Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 2 (FHEQ LEVEL 5)

AEROSPACE 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	
Interim Pro-Vice Chancellor/Interim Executive Dean	Professor Johann Sienz
Head of 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 Aerospace Engineering	Professor Ben Evans
Aerospace Engineering Programme Director	Dr Alexander Shaw A.D.Shaw@swansea.ac.uk
Year 2 Coordinator	Dr Nick Croft T.N.Croft@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
Aerospace Engineering
BEng Aerospace Engineering[H400,H405]
BEng Aerospace Engineering with a Year Abroad[H401]
MEng Aerospace Engineering[H403]
MEng Aerospace Engineering with a Year Abroad[H406]

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-261 **Thermodynamics 2** **10 Credits** **Dr RS Ransing** **CORE**	**EG-260** **Dynamics 1 (Mech & Aero)** **10 Credits** **Prof H Haddad Khodaparast** **CORE**
EG-293 **Aerodynamics** **10 Credits** **Dr A Celik** **CORE**	**EG-263** **Engineering Design 2** **10 Credits** **Dr Y Xia/Mr JK Mcfadzean** **CORE**
EGA220 **Aerospace Systems** **10 Credits** **Dr MS Bonney** **CORE**	**EG-294** **Airframe Structures** **10 Credits** **Prof JC Arnold** **CORE**
EGA227 **Structural Mechanics for Aerospace Engineers** **10 Credits** **Dr AD Shaw** **CORE**	**EG-296** **Flight Mechanics** **10 Credits** **Prof WG Dettmer** **CORE**
EGA228 **Aerospace Control** **10 Credits** **Dr S Jiffri** **CORE**	
EG-277 **Research Project Preparation** **0 Credits** **Dr AC Tappenden/Dr M Fazeli/Mrs KM Thomas**	
EGA229 **Experimental Studies - Aerospace** **10 Credits** **Mr W Jarrett/Prof JC Arnold/Dr MS Bonney/Dr A Coccarelli/Dr Z Jelic** **CORE**	
EGA230 **Computer Aided Engineering (Aerospace)** **10 Credits** **Dr MJ Clee/Dr X Zou** **CORE**	
Total 120 Credits	

Optional Modules
Choose exactly 10 credits
Space Stream

EGA215	Rocket and Space Technology	Dr I Sazonov	TB2	10 (CORE)

Or
Choose exactly 10 credits
Structural/Computational Stream

EGA206	Aerospace Structural Mechanics and Materials	Prof DJ Penney/Dr AS Ademiloye	TB2	10 (CORE)

Or
Choose exactly 10 credits
Material/Propulsion Stream

EG-213	Mechanical Properties of Materials	Dr HL Cockings/Prof MT Whittaker	TB2	10 (CORE)

Year 2 (FHEQ Level 5) 2023/24
Aerospace Engineering
BEng Aerospace Engineering with a Year in Industry[H402]
MEng Aerospace Engineering with a Year in Industry[H404]

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-261 **Thermodynamics 2** **10 Credits** **Dr RS Ransing** **CORE**	**EG-260** **Dynamics 1 (Mech & Aero)** **10 Credits** **Prof H Haddad Khodaparast** **CORE**
EG-293 **Aerodynamics** **10 Credits** **Dr A Celik** **CORE**	**EG-263** **Engineering Design 2** **10 Credits** **Dr Y Xia/Mr JK Mcfadzean** **CORE**
EGA220 **Aerospace Systems** **10 Credits** **Dr MS Bonney** **CORE**	**EG-294** **Airframe Structures** **10 Credits** **Prof JC Arnold** **CORE**
EGA227 **Structural Mechanics for Aerospace Engineers** **10 Credits** **Dr AD Shaw** **CORE**	**EG-296** **Flight Mechanics** **10 Credits** **Prof WG Dettmer** **CORE**
EGA228 **Aerospace Control** **10 Credits** **Dr S Jiffri** **CORE**	
EG-233 **Placement Preparation: Engineering Industrial Year** **0 Credits** **Prof GTM Bunting/Dr SA Rolland/Dr V Samaras**	
EG-277 **Research Project Preparation** **0 Credits** **Dr AC Tappenden/Dr M Fazeli/Mrs KM Thomas**	
EGA229 **Experimental Studies - Aerospace** **10 Credits** **Mr W Jarrett/Prof JC Arnold/Dr MS Bonney/Dr A Coccarelli/Dr Z Jelic** **CORE**	
EGA230 **Computer Aided Engineering (Aerospace)** **10 Credits** **Dr MJ Clee/Dr X Zou** **CORE**	
Total 120 Credits	

Optional Modules
Choose exactly 10 credits
Space Stream

EGA215	Rocket and Space Technology	Dr I Sazonov	TB2	10 (CORE)

Or
Choose exactly 10 credits
Structural/Computational Stream

EGA206	Aerospace Structural Mechanics and Materials	Prof DJ Penney/Dr AS Ademiloye	TB2	10 (CORE)

Or

Choose exactly 10 credits

Material/Propulsion Stream

EG-213	Mechanical Properties of Materials	Dr HL Cockings/Prof MT Whittaker	TB2	10 (CORE)

EG-213 Mechanical Properties of Materials

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr HL Cockings, Prof MT Whittaker

Format: Lectures - 30 hours. Office hours - 10 hours. Directed private study - 30 hours. Preparation for assessment - 30 hours. Contact hours will be delivered through on-campus activities such as lectures and example classes.

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.

Lecture based at University campus.

Module Aims: The course provides a basic understanding of the relationship between the microstructure and the mechanical properties of metals. It will build on certain aspects of mechanical performance introduced in EG-180 (Introduction to Materials Engineering) and provide a reference point for supplementary modules in later years of the study.

Module Aims: to introduce the underlying principles of the mechanical properties of engineering materials.

Module Content: Module content: [lecture hours]

• Deformation processes in crystals: Fundamentals of elastic and plastic deformation and the stress-strain curve, the theoretical shear stress and critical resolved shear stress. [2]
• The concept of dislocations: Description of edge, screw and mixed dislocations and atomic models to represent dislocations in crystal structures, representation of dislocation movement, the Burgers vector and Burgers circuit models. [5]
• Behaviour of dislocations: dislocation loops, dislocation sources, repulsion and annihilation, multiplication, forces and stress fields around dislocations, cross slip and climb. [3]
• The role of dislocations and pile-ups in work hardening and the corresponding stress-strain characteristics of materials. [2]
• Deformation of crystalline solids and the role of cold and hot work in metals and alloys, annealing - recovery, recrystallisation and grain growth. [2]
• Precipitation and particle strengthening in metals. [1]
• Elementary description of fracture in a range of ductile and brittle materials. Ductile voids, brittle cleavage and the transition of fracture behaviour with temperature, concept of toughness. [2]
• Basic fatigue crack initiation mechanisms, fracture surface features under fatigue loading, Stage I and II cracks. [3]
• Introduction to creep and creep fracture. Distinctions between low and high temperature creep. [2]
• Temperature capabilities of materials - case study of an aero gas turbine. [2]

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to:
- Describe the relationship between microstructure and the resulting mechanical response measured on the macroscopic scale. Relate atomic / microstructural details to macroscopic behaviour.
- Describe the elastic and plastic deformation mechanisms in crystalline materials.
- Discuss alloy strengthening mechanisms and basic fracture mechanisms.
- Appreciate the important parameters describing mechanical behaviour and compare and contrast the performance of a range of engineering alloys.
- Undertake basic manipulation of stresses to determine stress fields.
- Relate fracture surface details to failure behaviour.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- 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%)
	Assignment 1 (10%)
	Assignment 2 (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: 2 hour written examination at end of semester (80%)
Assignment 1 - continuous assessment (10%)
Assignment 2 - continuous assessment (10%)

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

Assessment Feedback:
* Written feedback on coursework.
* General module feedback for examination.
* Verbal feedback in example classes.

Failure Redemption: Supplementary examination

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
Additional notes: detailed PowerPoint slides provided.

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-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.

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.

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-263 Engineering Design 2

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-163; EG-165; EG-264

Lecturer(s): Dr Y Xia, Mr JK Mcfadzean

Format: Lectures 10 hours
Laboratory work 30 hours
Directed private study 60 hours

Delivery Method: Lectures to put the design projects into context, but the majority of work will take place in computer design lab sessions and independent working, individually and as a group.
Assessment: Continuous Assessment 100%.

Module Aims: Within this module students will be expected to work in groups to achieving a solution to a specific design problem involving a multi-disciplinary approach. Projects will involve conceptual, preliminary and detailed design and analysis of wing, horizontal and vertical stabilizer for a light-single engine aircraft, based on their review (or reverse engineering) of an existing aircraft structure they chose. Projects will run as part of industry-based design projects. Students will be required to produce highly technical design concepts. Each student will be required to take responsibility for particular and defined aspects of the design during the term which will form an important part of the assessment process. The work is presented with an overview of the team project, but with especial detail paid to the individual student contributions.

Module Content:
Module content:
• Application of core engineering subjects (fluids-aerodynamics, thermo, stress and dynamics) to a practical design project related to their discipline.
• Computer aided design.
• Advanced design practice.

Intended Learning Outcomes:
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.
Experience of project planning and teamwork, deadlines and organisation of meetings.

Intended Learning Outcomes - on successful completion of this unit students will be expected, at threshold level, to be able to:

• Demonstrate a knowledge and understanding of the multidisciplinary nature of design. Understand and evaluate the implications of many design decisions. Understand, analyse, evaluate the main stages of embodiment, concept and detail design, and be able to contribute to each of these.

• Comprehend, analyse and evaluate the links between design and manufacture of a product prototype model.

• Apply analysis and evaluate tools in the design and manufacture of a product. This will include engineering sciences as well as manufacturing and commercial considerations.

• KU2 Have an appreciation of the wider multidisciplinary engineering context and its underlying principles, particularly when applied to design.
• KU3 Appreciate the social, environmental, ethical, economic and commercial considerations affecting the exercise of their engineering judgement.
• D1 Investigate and define a problem and identify constraints including environmental and sustainability limitations, health & safety and risk assessment issues.
• D4 Use creativity to establish innovative solutions.
• D5 Ensure fitness for purpose for all aspects of the problem including production, operation, maintenance & disposal.
• D6 Manage the design process and evaluate outcomes.
• P1 Knowledge of characteristics of particular equipment, processes or products.
• P2 Workshop and laboratory skills.
• P6 Understanding of appropriate codes of practice and industry standards.
• P8 Ability to work with technical uncertainty.
• PS1 Possess practical engineering skills acquired through, work carried out in laboratories and workshops; in individual and group project work; in design work; and in the use of computer software in design, analysis and control.
• S2 Knowledge of management techniques that may be used to achieve engineering objectives within that context.
• S3 Understanding of the requirement for engineering activities to promote sustainable development.
• S4 Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues.
• S5 Understanding of the need for a high level of professional and ethical conduct in engineering

Assessment:	Coursework 1 (40%)
	Coursework 2 (20%)
	Coursework 3 (10%)
	Coursework 4 (30%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Assessment:
Coursework 1: Concept and Preliminary Design Report (40%)- Group Work
Coursework 2: Detailed Design_Group/Subgroup Drawings (20%)- Group Work
Coursework 3: Detailed Design_Individual Technical Drawing (10%)- Individual Work
Coursework 4: Final Individual Report (30%)- Individual Work

Resit Assessment: Coursework reassessment instrument--Individual 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.
Feedback and breakdown markings will be provided on the students' online submissions within three weeks.

Failure Redemption:
Failure would be redeemed by doing a design exercise and submitting a formal report during the normal resit period in summer.

Additional Notes: Delivery of both teaching and assessment will be blended, primarily as face to face lectures and computer labs on campus.

PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

Available to visiting and exchange students.

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-293 Aerodynamics

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-113; EG-115; EG-160

Co-requisite Modules:

Lecturer(s): Dr A Celik

Format: Lectures and examples : 33 hours (3 hours x 11 weeks)
Directed private study : 33 hours (3 hours x 11 weeks)
Office-Hours :16.5 hours (1.5 hour x 11 weeks)

Delivery Method: The lectures will be held in person.
The 3 hours of time allocated each week will be used for lectures (2 hours) and examples (1 hour).
The Canvas site will contain reading materials, screencasts from lectures, self-assessment sheets, past exam papers and answers.

Module Aims: This module aims to extend the previous Fluid Mechanics 1 module from Level 1 and develops the students' understanding of the fundamental equations governing aerodynamics and their application to aeronautical systems. The systems will apply the theory to problem-solving in the field of aerodynamics.

Module Content:
Module content:

• Introduction: derivation of the equations of fluid motion; dimensional analysis and similarity; simplified equations.
• Introduction to boundary layers, shear stresses, drag coefficient and flow separation.
• Basic 2D incompressible inviscid flow: vorticity, circulation and the production of lift.
• Kutta-Joukowski law; use of potential methods for flow over aerofoils.
• Basic 3D incompressible inviscid flow: vortex filaments; lift and downwash on finite wings; lifting line theory.

Intended Learning Outcomes: Technical Outcomes
After completing this module, the students should be able to:
• Demonstrate a knowledge and understanding of: fluid flows related to forces on fixed wing aircraft and the tools available for basic theoretical and computational modelling.
• Explain how various fluid flow regimes are influencing forces on fixed aircraft wings, (evaluated in exam, SM1).
• Identify dimensionless parameters relevant for a given flow and use dimensional analysis for appropriate scaling the flow problem, (evaluated in exam, SM2).
• Use theoretical and computational tools for quantitative analysis of aerofoils, (evaluated in assignment & exam, SM5, EA1).
• Demonstrate knowledge and understanding of appropriate procedures to estimate aerodynamic performance for preliminary design calculations, (evaluated in exam, EA2).

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
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%)
Group Work - Project (15%)
Online Class Test (15%)

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

Assessment Description: The coursework will be set around weeks 6-8, with 2-3 weeks to finish it. The coursework will require the students to solve an aerodynamics problem using a computer. This is a group project.

The examination will consist of 3 or 4 compulsory questions.

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

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

Assessment Feedback:
Students receive feedback from the coursework in the form of a marking sheet evaluating different criteria regarding their report.

Feedback from the final examination is via the University feedback form.

Feedback for the online quiz will be provided the same day through Canvas.

Failure Redemption: Any resits are done by a supplementary exam worth 100% of the final mark.

Additional Notes: All the activities will be in-person. Self-assessments (not to be assessed) will be provided through Canvas.

Available to visiting and exchange students.

The syllabus, Canvas site and examination for both these groups will be identical.

This module is assessed by a combination of examination (70%), Group Coursework (15%), and 5 Online Quizzes (15% - 3% each).

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

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

EG-294 Airframe Structures

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-120; EG-166; EG-227

Co-requisite Modules: EG-229

Lecturer(s): Prof JC Arnold

Format: Lectures and examples classes: 20 hours.
Example classes: 10 hours Directed private study and revision: 70 hours Contact Hours will be delivered mainly through on-campus lectures and examples classes, supported by extensive on-line learning resources.

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 based on lectures and example classes supported by additional on-line content. The priority will be for on-site delivery of lecture and examples classes, supported by on-line material.

Module Aims:
This module covers the fundamentals of linear elasticity and the stress analysis of the thin-walled structural components which are commonly employed in the design of modern wings and fuselages.

In particular, the bending, shearing and twisting of thin-walled beams with open, closed or multi-cell cross-sections is studied in detail.

The stiffening effect of stringers is investigated and end constraints are discussed.

Numerous examples demonstrate the application of the theory.

The module teaches the analytical skills, but also develops the students' feeling for thin-walled structures.

Module Content:
Fundamentals of Linear Elasticity:
• Stress and strain, Hooke's law, assumptions.

Bending of Beams:
• Second moments of area
• Axial stress and deflections for in-plane and skew bending.
• Shear stress in thin-walled open, closed and multi-cell sections.
• Shear centre of thin-walled open, closed and multi-cell sections.

Torsion and twist:
• Shear stress and twist of thin-walled open, closed and multi-cell sections, end constraints.

Structural idealization

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 the behaviour of thin-walled airframe structures (EA1), including the ability to calculate (evaluated in final assessment):
 o Shear forces and bending moments for symmetric and skew bending
 o Sectional properties, shear centre, torsion and twist of open, closed and multi-cell thin-walled sections.
 o Stresses and deflections of thin-walled beams
 o Direct stresses in stringers
• Identify, classify and describe the performance of various thin-walled airframe structures through the use of analytical methods (EA2) (evaluated in final assessment).

Accreditation Outcomes (AHEP)
- A comprehensive knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- 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 (75%) Assignment 1 (10%) Assignment 2 (15%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Assignments (25%):
Assignments 1 and 2 comprise on-line assignments worth 10% and 15% covering the fundamentals of the course and some open-ended examples.

Examination (75%):
This is an open book examination and this year will be undertaken as an on-line assessment via Canvas. Adhering to the University Examination Guidelines, students are permitted to use any written or printed notes and books during the examination. The examination forms 75% of the module mark.

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

Assessment Feedback: Marks and some explanatory comments will be available to each student on Canvas once marks have been released to all students.

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

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

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

Lecture notes, example questions, worked solutions and past question papers will be available on Canvas.

EG-296 Flight Mechanics

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-113; EG-115; EG-166

Co-requisite Modules: EG-260; EG-293

Lecturer(s): Prof WG Dettmer

Format: Lectures and example classes: 30 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: There will be no preparatory work and study before each lecture as written in the module handbook

Module Aims:
This module provides a thorough introduction to the mechanics of flight. It covers the fundamentals of airplane aerodynamics, performance, stability and control. The basic concepts and principles are derived and their application to specific problems is demonstrated.

Module Content:
Basic Aerodynamics:
• Basics of airfoils and finite wings, induced drag.
• Airplane aerodynamics.

Airplane Performance:

• Airplane propulsion.
• Steady level unaccelerated flight.
• Climbing, gliding and turning flight.
• Take-off and landing.
• Range and endurance.
• V-n diagram.

Static Stability and Control:

• Longitudinal static stability and control.
• Neutral point and static margin, elevator tails.
• Directional and lateral static stability and control.
• Asymmetric engine failure
• Dihedral

Intended Learning Outcomes: Technical Outcomes
Upon successful completion of this module, students will be expected, at threshold level, to be able to:
• Analyse airplane performance based on a set of key parameters (assessed in the assignment and in the exam, SM1, SM2, EA2, EA3),.
• Analyse the static stability and control of an airplane (assessed in the assignment and in the exam, SM1, SM2, EA2, EA3).
• Explain the fundamental principles and concepts of flight mechanics (assessed in the exam, SM1, EA1).

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- 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)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)

Assessment:	Examination 1 (85%)
	Assignment 1 (5%)
	Assignment 2 (5%)
	Assignment 3 (5%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Examination:
The examination forms 85% of the module mark.

Assignments 1 - 3: Small Jet Airplane - Case Study
These are individual on-line assignments. Each assignment is worth 5% of the module mark.

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

Assessment Feedback: Examination: A general pro-forma is completed, covering errors/issues that were identified during the marking process, and produced as formal examination feedback.

Assignments: General feedback on the assignment will be given in a lecture.
Individual feedback will be given in office hours.

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

Additional Notes: All the activities will be in-person. Self-assessments (not to be assessed) can be provided through Canvas.

EGA206 Aerospace Structural Mechanics and Materials

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-120; EG-221; EG-294

Lecturer(s): Prof DJ Penney, Dr AS Ademiloye

Format: Lectures: 20 hours
Example classes: 10 hours
Private study/reading: 40 hours
Preparation for assessment: 30 hours

Delivery Method:
Lectures based at University Bay Campus

Module Aims:
Building on Strength of Materials and Structural Mechanics 2(a), this module introduces the students to the stiffness method for structural analysis, followed by lectures covering stress concentration, fatigue, cracking and creeping of materials and how to design for these in the aerospace and automotive industry.

Module Content:
• Stiffness Method of Structural Analysis 2D - Introduction; Simple spring-rigid bar systems; Stiffness matrix for pin-jointed bar; Force and displacement transformations; Equilibrium and compatibility equations; Application to simple trusses;
• Systematic assembly of global stiffness matrix. Examples.
• 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; case histories.
• 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.
• Elementary description of fracture in a range of ductile and brittle materials. Ductile voids, brittle cleavage and the transition of fracture behaviour with temperature, concept of toughness.
• Basic fatigue crack initiation mechanisms, fracture surface features under fatigue loading, Stage I and II cracks.
• Introduction to creep and creep fracture. Distinctions between low and high temperature creep.
• Temperature capabilities of materials - case study of an aero gas turbine.

Intended Learning Outcomes: Technical Outcomes
By the end of this module, you should have:
- Comprehension of stiffness, stresses and its application in trusses (SM1i) (EA31) Assessed in exam
- A comprehension and understanding of the relationship between microstructural and the resulting mechanical response measured on the macroscopic scale. (SM1i) (P2i) Assessed in exam and course work
- Comprehension of common failure methods (stress, fatigue, creep, corrosion) for typical engineering metals and an ability to recommend mitigation strategies (SM1i) (D4i) (P2i) Assessed in exam and course work

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
- 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)
- Knowledge of characteristics of particular materials, equipment, processes, or products (P2)

Assessment: Examination 1 (80%)
Assignment 1 (10%)
Assignment 2 (10%)

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

Assessment Description:
Examination (80%)
Assignment 1 (10%) based on structural component
Assignment 2 (10%) based on materials component

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

Assessment Feedback:
Written feedback on coursework.
General module feedback on examination.
Verbal feedback in example classes.

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

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 students.

Assessment: Exam (80%) and Continuous Assessment (20%)

EGA215 Rocket and Space Technology

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-113; EG-115; EG-166

Co-requisite Modules: EGA220; EGA321; EGA341

Lecturer(s): Dr I Sazonov

Format: 20 hours lectures plus examples classes
10 hours of Matlab classes
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 will consist of lectures, which focus on theoretical aspects of Rocket Technology; example classes, which concentrate on applying the theory to solve practical examples with the focus on Matlab programming.

Module Aims:
The module introduces the concepts associated with rocket dynamics, trajectories and orbits of space vehicles and space missions.

Module Content:
1 The Transfer Segment - Launcher dynamics

• Rocket engine design and operation
• Rocket dynamics equations
• Sounding rocket
• Gravity turn
• Multistage rocket: restricted limit approximation
• Multistage rocket: optimisation of mass in the general case

2 The Space Segment - Orbital mechanics

• Two-body equations of motion
• Kepler's Laws
• Trajectory and orbits
• Orbital manoeuvring

2 MATLAB programming for rocket dynamics and orbital manoeuvres

Intended Learning Outcomes: Technical Outcomes
Upon successful completion of this module, students will be expected, at threshold level, to be able to:
• Derive and apply the ideal rocket equation in both the restricted and unrestricted limits (evaluated in examination).
• Derive and apply the equations of motion for a two-body orbital system (evaluated in examination).
• Utilise MATLAB to calculate rocket dynamics and orbital manoeuvres (evaluated in coursework)

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)

Assessment:	Assignment 1 (15%) Assignment 2 (15%) Examination (70%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Examination:
A 2-hour in-person exam (70%).

Coursework:
There will be 2 separate pieces of coursework each worth 15% of the module mark. These assignments will focus on numerical descriptions of rocket ballistics, performance and flight.

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

Assessment Feedback:
Students receive feedback from the coursework in the form of a marking sheet evaluating different criteria regarding their report. Feedback from the final examination is via the University feedback form.

Failure Redemption:
Through a 100% supplementary examination in the resit period.

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.

30% from continuous assessment (two assignments: 15% week 6, 15% week 10);
70% from end of semester examination - closed book

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

EGA220 Aerospace Systems

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MS Bonney

Format: 20 hours lectures, 10 hours examples

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 and Example classes.

Module Aims:

The module introduces systems to aerospace engineering students, and covers aspects of systems engineering, systems management, aircraft fluid systems,aircraft electrical and electronics systems, aircraft flight control systems, maintenance and reliability of systems.

Module Content:

- Systems and Systems Engineering, Systems Management (6 hours)

- Aerospace Systems (21 hours)
  + Fluid Mechanics applications in Aerospace Systems
  + Aircraft Hydraulic Systems
  + Aircraft Pneumatic Systems
  + Aircraft Fuel System
  + Aircraft Landing Gear
  + Aircraft Environmental Systems
  + Aircraft Electrical Systems
  + Flight Control, Instrumentation and Navigation Systems

- Reliability and Maintainability of Systems (3 hours)

Intended Learning Outcomes: Intended Learning Outcomes: on successful completion of this module students will be expected, at threshold level, to be able to:

- Explain the concept of systems, the management of them, and their maintenance and reliability. (Assessed in the examination; SM1p,m; SM2p,m; SM3p.m; SM4m;).
- Explain the operating principles of aircraft fluid systems, and calculate basic requirements for their operation.(Assessed in the examination; SM1p,m; SM2p,m; SM3p,m; SM4m; EA1p,m; EA2p,m;)
- Identify power sources for aircraft hydraulic and pneumatic systems and how they operate.(Assessed in the examination; SM1p,m; SM2p,m; SM3p,m; SM4m; EA1p,m; EA2p,m;)
- Explain the operating principles and operating role of aircraft electrical and electronics systems.(Assessed in the examination; SM1p,m; SM2p,m; SM3p,m; SM4m; EA1p,m; EA2p,m;)
- Identify power sources for aircraft electrical and electronic systems and how they operate.(Assessed in the examination; SM1p,m; SM2p,m; SM3p,m; SM4m; EA1p,m; EA2p,m;)
- Analyse and calculate basic requirements for operation of particular aircraft system.(Assessed in the coursework;SM1p,m; SM2p,m; SM3p,m; SM4m; EA1p,m; EA2p,m; D4p,m;)

Note: The codes above relate to AHEP learning outcomes requirements.

Extended Learning Outcomes:

KU2 Have an appreciation of the wider multidisciplinary engineering context and its underlying principles, particularly when applied to design.

KU3 Appreciate the social, environmental, ethical, economic and commercial considerations affecting the exercise of their engineering judgement.

EA4m Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems

D4 Use creativity to establish innovative solutions.

D5 Ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal

P1 Knowledge of characteristics of particular equipment, processes or products

P6 Understanding of appropriate codes of practice and industry standards

P8 Ability to work with technical uncertainty

S2 Knowledge of management techniques which may be used to achieve engineering objectives within that context

S3 Understanding of the requirement for engineering activities to promote sustainable development

S4 Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues.

S5 Understanding of the need for a high level of professional and ethical conduct in engineering

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

Assessment Description:
Assessment: 20% internal assessment (coursework - assignment, individual) and Examination (Open Book) at the end of the Semester (80%). Resits in August will have 100% weighting.

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

Assessment Feedback:
Via written feedback for the internal assessment (coursework-assignment) and overview of generic issues from written examinations. Feedback will be provided through VLE - "CANVAS" platform.

Failure Redemption: An opportunity to redeem failures will be available within the rules of the University. If a resit is given it will be via 100% supplementary examination.
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.   The modules introduces systems to aerospace engineering students, and covers aspects of systems engineering, systems management, aircraft fluid systems,aircraft electrical and electronics systems, aircraft flight control systems, maintenance and reliability of systems.

EGA227 Structural Mechanics for Aerospace Engineers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr AD Shaw

Format: Approximate breakdown:
Blended learning* 30 hours
Directed private study 40 hours
Preparation for assessment 30 hours
*This consists of a mixture of online videos that may be viewed at any time, examples, and timetabled online sessions led by the lecturer.

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

2 hour lecture plus 1 hour example classes/blended learning activity.
Assessment: 20% for open book continuous assessment Canvas tests, 80% from end of teaching block examination.

Module Aims: This module develops the structural concepts studied in EG166 'Engineering Mechanics' and EG120 'Strength of Materials', with an emphasis on aerospace structures. The concepts of residual stress, constitutive laws and compatibility are introduced, as are virtual work and energy theorems, which lead to the highly versatile unit load method. This enables students to obtain internal loads, reactions and deflections for complex and statically indeterminate structures.

Module Content:
• Determinate and Indeterminate Structures - Load carrying actions, Definitions of:- External and internal indeterminacy;
• Calculations for pin-jointed trusses and rigid jointed frames; Symmetry and anti-symmetry. Use of Heaviside function.
• Indeterminate 1d structures – sources of residual stress, concepts of compatibility and constitutive laws. Application to composites.
• Analysis of two dimensional statically determinate structures - Free body diagrams; Equations of equilibrium; Support & joint symbols; Calculation of reactions, bending moment, shear force, axial force and torsion diagrams. Principle of superposition.
• Virtual work and the calculation of displacements - Definition of work, Principle of virtual work; Unit load theorem;
• Calculation of displacements in trusses and rigid jointed frames. Castiaglano's theorems.
• Analysis of loads in indeterminate trusses and frames.

Intended Learning Outcomes: Technical Outcomes
On successful completion of this module, students should be able, at threshold level, to:
• Demonstrate a knowledge and comprehension of: the principles of equilibrium, compatibility and the influence of material behaviour, including residual stresses and strains (Assessed during both assessments, SM1,SM2,EA2)
• Use equilibrium to analyse reactions and internal axial forces, bending moments, and shear forces in more complex frames and structures. (Assessed during both assessments, SM1,SM2,EA2,D6)
• Apply the Unit Load Method for the calculation of displacements and rotations in structures. (Assessed during both assessments, SM1,SM2,EA2,D6)
• Comprehend the difference between statically determinate and indeterminate structures, calculate the degree of indeterminacy, and understand how indeterminacy can lead to residual stresses. (Assessed during assignment*, SM1,SM2,EA2)
• Analyse residual stresses in 1D indeterminate structures with thermal effects and errors of fit, and apply this to simple composite material structures. (Assessed during both assessments, SM1,SM2,EA2,D6)
• Analyse reactions and internal forces and moments in indeterminate structures. (Assessed during examination, SM1, SM2, EA2,D6)
• Understand the energy and virtual work theorems that underpin the unit load method. (Assessed during assignment, SM1,SM2,EA2)

*Note - the 'assignment' is a number of short online tests posted throughout the teaching of the module.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
- Communicate their work to technical and non-technical audiences (D6)

Assessment:	Examination 1 (80%)
	Assignment 1 (10%)
	Assignment 2 (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description:
The final examination is CLOSED BOOK, and it contributes 80% to the final mark of the module.

The continuous assessment consists of a series of short online tests available throughout the semester.

For the supplementary examination (resit), the mark is purely based on the exam. Note, the mark for the resit is capped at 40%.

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

Assessment Feedback:
Throughout the term, students will receive feedback in the form of marked assignments and discussion of tutorial examples.
Standard examination feedback form available for all students after the examination.

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

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

The 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. Students will be assessed in January by a take home examination (80%) and by mid-module online assessments (20%).

Additional notes:
This module particularly builds on the work you have done in the Level 1 Engineering Mechanics module and the Strength of Materials module. You should revise the topics learnt in these modules, particularly in the early part of this current module. This module also assumes that you are familiar with the basic mathematical concepts learnt in the Level 1 mathematics modules.

EGA228 Aerospace Control

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Jiffri

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

Delivery Method: Module is Lecture and Examples class based.

Lectures will consist of a blend of live (synchronous) and pre-recorded (asynchronous) online delivery.

It is possible that the Examples classes will be run on-campus, although this will depend on Covid-19-related restrictions and University policy at the time. (If unable to run on-campus, then example classes will be run online via Canvas).

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, Bode, Nyquist and root-locus analysis, stability conditions and compensation design.
The overall aim is to understand and be able to apply basic techniques for the analysis and design of feedback control systems.

Module Content: • Laplace transforms and dynamic systems;
• 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
On successful completion of this unit students will be expected, at the threshold level, to be able to demonstrate knowledge of, comprehension of and the ability to apply the following topics to relevant problems (all evaluated through the exam):
• 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;
• Time and frequency responses;
• Steady-state accuracy.
Furthermore, successful completion of the coursework will equip students with the ability to construct and analyse simple open- and closed-loop dynamic systems in Simulink.

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

Assessment:	Examination 1 (90%) Coursework 1 (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

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

The examination is worth 90% of the module, and will consist of 4 questions. All questions are compulsory.

The coursework is worth 10% of the module, and is an opportunity for students to gain familiarity with Simulink by performing a few Dynamics and Control related tasks. This is a self-study component, and therefore will not be addressed during lectures; students will, however, be provided with appropriate self-study material including a video tutorial.

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

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.

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

EGA229 Experimental Studies - Aerospace

Credits: 10 Session: 2023/24 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Mr W Jarrett, Prof JC Arnold, Dr MS Bonney, Dr A Coccarelli, Dr Z Jelic

Format: Lectures 6 hours it in total, throughout the module.
Practical classes 16 hours in total.
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

Lectures, practicals and directed independent study.

Module Aims:
The course introduces the students to experimental studies in a wide range of subjects relevant to Aerospace Engineering.

Each experiment is self contained and the student will present the findings in written form through a lab report (or combination of lab reports and class tests) which will have a set of experiment specific questions to answer.

This written reports and class tests also forms the basis for the assessment.

All students work in groups and carry out five in-situ experiments and one external experiment, however the assignments 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 within the fortnight after the experiment.

Module Content:
Revision of lab report writing, and statistical data / error analysis.

Measurement techniques for physical parameters: position, velocity, acceleration, temperature, pressure, strain, flow, force.

Experimental Laboratory classes are:
• Heat Pump Lab
• Flight Dynamics Analysis (Flight Simulator)
• Wind tunnel Measurements
• Vibration Experiment
• Structures experiment (shear center)
• Airplane based flying lab experiment

Intended Learning Outcomes: Intended Learning Outcomes - on successful completion of this module students will be expected, at threshold level, to be able to:

• Apply acquired knowledge and understand a wide range of experimental techniques (assessed in the coursework(s)),
• Understand and follow experimental procedures (assessed in the coursework(s)),
• Consider health and safety issues when working in labs (assessed in the coursework(s)),
• Maintain accurate informal notes (assessed in the coursework(s)),
• Report findings in written form (assessed in the coursework(s)),
Above learning outcomes relate to AHEP requirement codes: SM1p,m; SM2p.m; SM3p.m; SM4m; EA1p,m; EA2p,m; ET6p,m; EP1p,m; EP2p,m; EP3p,m; EP4p,m; EP9p; EP11m;
• Extended Learning Outcomes:

• KU3 Appreciate the social, environmental, ethical, economic and commercial considerations affecting the exercise of their engineering judgement.

• D1 Investigate and define a problem and identify constraints including environmental and sustainability limitations, health & safety and risk assessment issues.

• P1 Knowledge of characteristics of particular equipment, processes or products

• P2 Workshop and laboratory skills

• P6 Understanding of appropriate codes of practice and industry standards

• P8 Ability to work with technical uncertainty

• S1 Possess practical engineering skills acquired through, work carried out in laboratories and workshops; in individual & group project work; in design work; and in the use of computer software in design, analysis and control

• S2 Knowledge of management techniques which may be used to achieve engineering objectives within that context

• S4 Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues.

• S5 Understanding of the need for a high level of professional and ethical conduct in engineering

Assessment:	Coursework 1 (20%)
	Coursework 2 (20%)
	Coursework 3 (20%)
	Coursework 4 (20%)
	Coursework 5 (20%)
	Coursework 6 (0%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Coursework 1: Wind Tunnel Coursework 2: Heat Pump Coursework 3: Flight Dynamics Coursework 4: Vibration Coursework 5: Structures Coursework 6: Flying - In general, experimental reports (or combination of reports and class tests) for each in-situ experiment (C1 to C5) are handed in (or completed) within two weeks after the experiment, each assignment is worth 20% of the total module mark - Experimental report for C6 is handed within two weeks after the external experiment, pass/fail module component - qualification mark. - All assignments that need to be handed in, are submitted electronically via VLE - "CANVAS" using instructions or provided templates. - If you do not meet the requirements of the Pass/Fail component, you will receive a QF outcome. This means that you will be required to repeat the failed component(s), even if your module mark is above 40%.
Moderation approach to main assessment: Moderation by sampling of the cohort
Assessment Feedback: The Lab Reports (and tests) 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. A grade of ZERO or QF (Qualified Failure) will be awarded for failure to attend the experimental lab. All assignments are submitted electronically and the University rules on Plagiarism apply. Additional notes: Final mark is based on: Five Technical Reports for five in-situ experiments, and additional qualification assignments (pass/fail assignments) related to the external experiment.

EGA230 Computer Aided Engineering (Aerospace)

Credits: 10 Session: 2023/24 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MJ Clee, Dr X Zou

Format: Lectures 10 hours
Example classes / Laboratory work 20 hours
Directed private study 70 hours

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

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

Delivery by Lectures and Lab Classes which could be face-face or online via recorded videos, platforms such as zoom. Any online delivery will be supplemented by additional documents in the form of Lecture notes, slideshows and worked examples which will be available to students during the duration of the module.

Assessment: Continual Assessment
50% from FEA assignments
50% from Matlab assignments
BOTH ASSIGNMENTS MUST BE PASSED TO PASS THE MODULE
Penalty for late submission of continual assessment assignments:
For FEA and MATLAB assignments: normally ZERO marks will be awarded.

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 stress analysis of one-dimensional beam structures and two dimensional structures, etc.

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

(Review)

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 stuctures, eg beams and plates subject to different loadings.

Intended Learning Outcomes: Learning Outcomes Assessed by:

MATLAB Assignments (50% Combined):
• A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations.
• Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and implement appropriate action.

Solidworks 50% Assignment:
• Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations.
• Ability to apply relevant practical and laboratory skills.
• Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities.

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

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)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
- Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D7m)
- Knowledge of characteristics of particular 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 (50%)
Coursework 2 (50%)

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

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

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 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:
Students who failed the module will be given equivalent exercises to the components they did not achieve a pass mark for during the first sit. The mark in any passed first sit coursework will carry forward to the resit and the student will not be allowed to improve this mark.

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.

THIS MODULE IS NORMALLY ASSESSED IN SEMESTERS 1 AND 2.

FAILURE TO ATTEND ACTIVITIES THAT ARE A MODULE REQUIREMENT WILL NORMALLY MEAN THAT YOU FAIL THE MODULE

LATE SUBMISSIONS OF ASSESSMENTS WILL BE HANDLED ACCORDING TO UNIVERSITY EXAMINATION PROCEDURES BUT WILL NOT NORMALLY CONTRIBUTE TO THE TOTAL MARK FOR THE MODULE

Penalty for late submission of continual assessment assignments:
for FEA and MATLAB assignments: normally ZERO marks will be awarded.
Office hours will be posted on the notice board outside the rooms of the lecturers.