature values for the air from given initial conditions? We will only use atmospheric pressure value for our problems. For human comfort, the control of humidity, temperature and air speed are important. We will ignore air speed but focus on the dependency of the moisture carrying capacity of air on its temperature.

Week 10-11: Refrigeration and Heat Pumps.
Satisfying our future heating and cooling needs in a most environmentally friendly way will remain as a challenge over next few decades. The global warming potential of current refrigerants is not good – in fact, it is very bad. You will learn the basic and perhaps potentially environmentally unfriendly refrigeration (vapour compression) cycle but also gain insights on how thermodynamics can help you to address this global challenge efficiently. You have an opportunity to undertake heat pump experiment to reinforce your thermodynamics understanding in experimental studies module.

Did you know that the industry achieved the journey from a D rating to A rating for domestic refrigerators by just improving insulation! This resulted in reducing the time that compressor runs from 50% to 33%.

“Until the end of February 2021, over 90% of products were labelled either A+, A++ or A+++. The new

[energy rating] system will be clearer for consumers and ensure that businesses continue to innovate and offer even more efficient products. This also helps us to reduce our greenhouse gas emissions."
EU Commissioner for Energy, Kadri Simson, March 2021.

Intended Learning Outcomes: After completing this course, you should be able answer the following questions:

1. How efficiently can I convert heat energy to useful work?
2. How much air do we need to completely burn a given mass or volume of a hydrocarbon fuel and what are the products of combustion?
3. How efficiently can I extract heat from a cold environment and transfer to a warm environment?
4. How to achieve desired humidity and temperature values for the air from given initial conditions?
5. How to quantify irreversibility in a variety of processes including understanding of the irreversibility in relation to the isentropic efficiency of a compressor.
6. Understand the difference between the 1st and 2nd Law Efficiency.

Accreditation Outcomes and how they are achieved

Apply knowledge of mathematics and engineering principles to the solution of complex problems. Some of the knowledge will be at the forefront of the particular subject of study.
How it is achieved: Irreversibility and Second law of thermodynamics analysis of flow/non-flow, steady/unsteady with and without phase change of the working fluid. Understanding thermal irreversibility concepts and application of the second law analysis at the forefront of the thermodynamics application.

Analyse complex problems to reach substantiated conclusions using first principles of engineering principles.
This will involve evaluating available data using first principle and using engineering judgment to work with information that may be uncertain or incomplete, discussing the limitations of the techniques employed
How it is achieved: Performance analysis of a jet engine and solving of relevant engineering problems.

Evaluate the environmental and societal impact of solutions to complex problems and minimise adverse impacts.
How it is achieved: Study combustion of carbon based fuels, refrigerants and alternatives. Learn how to minimise irreversibility with the help of the second law of thermodynamics during any energy conversion process.

Use practical laboratory skills to investigate complex problems.
How it is achieved:
Experience of a laboratory demonstration of a jet engine in operation and analysis of the data measured.

Assessment:	Online Class Test (25%)
	Examination (75%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Online Canvas quiz will cover syllabus taught in weeks 1 to 6.

Jet Engine Experiment is part of EG-261. Unless you have extenuating circumstances, in-person attendance is compulsory else you will loose 10 marks from the Online Canvas quiz. You are required to arrive at the jet engine lab 5 minutes before the scheduled time and sign the attendance sheet.

Examination is traditional final closed book exam and covers the whole of the syllabus.

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

Assessment Feedback: Students receive feedback from Canvas multiple choice questions by being given their scores in each question. The overall feedback will be discussed in the class. Sample answers for the final exam paper will be made available on Canvas.

Failure Redemption: An opportunity to redeem failures will be available within the rules of the University, if permitted the resit will be via 100% supplementary examination.

Reading List: Yunus A. Cengel author., Michael A. Boles author.; Mehmet Kanoglu author., Thermodynamics : an engineering approach / Yunus A. Cengel, Michael A. Boles, Mehmet Kanoglu., New York, NY : McGraw-Hill Education, 2019.ISBN: 9781260092684 Yunus A. Cengel author., Michael A Boles joint author., Thermodynamics : an engineering approach / Yunus A. Cengel (University of Nevada, Reno) and Michael A. Boles (North Carolina State University)., New York : McGraw-Hill Education, 2015.ISBN: 9789814595292 Yunus A. Cengel, Michael A Boles, Thermodynamics : an engineering approach / Yunus A. Cengel and Michael A. Boles ; adapted by Mehmet Kanoglu., McGraw-Hill, 2011.ISBN: 9780071311113
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. • AVAILABLE TO: visiting and exchange students if they satisfy the pre-requisite (EG-161) requirements for this module. This is a core module for several degree schemes

EG-262 Stress Analysis 1

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-120

Co-requisite Modules:

Lecturer(s): Dr L Prakash

Format: Lectures: 20 hours Example classes: 10 hours Directed private study and revision: 70 hours

Directed private study and revision: 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 is based on lectures and example classes and additional supporting on-line content.

Module Aims: This module continues on from EG-120 and includes: section properties; unsymmetrical bending; stresses in thick cylinders; rotating discs; theories of failure; stress concentration effects; fatigue and linear elastic fracture mechanics.

Module Content:
• Stress and strain: Stress equilibrium, strain compatibility, stress-strain relationships.
• Section Properties: Second moment of area; product moment of area; principal axes; unsymmetrical bending.
• Thin cylinder formulae.
• Thick Cylinders: Derivation of Lame equations; built-up cylinders and shrink/interference fits.
• Rotating Discs: Derivation of basic equations; effect of 'fit' and external loads.
• Failure Theories: Failure mechanisms; ductile and brittle failure; Tresca theory, von Mises theory; other relevant theories.
• Stress Concentration Effects: Causes and effects; examples of stress concentration factors and design data; effect of surface finish, residual stresses etc.; design to minimise stress concentration effects.
• Fatigue: Nature of fatigue; low and high cycle fatigue; presentation of fatigue data; fatigue strength; notch sensitivity; variable loading and cumulative damage; design for infinite life and acceptable finite life.
• Linear Elastic Fracture Mechanics: Modes of failure; stress function approach; fracture toughness; LEFM applied to fatigue; environmental effects.

Intended Learning Outcomes:
Technical Outcomes
Upon successful completion of this module, students will be expected, at threshold level, to be able to:
Understand and apply relevant engineering principles to analyse key engineering processes including (EA1b) (evaluated in examination):
• The significance and theory of unsymmetrical bending
• Thin and thick cylinders and rotating disc theory
• Theories of ductile and brittle material failure
• Stress concentration features and their effects on design
• Fatigue and fracture theories

Identify, classify and describe the performance of components through the use of analytical methods (EA2) (evaluated in examination) including an ability to:
• Identify the sources and types of stress and stress concentration in components and structures under various loading regimes and choose suitable methods of analysis based on the loading and boundary conditions.
• Apply the equations of unsymmetrical bending, thin and thick cylinders and rotating discs to practical problems.
• Design simple components and structures to avoid failure by yielding, fatigue and/or fracture, including the effects of stress concentration features.

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

Assessment:	Examination 1 (70%) Assignment 1 (30%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Examination: The examination (written or online or OMR sheet based exam) forms 70% of the module mark.
Assignment 1 (30%) will be either Canvas test or case study.

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

Assessment Feedback: A general pro-forma is completed, covering errors/issues that were identified during the marking process, and produced as formal examination feedback.
The marks for assignment 1 will be provided at the deadline time. Further feedback, including worked solutions will be provided within the week after the deadline.

Failure Redemption: A supplementary written examination will be set which will form 100% of the mark.

Reading List: E. J. Hearn (Edwin John), Mechanics of materials 1 an introduction to the mechanics of elastic and plastic deformation of solids and structural materials / E.J. Hearn., Butterworth-Heinemann, 1997.ISBN: 1281047694
E. J. Hearn (Edwin John), Mechanics of materials 2 : an introduction to the mechanics of elastic and plastic deformation of solids and structural materials / E.J. Hearn., Butterworth-Heinemann, 1997.ISBN: 0750632666
D. W. A. Rees (David W. A.), 1947- author., Mechanics of solids and structures / David W.A. Rees., London : Imperial College Press, 2016.ISBN: 9781783263950
Rees, D. W. A., The mechanics of solids and structures / D.W.A. Rees., McGraw-Hill,, 1990.
Pilkey, Walter D., Pilkey, Deborah F., Peterson, Rudolph Earl,, Peterson's stress concentration factors / Walter D. Pilkey, Deborah F. Pilkey, John Wiley,, c2008..ISBN: 9780470048245

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

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

Available to visiting and exchange students.

EG-264 Computer Aided Engineering

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-163

Co-requisite Modules:

Lecturer(s): Mr R Rees

Format: Q&A Lectures: 11 hours
PC Lab Activity time:22 hours
(Combined into 3 hour timetabled sessions).
Directed private study: 67 hours
Contact Hours will be delivered on-campus in computer labs with combined lectures and PC lab work time. The sessions will be held through screensharing software to ensure clarity of the subject material during the lectures and practical computer sessions.

Delivery Method: 1 hour Lecture/Exercise class held in computer lab, after which the 2 hour computer lab session immediately follows to allow students to implement learnt material.

Module Aims: This module deals with the significance of computers in numerical analysis. Integration by MATLAB and Finite Element Analysis (FEA) - (a) Review of MATLAB programming techniques; (b) Introduction of FEA and the techniques to implement FEA by using Solidworks, including design studies and stress simulations.

Module Aims: Competence in SOLIDWORKS to implement FEA method and MATLAB to solve mathematical problems.

Module Content: Module content:
MATLAB - (a) Review of MATLAB programming techniques; (b) Introduction of numerical analysis basics, including solution of nonlinear algebraic equations and numerical integration etc.

FEA Method: (a) Introduction of FEA method; (b) Fundamental techniques to implement FEA by using SOLIDWORKS software; and (c) Implementation of FEA method for stress analysis of different mechanical structures, e.g., beams and plates subject to different loadings.

Intended Learning Outcomes:
Assessed by:
- MATLAB Individual Assignment 50%:
- Solidworks Individual Assignment 50%

Technical Outcomes
After completing this module students should be able to:
- Demonstrate an ability to implement FEA by using Solidworks and utilise MATLAB to implement numerical methods in solving mathematical problems.

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, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4b)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)

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

Assessment Description: Coursework 1 (50%) - Individual Assessment - MATLAB question sheet assessment based on numerical integration and root finding through MATLAB.
Coursework 2 (50%) – Individual Assessment - Technical design based report using Solidworks, FEA and optimisation.

Assignments for two sections of the module are marked after each section.

Important information: In order to pass the module, students must achieve a minimum of 40% in both Coursework 1 and Coursework 2. If you do not achieve 40% in each component, you will receive a QF outcome, and will be required to complete a supplementary assessment in the failed component(s) during the July/ August supplementary period.

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

Assessment Feedback: Students will receive feedback on their assignment in lectures, office hours and on Canvas

Failure Redemption: If the module is not passed, students will resit the components that they have failed. i.e. if Coursework 1 or 2 is failed, you will have to complete a supplementary coursework in Coursework 1 or 2. If both components are failed, you will have to complete supplementary coursework in both components.

Reading List: Attaway, Stormy, author., MATLAB : a practical introduction to programming and problem solving, Butterworth-Heinemann, 2023.ISBN: 9780323917506
Desmond J. Higham 1964- author., Nicholas J. Higham 1961- author., MATLAB guide / Desmond J. Higham and Nicholas J. Higham., Philadelphia : Society for Industrial and Applied Mathematics, 2017.ISBN: 9781611974652

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

N.B. Both module sections (MATLAB and Solidworks) must be passed to pass the module. The minimum pass mark for each area is 40%. If grades of 40% or higher are not attained in the MATLAB or Solidworks components, supplementary assessments will be required to be taken during July - August, for which ever component is failed, or both if neither have been passed.

LATE SUBMISSION PENALTY: ZERO TOLERANCE - For late submissions of continual assessment assignments, ZERO marks will be awarded. To consider late submissions for marking, university procedures for extenuating circumstances must be followed and approved.

AVAILABLE TO VISITING AND EXCHANGE STUDENTS.

THIS MODULE IS NORMALLY ONLY ASSESSED IN SEMESTER 1.

Office hours will be posted on the Canvas course.

EG-268 Experimental Studies - Mechanical

Credits: 10 Session: 2023/24 September-June

Pre-requisite Modules: EG-163

Co-requisite Modules:

Lecturer(s): Dr H Arora, Dr A Coccarelli, Mr W Jarrett, Dr EH Jewell, Dr B Morgan

Format: Coordinator = 1hr/week
Academic + Demonstrator = 1 hour per week each
Lectures 5 hours it in total, throughout the module
Practical classes 4 hours per week
Directed private study 4 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

Lecture, practical and directed independent study.

Module Aims: The course introduces the students to experimental studies in a wide range of subjects. There are four individual experiments (HEAT/JET/STRESS/VIBRATION)

Each experiment is self contained and the student will be assessed via either:
- A lab report which will have a set of experiment specific questions to answer.
- An online Canvas assessment.

All students work is scheduled in groups and individuals will carry out four experiments. The assessments are all individually submitted.

The students keep a log-book of the experimental observations and results, which is used for reference for the technical report from each experiment written-up in the week after the experiment.

Module Content: - Revision of lab report writing, and statistical data / error analysis [3].
- Measurement techniques for physical parameters: position, velocity, acceleration, temperature, pressure, strain, flow.

Laboratory classes are:
- Four Individual experiments (HEAT/JET/STRESS/VIBRATION).

Intended Learning Outcomes:
Technical Outcomes
- A knowledge and understanding of: a wide range of experimental techniques.
- An ability to: understand and follow experimental procedures.
- An ability to: consider health and safety issues when working in labs.
- An ability to: maintain accurate informal notes.
- An ability to: report findings in written form.
- An ability to: interpret experimental data and use it to make constructive criticisms of analytical models.

Accreditation Outcomes (AHEP)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4b)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc.) (P1)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2)
- Ability to apply relevant practical and laboratory skills (P3)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Assessment:	Coursework 1 (25%) Coursework 2 (25%) Coursework 3 (25%) Coursework 4 (25%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description:

1. Experimental reports and/or Canvas tests for each experiment (C1 to C4) are handed in a week after the experiment (exact dates outlined for each group).

Each C1 to C4 experiment carries a total of 25%: CW1 = Jet Engine; CW2 = Fluids; CW3 = Stress/Strain; and CW4 = Vibration.

2. All assignments are submitted electronically on Canvas using templates.

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

Assessment Feedback: Feedback and marking via Online assessments.
Lab reports are returned with feedback via Canvas within three weeks from submission.

Failure Redemption: A supplementary piece of coursework will be set which will form 100% of the mark. Written work may be resubmitted in the supplementary period but it is not possible to repeat experiments.

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

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

Students will not gain any marks for practicals (or on-line equivalents) that they have not attended, even if a report is submitted, unless there are valid extenuating circumstances.

All assignments are submitted electronically and the University rules on Plagiarism apply.

Final mark is based on: Four Assessments based on Four Experiments (25% each)

EG-269 Design of Machine Elements

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-165; EG-165

Co-requisite Modules:

Lecturer(s): Dr CA Griffiths

Format: Lectures 20 hours
Example classes 10 hours (to be delivered online)
Directed private study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

Lectures

Module Aims: The module introduces the students to the design and analysis of a number of common machine elements including drives and couplings, gears, bearings and power screws. Balancing of rotating machinery is also covered.

Module Content:
- Drives and couplings - clutches, brakes, belts and couplings
- Balancing - rotating and reciprocating systems
- Gear design - gears, the analysis of gearboxes, including epicyclics
- Bearings - types of bearings, bearing design, bearing selection
- Screws and threads - power screws

Intended Learning Outcomes:
Technical Outcomes
- A knowledge and understanding of: the design and selection process for typical machinery components.
- An ability to: identify the important machine components under various loading regimes and choose suitable methods of analysis based on the loading and boundary conditions.
- An ability to: apply the knowledge to practical machine design problems.

Accreditation Outcomes (AHEP)
- Work with information that may be incomplete or uncertain and quantify the effect of this on the design (D3b)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4b)

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

Assessment Description: Closed book examination.

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

Assessment Feedback: Students receive their marked coursework with feedback within three weeks of the submission deadline and in time for exam revision. A general pro-forma is completed, covering errors/issues that were identified during the marking process, and produced as formal examination feedback.

Failure Redemption: A supplementary written examination will be set which will form 100% of the mark.

Reading List: Robert C. Juvinall author., Kurt M. Marshek author., Fundamentals of machine component design / Robert C. Juvinall, Kurt M. Marshek., Hoboken, NJ : John Wiley & Sons, Inc., 2017.ISBN: 9781119342816
Robert C. Juvinall author., Kurt M. Marshek author., Juvinall's fundamentals of machine component design : SI version / Robert C. Juvinall, Kurt M. Marshek., Hoboken, New Jersey : John Wiley & Sons, Inc., 2017.ISBN: 9781119382904
Robert C. Juvinall, Kurt M Marshek, Machine component design / Robert C. Juvinall ; Kurt M. Marshek., Wiley, 2012.ISBN: 9781118092262

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

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

Notes, worked examples and past papers for this module can be found on Canvas.

EG-277 Research Project Preparation

Credits: 0 Session: 2023/24 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr AC Tappenden, Dr M Fazeli, Mrs KM Thomas

Format: Formal Lectures - 2-3 hours

Delivery Method: 2-3 formal lectures throughout the academic year concerning project design and selection.

Module Aims:
This module has been designed to provide you with information needed ahead of undertaking a research project in Year 3 of studies.

The research project in Year 3 is worth 30 credits, and will involve the application of scientific and engineering principles to the solution of a practical problem associated with engineering systems and processes.

In the research project you will gain experience in working independently on a substantial, individually assigned task, using accepted planning procedures. It will require and develop self-organisation and the critical evaluation of options and results, as well as developing technical knowledge in the chosen topic.

The preparation for the research project commences in Year 2 where you are required to engage in project selection. In this preparation module we will confirm the options available to you to either define your own project or to select from a list of project titles and descriptors put forward by academic staff. Communications concerned project selection will be done via the Canvas course page. Additional supplementary resources will also be provided.

Module Content: In conjunction the formal lectures and supplementary resources will cover:

• Key staff members - contact details
• Key dates for Year 2 regarding project selection - defining your own project or selecting from staff titles
• How to design a project concept and what to consider before approaching a possible supervisor
• Where to start in finding a possible supervisor
• What to do if you're hoping to undertake a placement year
• Selecting from staff titles
• Further information around the allocation process
• First steps in EG-353 when you commence Year 3

Intended Learning Outcomes: NA

Assessment: Participation Exercise (100%)

Assessment Description: This module is not assessed but we would strongly suggest participation to ensure that you understand how the project selection system will work.

Moderation approach to main assessment: Not applicable

Assessment Feedback: NA

Failure Redemption: NA

Additional Notes: Only available to students following an Engineering Degree Programme.

EG-284 Manufacturing Technology II

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof TC Claypole

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

Delivery Method: Assessment:
Examination – 60%
Assignments – 40%
- State of the art notes for each the 3 topics - (Topic 1 10%, Topic 2 10%, Topic 3 5%)
Based on a Literature review of journal papers correctly referenced Bibliography
Summary of the lectures/examples for each of the 3 topics (5% per topic)

Module Aims: The course builds on information presented in Manufacturing Technology I (EG-182) by describing advanced processes for special machining and surface modification and by examining available joining techniques for assembly of components. The advantages and limitations of specific processes are outlined and procedure for optimum design and manufacture provided.
Module Aims: to provide awareness and understanding of advanced manufacturing methods used for engineering materials and components.

Module Content:
Module content:

Topic 1 – Non-traditional machining
• Fabrication – machining of flat stock
o Laser
o Plasma
o Waterjet
• Micro machining
o Applications
o Advanced Manufacture by Printing
 Flexography
o Screen printing
o Ink jet
o Aerosol jet deposition
o Vacuum Metallising
o Laser micromachining
Topic 2 – Additive manufacture
• Measurement of surface profile
o Stylus system
o Infinite focus microscopy
o White light interferometry
• Coating
o Anodising
o Plasma Carburising and Nitriding
o Electroplating
• 3D Printing
o Fused Deposition
o Stereolithography/Resin 3D printing
o Ink jet resin injection
o Laser sintering
Topic 3 – Joining
• Welding
o Fusion welding
o Solid state welding
• Brazing
• Soldering
• Adhesive Bonding
o Joint design
o Adhesive types
• Mechanical Assembly
o Threaded fasteners
o Rivets
o Assembly methods based on interference fits
o Other mechanical fastening methods
o Moulding inserts and integral fasteners
o Design for assembly

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should be able to:
- Understand the principles, advantages and limitations of the main non-traditional machining processes.
- Discuss coating technology, joining techniques and their advantages and limitations.
- Select appropriate machining, coating and joining techniques.
- Relate the effects of large scale processes on the microscopic structure of materials.
- Compare information from several sources to select optimum processing.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2)

Assessment:	Assignment 1 (10%)
	Examination (60%)
	Assignment 2 (10%)
	Assignment 3 (5%)
	Coursework 1 (5%)
	Coursework 2 (5%)
	Coursework 3 (5%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Assessment:
Examination – 60%
Assignments – 40%
- Based on a Summary of the lectures/examples for each of the 3 topics
Topic 1 5% (Coursework 1)
Topic 2 5% (Coursework 2)
Topic 3 5% (Coursework 3)
-Literature review of journal papers correctly referenced with a Bibliography
Topic 1 10% (Assignment 1)
Topic 2 10% (Assignment 2)
Topic 3 5% (Assignment 3)

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

Assessment Feedback: Through Faculty of Science and Engineering feedback procedure

Failure Redemption: Supplementary Examination 100% in August

Reading List: Cary, Howard B., Helzer, Scott C., Modern welding technology / Howard B. Cary, Scott C. Helzer., Pearson/Prentice Hall,, c2005..ISBN: 978013130296
Easterling, K. E., Introduction to the physical metallurgy of welding., Butterworths,, 1983.ISBN: 0408013524
Halmshaw, R., Non-destructive testing / R. Halmshaw., Edward Arnold,, 1991.ISBN: 0340545216

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

EGA214 Mechanical Engineering Design 2

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-163; EG-165

Co-requisite Modules: EG-264

Lecturer(s): Dr W Harrison, Dr PJ Dorrington, Dr B Morgan, Dr JS Thompson

Format: Lectures 7 x 1 hour lectures plus 2 x Q&A Lectures;
Creativity sessions (idea generation and Virtual Reality) 6 hours;
PCLabs/ design support 7 x 2 hours; two lecturers, two sets of 8x 1hour office hours.
Directed private study 50 hours.
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, workshops, virtual reality and office hours.

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

Lectures to put the design projects into context, but 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.

Module Aims: Within this module students will be expected to complete a series of exercises that will the form the basis of a 'major' design. The scope of the module will involve the students to work in groups where they will consider, as a team, conceptual designs, embodiment using innovative approaches to design processes and standards etc., leading to final design documentations and manufacturing techniques.

Module Content: This module involves working through the stages of an open-ended major design project. Working in groups, students will apply their engineering knowledge to develop concept designs and refine these designs based on materials, manufacturing and environmental considerations.

Intended Learning Outcomes: Technical Outcomes
At the end of this module, you should have:
- A 'greater' knowledge and understanding of multi-disciplinary aspects of the design process leading to a total design solution.
- An ability to apply theoretical subjects to a real engineering problems.

Accreditation Outcomes (AHEP)
- Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (D1)
- 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)
- Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal (D4)
- Plan and manage the design process, including cost drivers, and evaluate outcomes (D5)
- Communicate their work to technical and non-technical audiences (D6)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques (EL6)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)
- Understanding of, and the ability to work in, different roles within an engineering team (P11)

Assessment:	Peer Assessment (5%)
	Group Work - Presentation (20%)
	Report - Group (70%)
	Peer Assessment (5%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Assignment 1 – Peer review 1 (5%) Assignment 2 - Group Presentation of early concept designs - 20% (5% of this is individual mark) Assignment 3 - Final Group Report + Individual Report - 70 % (15% group + 55% individual) Assignment 4 – Peer review 2 (5%) Resit Component: Design report (100%)
Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit
Assessment Feedback: Lectures will provide feedback on presentations during lecture and laboratory sessions. Tutorial sessions may also be used for general feedback and guidance.
Failure Redemption: A failure would be redeemed by doing a design exercise and submitting a formal report during the normal August Supplementary period. This would form 100% of the mark.
Reading List: Childs, Peter R. N., author., Mechanical Design Engineering Handbook, Butterworth-Heinemann, 2019.ISBN: 0081023685 Ashby, M. F, Materials selection in mechanical design / Michael F. Ashby., Butterworth-Heinemann, 2011.ISBN: 9781856176637 Thompson, Rob (Designer) author., Manufacturing processes for design professionals, Thames & Hudson, 2007.ISBN: 9780500775011 Simmons, C. H. (Colin H.), Phelps, Neil.; Maguire, D. E. (Dennis E.), Manual of engineering drawing technical product specification and documentation to British and international standards, Elsevier/Butterworth-Heinemann, 2012.ISBN: 1283734915
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 This module has a mixture of group work and individual assessment. The work you submit must be your own work. **This means that you cannot use existing product examples and call them your own 'concepts' or 'ideas'. It is acceptable to reference existing market products stating if/how they may have influenced your design thinking, BUT they must be fully referenced and separate from your own designs**. If you copy any CAD files or designs then you will be referred for academic misconduct. The usual University regulations regarding academic misconduct apply. For further information regarding Academic Misconduct please follow the link below: https://myuni.swansea.ac.uk/academic-life/academic-regulations/assessment-and-progress/academic-misconduct-procedure/

EGA265 Fluid Mechanics 2

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-160

Co-requisite Modules:

Lecturer(s): Dr EH Jewell

Format:
-- Live or online lectures (also recorded): 30 hours
-- On-demand pre-recorded material: 10 hours
-- Directed private study 40 hours (includes the study of on-demand material)
-- Preparation for assessment 30 hours

Delivery Method: Delivery of approximately 30 hours of live lectures will either be physically on-campus (Covid-19 situation permitting) or online via Zoom. These lectures will be recorded. A blended learning approach will be taken for example problems, where pre-recorded fully worked examples will be made available on Canvas Digital Learning Platform.

Module Aims: This module aims to build on the concepts taught on stationary and flowing fluids in EG-160 (Fluid Mechanics 1) and extend the knowledge to solve the problems and explain physical phenomena that involve internal and external flows. The module will cover:
(i) dimensional analysis and modelling;
(ii) flow through piping networks and pump selection, flow rate and velocity measurement;
(iii) prediction of lift and drag for flows over common geometries,
(iv) fluid kinematics and preliminary differential analysis of fluid flow.

Module Content: • Internal Flow: Laminar and turbulent flow in pipes, Minor loses, Piping networks and pump selection, Flow rate and velocity measurement.
• External Flow: Friction and pressure drag, Lift, Drag coefficients of common geometries, Flow over flat plates, cylinders and spheres.
• Dimensional Analysis and Modelling: Bukingham Pi Theorem, Correlation of experimental data, Incomplete similarity, wind tunnel testing, flow with free surfaces.
• Fluid Kinematics and differential analysis of fluid flow: Lagrangian and Eulerian descriptions of fluid flow, vorticity, Reynolds Transport Theorem, and the continuity equation.

Intended Learning Outcomes: Technical Outcomes
Upon completion of the module the student should be able to:
- Maintain and extend a sound theoretical approach to the application of fluid mechanics in engineering practice.
- Contribute to the design and development of engineering solutions for products and processes involving fluids and fluid mechanics. Evaluate possible engineering solutions taking into account fitness for purpose. Collect and analyse results.

Upon completion of the module the student should be able to demonstrate a knowledge and understanding of:
- Dimensional analysis, experimental testing and correlation with experimental data and incomplete similarity.
- Series and parallel piping systems with pumps and turbines.
- Flow rates and velocity measurement techniques.
- Drag and lift coefficients, flow over flat plates, cylinders and spheres.
- Lagrangian and Eulerian descriptions of flow and the Reynolds Transport theorem, vorticity, and continuity equation.

Accreditation Outcomes (AHEP)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (P1)

Assessment: Examination 1 (90%)
Online Multiple Choice Questions (10%)

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

Assessment Description: Online Multiple Choice Questions: 30-45 minutes online test with multiple choice questions held via Canvas (10%).

In-person examination - 2 hours and 30 minutes (90%).

Confirmation of the resit method: it would only be done if the aggregate module mark is less than 40%.

Resits (supplementary examinations) in August will have 100% weighting, i.e. a single separate resit assessment will determine the entire module mark.

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

Assessment Feedback: - Problem sets will be released regularly for students to attempt and full solutions will be released after two weeks.
- Feedback solutions on example sheets will be made available on the Canvas.
- Overview of generic issues and common errors from written examinations will be discussed in lectures.
- Feedback solutions of past two year's exam papers will be made available on Canvas.
- Feedback solutions of online test will be made available on Canvas and discussed in the lectures. The test's solutions, common errors, and full length solutions will be discussed within the classroom.

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

Reading List: Cengel, Yunus A., author., Cimbala, John M., author., Fluid mechanics : fundamentals and applications, McGraw-Hill Education, 2018 - 2018.ISBN: 9781259921902
Cengel, Yunus, Fluid mechanics: fundamentals and applications (Third edition in SI units).ISBN: 9780077173593
Çengel, Yunus A; Cimbala, John M, Fluid mechanics : fundamentals and applications / Yunus A. Çengel, Department of Mechanical Engineering, University of Nevada, Reno, John M. Cimbala, Department of Mechanical and Nuclear Engineering, the Pennsylvania State University., 2014.ISBN: 9780073380322

Additional Notes: Delivery of approximately 30 hours of live lectures will either be physically on-campus or online via Zoom. These lectures will be recorded. A blended learning approach will be taken for examples, where pre-recorded fully worked examples will be made available on Canvas Digital Learning Platform.

Available to visiting and exchange students.

EGA266 Digital Manufacturing

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Mr AJ Morgan

Format: Lectures: 8x 1 hour/week; Labs: 3-5 sets of 4 hours/week; Directed private study: 3 hours/week. Contact Hours will be delivered on-campus, and may include, for example, lectures, practical sessions, PCLabs. Office hours will be a blend of online and offline.

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

Lectures to put digital manufacturing into context and introduce theory, with most of the work being undertaken in the digital manufacturing lab sessions. This will be supported by independent working in the lab; private study to learn about the fabrication process of 3DPrinters, along with problem-solving in a group.

Additional sessions may be added to the timetable at the lecturer's discretion to allow students to print their test parts, and their final designs. These must be made use of as organising lab space last minute is difficult.

Module Aims: Within this module students will learn about digital manufacturing, from its role in concept development through to prototype production and small batch manufacture. They will be introduced to the way in which manufacturing is changing and the future possibilities presented by emerging digital manufacturing technologies. They will work individually to fabricate a digital manufacturing machine (3DPrinter), which they will calibrate and produce test parts on, as well as their own design of a 3DPrinted engineering design.

Module Content:
This module will cover the following content (in varying levels of depth):

- Basic Principles and applications of digital manufacturing;
- Basic working principles of a filament 3D printer;
- Designing/Computer modelling, manufacturing and assembling for filament 3DPrinting.
- Project: build, make, calibrate and test a 3D printer.

Intended Learning Outcomes:
Technical Outcomes
By the end of this module students will:
- Be expected to have developed their process knowledge of digital manufacturing – in particular 3D Printing – through experimentation with a 3D printer they assemble. They must select suitable processing parameters to experiment with on their machine, analyse the findings and implement changes to improve the quality of printed parts resulting from the findings of their experiments.
- Be able to apply relevant practical and laboratory skills through the assembly and testing of a 3D Printer, determining how the different parts relate to one another to form a working digital manufacturing machine.
- Have made use of and understood the different types of technical literature and other information sources which engineers utilise when building digital manufacturing equipment. Students will need to discover relevant knowledge from these sources to understand and overcome any technical uncertainty (problems) which may arise during assembly of the 3D printer.
- Have applied advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal of their 3D printers. They will achieve these learning outcomes through practical lab-based activities to construct a working 3D printer. This will be supported by individual logbooks, which will outline key decision points throughout the manufacturing process, and demonstrate how individuals have contributed to elements of the group project.

Accreditation Outcomes (AHEP)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2)
- Ability to apply relevant practical and laboratory skills (P3)
- Understanding of the use of technical literature (P4)
- Ability to work with technical uncertainty (P8)
- Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal (D4)
- Exercise initiative and personal responsibility (G4)

Assessment:	Assignment 1 (5%) Assignment 2 (15%) Assignment 3 (5%) Assignment 4 (60%) Assignment 5 (15%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Assignment 1 - Completion of Risk Assessment, 5%
Assignment 2 – Scrutineering video/or lab assessment 15%
Assignment 3 – Printed test print, 5%
Assignment 4 – 3DPrinting report, 60%
Assignment 3 – Printed prototype for review/testing, 15%
Note:-
- specific requirements of each assignment will be outlined during the module
- these are all individual assignments.

Moderation approach to main assessment: Partial moderation

Assessment Feedback: Lectures will provide feedback on observed progress, hints and tips on building the machines as the module progresses.
Lecturers, Teaching Assistants and technicians will provide additional feedback during online PCLab sessions, and during office hours.
Office hours may also be used for general feedback and guidance.
Feedback and suggestions for improvement will be provided in a written or audio format on assessments which are submitted via Canvas (e.g. report).

Failure Redemption: A failure would be redeemed by doing a design exercise for the development of a new, innovative element of a 3D printer OR a product that is designed specifically for the 3DP process and submitting a formal report during the normal August supplementary period. This would form 100% of the mark. This would be capped at 40%.

Reading List: Hausman, Kirk Kalani; Horne, Richard, 3d printing for dummies / by Kalani Kirk Hausman and Richard Horne., 2014.ISBN: 9781118660775
Gibson, I. (Ian) author., Rosen, D. W. (David W.), author.; Stucker, B. (Brent), author.; Khorasani, Mahyar, author., Additive manufacturing technologies., Springer, 2021.ISBN: 9783030561277
Gibson, Ian; Rosen, David; Stucker, B. (Brent), Additive manufacturing technologies : 3D printing, rapid prototyping, and direct digital manufacturing / edited by Ian Gibson, David Rosen and Brent Stucker., Springer Verlag, 2016.ISBN: 9781493944552
Gibb, Alicia, Building open source hardware : DIY manufacturing for hackers and makers / Alicia Gibb with [fourteen others]., 2015.ISBN: 9780321906045
Pearce, Joshua, author., Open-source lab : how to build your own hardware and reduce research costs, Elsevier, 2014.ISBN: 9780124104624
Martin Leary author., Design for additive manufacturing / Martin Leary., Amsterdam : Elsevier, 2020.ISBN: 9780128168875
Olaf Diegel author., Axel Nordin author.; Damien Motte author., A practical guide to design for additive manufacturing / Olaf Diegel, Axel Nordin, Damien Motte., Gateway East, Singapore : Springer, 2020.ISBN: 9789811382819
Hod. Lipson, Melba Kurman, Fabricated the new world of 3D printing / Hod Lipson, Melba Kurman., John Wiley and Sons, 2013.ISBN: 1299189776
Joe Micallef author., Beginning design for 3D printing / Joe Micallef., New York : Apress, 2015.ISBN: 9781484209462
David M. Dietrich author., Michael A. Kenworthy author; Elizabeth A. Cudney author, Additive manufacturing change management : best practices / David M. Dietrich, Michael Kenworthy, Elizabeth A. Cudney., Boca Raton, FL : CRC Press, 2019.ISBN: 9780429878046
Subramanian Senthilkannan Muthu editor.; Monica Mahesh Savalani editor., Handbook of sustainability in additive manufacturing. Volume 1 / Subramanian Senthilkannan Muthu, Monica Mahesh Savalani, editors., Singapore : Springer, 2016.ISBN: 9789811005497

Additional Notes: This module will be be delivered onsite.
You will build a 3DPrinter onsite during this module; once you have built the printer assigned to you, there will be the option of collecting it and operating it in a safe environment at your residence. However, you must complete a full Risk Assessment prior to doing this, and you must use the machine in a well-ventilated area, only use PLA, and not leave the machine unattended for longer than 30minute periods, and do not run the machine overnight. This is to ensure you get the valuable 'hands-on' design, build and testing of an actual printer.

PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION OF ALL COURSEWORK.
It is strongly recommended that individuals give themselves a slightly earlier deadline than the FINAL submission deadline, e.g. a day before, or at least a few hours. This will provide you with time if you have any formatting errors or upload issues on Canvas/Turnitin/other submission portals.

Canvas contains course information, background content and core module material. Announcements relating to the module will also appear here, you are expected to read announcements regularly.

This module provides individuals with practical experience of building and using a 3DPrinter onsite with the optional use of using it at home to develop their learning without the constraints of lab opening times. The student is responsible for carrying out their own risk assessment prior to building and running the machine in their own home. They must only operate the machine as it is intended to be used, and always follow health and safety procedures as would be
expected within a university laboratory (these will be on Canvas as a reference, and it is assumed you have read these before commencing any machine building).