Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE & ENGINEERING

STUDENT HANDBOOK

MSc (FHEQ LEVEL 7)

MSC COMPUTATIONAL MECHANICS DEGREE PROGRAMME

YEAR 1

SUBJECT SPECIFIC
(PART TWO OF TWO)
MODULE AND COURSE STRUCTURE
2022/23

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 22-23 academic year begins on 26 September 2022

Full term dates can be found here

DATES OF 22-23 TERMS

26 September 2022 – 16 December 2022

30 January 2023 – 31 March 2023

24 April 2023 – 09 June 2023

IMPORTANT

Swansea University and the Faculty of Science of Engineering takes any form of **academic misconduct** very seriously. In order to maintain academic integrity and ensure that the quality of an Award from Swansea University is not diminished, it is important to ensure that all students are judged on their ability. No student should have an unfair advantage over another as a result of academic misconduct - whether this is in the form of **Plagiarism**, **Collusion** or **Commissioning**.

It is important that you are aware of the **guidelines** governing Academic Misconduct within the University/Faculty of Science and Engineering and the possible implications. The Faculty of Science and Engineering will not take intent into consideration and in relation to an allegation of academic misconduct - there can be no defence that the offence was committed unintentionally or accidentally.

Please ensure that you read the University webpages covering the topic – procedural guidance here and further information here. You should also read the Faculty Part One handbook fully, in particular the pages that concern Academic Misconduct/Academic Integrity. You should also refer to the Faculty of Science and Engineering proof-reading policy and this can be found on the Community HUB on Canvas, under Course Documents.

Welcome 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.

This has been a challenging period for everyone. The COVID-19 pandemic has prompted a huge change in society as well as how we deliver our programmes at Swansea University and the way in which you study, research, learn and collaborate. We have been working hard to make sure you will have or continue to having an excellent experience with us.

We have further developed some exciting new approaches that I know you will enjoy, both on campus and online, and we cannot wait to share these with you.

At Swansea University and in the Faculty of Science & 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 staff, administrators, and your fellow students - I'm sure you will find many friendly helping hands ready to assist you.

We all know this period of change will continue and we will need to adapt and innovate to continue to be supportive and successful. At Swansea we are committed to making sure our students are fully involved in and informed about our response to challenges.

In the meantime, learn, create, collaborate, and most of all – enjoy yourself!

Professor Johann (Hans) Sienz
Interim Pro-Vice Chancellor/Interim 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 xperience (SLE)	Professor Paul Holland
School of Aerospace, Civil, Electrical, General and Mechanical Engineering **Head of School: Professor Antonio Gil**	
School Education Lead	Professor Cris Arnold
Head of Civil Engineering	Professor Eduardo de Souza Neto
Civil Engineering Programme Director	Dr Clare Wood – c.wood@swansea.ac.uk
MSc Computational Mechanics Coordinator	Professor Rubén Sevilla - R.Sevilla@Swansea.ac.uk

STUDENT SUPPORT

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

Standard Reception opening hours are Monday-Friday 9am-5pm.

The **Student Support Team** provides dedicated and professional support to all studentsin 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 and 01792 6062522 (Monday-Friday, 10am–12pm, 2–4pm).

Zoom: By appointment. Students can email, and if appropriate we will share a link to our Zoom calendar for students to select a date/time to meet.

The current student **webpages** also contain useful information and links to otherresources:

https://myuni.swansea.ac.uk/fse/coe-student-info/

READING LISTS

Reading lists for each module are available on the course Canvas page and are also accessible via http://ifindreading.swan.ac.uk/. We've removed reading lists from the 22-23 handbooks to ensure that you have access to the most up-to-date versions. Access to print material in the library may be limited due to CV-19; your reading lists will link to on-line material whenever possible. 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/

MSc (FHEQ Level 7) 2022/23
Computational Mechanics
MSc Computational Mechanics

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-M23 **Finite Element Computational Analysis** **10 Credits** **Prof R Sevilla** **CORE**	**EG-M47** **Business Leadership for Engineers** **10 Credits** **Dr A Munnangi/Dr AS Walters** **CORE**
EGEM03 **Continuum Mechanics** **10 Credits** **Prof D Peric** **CORE**	
EGIM02 **Advanced Computational Methods for Engineers** **10 Credits** **Dr F Zhao** **CORE**	
EGIM04 **Advanced Fluid Mechanics** **10 Credits** **Prof K Morgan** **CORE**	
EG-M194 **MSc Industrial Experience Preparation** **0 Credits** **Dr V Samaras** **CORE**	
EG-M102 **Industrial project** **30 Credits** **Prof R Sevilla** **CORE**	
Total 210 Credits	

Optional Modules

Choose exactly 30 credits

EG-M07	Optimisation	Prof C Giannetti/Dr L Evans	TB2	10 (CORE)
EGEM07	Fluid-Structure Interaction	Prof WG Dettmer	TB2	10 (CORE)
EGIM06	Computational Fluid Dynamics	Prof P Nithiarasu	TB2	10 (CORE)
EGIM08	Plasticity in Structural and Geotechnical Engineering	Prof D Peric	TB2	10 (CORE)

And

Choose exactly 10 credits

EGIM10F	Communications skills in a foreign language - French	Prof R Sevilla/Prof AJ Rothwell	TB1	10 (CORE)
EGIM10G	Communications skills in a foreign language - German	Prof R Sevilla/Prof AJ Rothwell	TB1+2	10 (CORE)
EGIM10S	Communications skills in a foreign language - Spanish	Prof R Sevilla/Mrs TA May	TB1	10 (CORE)

EG-M07 Optimisation

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof C Giannetti, Dr L Evans

Format: Timetabled lectures and example classes 30 hours;
Directed private study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

Assessment:
Exam: Extended Coursework 80% (LO1, 2 & 3)
Continuous Assessment: 20% - Assignment 1 (LO1 & 2) and Assignment 2 (LO 2 & 3)

Module Aims: This module provides an introduction to some important techniques of optimisation that may be used across a broad range of engineering disciplines. The focus is on understanding the methods through hand calculation rather than the use of particular software packages. Numerical examples are employed to illustrate concepts and potential applications.

Module Content:
Indicative syllabus content:
1. Statement of optimisation and reliability problems.
2. Lagrange multipliers
3. One-Dimensional Minimisation Methods. Direct and indirect methods: unrestricted search; dichotomous search; golden section method; quadratic interpolation; Newton's procedures.
4. Extrema of functions of several variables.
5. Multidimensional Minimisation Problems - direct methods such as: Taxi-cab; conjugate search procedure
6. Multidimensional Minimisation Problems - indirect methods such as: Steepest descent method; Newton's method.
7. Linear Programming - the Simplex Method

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should:
- Understand and be able to set up and carry out the necessary calculations for univariate unimodal optimisation problems LO1)
- Be able to use search techniques to determine the optima of unconstrained and constrained multivariable systems (LO2)
- Understand and be able to set up and carry out the necessary calculations for Linear Programming problems (LO3)

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 a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems (SM2m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects (SM6m)
- Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods (EA7M)
- Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D10M)

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

Assessment Description: Exam - 80%
Coursework - 2 separate pieces which involve a selection of problems which utilise the optimisation methods taught. 20%

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

Assessment Feedback:
Examination - Standard College of Engineering exam feedback form.

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

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

This module assumes good mathematical skills and students will be expected to demonstrate a good understanding of partial differentiation, Taylor series expansion and matrices.

Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded. The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

Additional notes: Office hours, lecture notes and other teaching materials will be posted on Canvas.

EG-M23 Finite Element Computational Analysis

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules: EG-323

Co-requisite Modules:

Lecturer(s): Prof R Sevilla

Format: Lectures 2h per week
Example Classes 1h per week
Directed private study 3h per week

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

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

The module is delivered by lectures and example classes.

A comprehensive set of notes and a list of exercises will be are available for download via Canvas before the start of the course.

Communication and course announcements, including office hours details, will be made via Canvas.

Course materials, including the course notes and links to relevant webpages, will be available for download from Canvas.

Module Aims: This module introduces the fundamentals of the Finite Element Method to enable the student to use it in the solution of a range of problems of engineering interest. The classes of engineering problems covered in this module include elastic analysis of structures, heat conduction problems, seepage flow through soils and ideal fluid flow. In this context, MATLAB sample programs will be provided to illustrate the structure of a finite element software capable of solving these classes of problems.

Module Content:

- Review of the Finite Element Method for 1D elasticity and steady-state heat transfer
- Isoparametric finite elements
- High-order finite elements
- Numerical integration. Gaussian quadratures
- 2D heat transfer
- Seepage flow
- Irrotational flow.
- Quadrilateral elements
- 2D high-order finite elements
- Mesh generation
- Error measures
- 2D elasticity (plane stress, plane strain and axisymmetric problems)
- 3D elasticity
- Transient heat transfer
- Dynamics

Intended Learning Outcomes: Upon completion of this module students should be able to:
• Use the weighted residual method to solve an engineering problem governed by partial differential equations.
• Convert a realistic elasticity, heat conduction, seepage flow and ideal fluid flow engineering problems into finite element models.
• Solve elasticity, heat transfer, seepage flow and ideal fluid flow problems by hand using the finite element method.
• Use a software to set up and produce finite element solutions of engineering problems.
• Analyse/assess the output of finite element simulations.

Accreditation Outcomes (AHEP)

MEng
SM1 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
SM2m 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
SM3m Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively
SM4m Awareness of developing technologies related to own specialisation
SM5m A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations
SM6m Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects
EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes
EA2i Ability to apply quantitative methods in order to understand the performance of systems and components
EA3m Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and implement appropriate action
EA4 Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems
EA6m Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems
P1 Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.)
P3 Ability to apply relevant practical and laboratory skills
P4 Understanding of the use of technical literature and other information sources
P9m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments
P11m Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader
G1 Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
G3m Monitor and adjust a personal programme of work on an on-going basis
G4 Exercise initiative and personal responsibility, which may be as a team member or leader

MSc
SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.
SM2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.
SM3m Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.
EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations
EA3m Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods.
D1m Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the

effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies
P2m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments.
P4m Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader.
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
G3 Monitor and adjust a personal programme of work on an on-going basis.

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

Assessment Description: - Examination (60% of the module marks)
Standard university examination (open book).

- Assignment (40% of the module marks)
Group assignment where students are required to choose one of the following options:
1. Create a finite element model using commercial software to solve a realistic engineering problem in solid or fluid mechanics.
2. Modify an existing MATLAB program to solve an engineering problem using finite elements.

(*) Option 1 will require students to have access and to independently learn how to use the commercial software ANSYS.
To support this task, students will have access to
- online resources
- support from the Math and CAE Cafe offered by the College of Engineering.

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

Assessment Feedback:
Examination - Standard university exam feedback form.

Assignment - Comments on submitted work will be sent to the groups.

Failure Redemption: Exam re-sits according to University regulations. A supplementary exam will form 60% of the module marks, with remaining 40% coming from the previously submitted coursework element.

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

Penalty for late submission of continual assessment assignment: No marks awarded for late submissions.

Available to visiting and exchange students.

This module requires a prior knowledge of:
1. Basic Finite Elements - more specifically, knowledge of the content of the module EG-323 is assumed.
2. Computer programming - more specifically, MATLAB programming language - at a fairly basic level.

EG-M47 Business Leadership for Engineers

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr A Munnangi, Dr AS Walters

Format: Lectures/Workshops - 22 hours
Open door tutorials/workshops - 8 hours
Directed private study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

Combination of interactive lectures/workshops/case studies and self-study.

Module Aims: At the end of this course students will be able to recognise and understand key characteristics of leadership as well as a wide range of strategic business skills, ideas and theories with emphasis on innovation and "entrepreneurial thinking" which is essential for the current multidisciplinary engineering environment. The course delivery integrates practical project work and academic rigour.

Module Content: Workshop 1 – Introduction & Leadership Part 1
Workshop 2 – Leadership Part 2
Workshop 3 – Team Formation, Development and Communication
Workshop 4 - Entrepreneurial Thinking
Workshop 5 – Change Management
Workshop 6 – Strategic Management
Workshop 7 – Innovation and Business Thinking, Group Assignment Part 1
Workshop 8 – Innovation and Business Thinking, Group Assignment Part 2
Workshop 9 – Group Assignment Workshop
Workshop 10 – Group Assignment Workshop

Intended Learning Outcomes:

Technical Outcomes

On successful completion of this module students will be expected, at threshold level, to be:

- Demonstrate an understanding of current leadership issues. Critically appraise theories and approaches to leadership and at the same time reflect on personal leadership aspects.
- Knowledge to assess the basic factors that must be considered for a business formation. Use of basic level strategy and innovation methods in order for an organisation to gain competitive advantage. Critically evaluate the rationale for utilising methods for idea generation/innovation.
- Have awareness of theoretical perspectives and approaches to change management in organisational environments. Synthesise the relationship between the external context of an organisation and its internal context and their impact on its strategic direction.
- Demonstrate and appraise, entrepreneurial way of working, team development and communication skills

Accreditation Outcomes (AHEP)

- Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (D2)
- Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D8m)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation, (ET3fl)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate, (ET4fl)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk. (ET6fl)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction. (ET7m)

Assessment: Group Work - Coursework (80%)
Online Class Test (10%)
Online Class Test (10%)
Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description:
Online Test 1 Assessment level marking - PGTM March 10%
Online Test 2 Assessment level marking - PGTM March 10%
Group Work Coursework Assessment level marking - PGTM April 80%

The group (5/6) assignment will require application of the "key skills" and innovation development tools to generate solutions for real-world scenarios – report (40 pages) and development of Business Canvas.

This module is assessed by a combination of group-based and individual assignments (quiz-1 and quiz-2). In the main exam, the marks students get in quiz -1 and quiz-2 will add to the marks the individual gets in the group assignment project. For the resit exam, the quiz-1 and quiz-2 marks will not add to the project.

Moderation approach to main assessment: Partial second marking

Assessment Feedback:
Continuous group feedback on "out-comes" of workshops, after submission of coursework 1 at request during open-tutorials.

Failure Redemption:
Exam resits according to University regulations.
100% coursework.

Additional Notes: 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

Related assignments are used to assess this module.

This module is assessed by a combination of group-based and individual assignments. In order for the individual assessment marks to count, you must achieve at least 40% in the group-based assignment. If you achieve less than 40% in the group-based assignment, then the module mark will be just the group-based assignment mark.

EGEM03 Continuum Mechanics

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof D Peric

Format: Lectures 24hrs in semester
Example classes 12hrs in semester
Directed private study 36hrs in semester

Delivery Method: Additional notes:
Failure to attend activities that are a module requirement will normally mean that you cannot sit the final exam in the module.
University regulations will apply for late submissions of the projects

Module Aims: This module is concerned with the fundamentals of solid mechanics with particular attention given to elastic solids.
Generic continuum mechanics concepts are introduced including basic geometric relations, balance principles and constitutive theory. This provides a basis for approximation methods and finite element method, in particular.
Solution techniques of classical elasticity are employed in the solution of several engineering problems, including torsion of cylindrical bars and two-dimensional problems of elasticity.

Module Content: Attendance is a course requirement. Each student will need to complete three small projects that will require hand calculation.

Elements of Tensor Algebra: Points. Vectors. Tensors: Definitions and Notation.Spectral Theorem; Principal Invariants; Cayley-Hamilton Theorem. [3]
Elements of Tensor Analysis: Differentiaton; Gradient. Divergence. Curl; Green's Formulae; Divergence Theorem. Stoke's Theorem. [4]
Geometry and Kinematics of Bodies: Deformation of Bodies: Displacement. Green-Lagrange Strain Tensor; Infinitesimal Strain and Rotation. Properties of the Strain Tensor. Normal and Shear Strains. [4]
Balance Principles: Linear and Angular Momentum Balance. The Stress Tensor. Local Equations of Equilibrium. Symmetry of the Stress Tensor; Properties of the Stress Tensor. Principal and Deviatoric Stresses; The Principle of Virtual Work. [3]
Constitutive Theory: The Principle of Energy Balance - The First Law of Thermodynamics; Strain Energy Function; Generalised Hooke's Law. The Elasticity Tensor; Isotropic Linear Elasticity: Constitutive Equations. Lame Coefficients. The Matrix Formulation. [4]
The Boundary Value Problems of Linear Elasticity: Summary of Field Equations; Navier's Equations; Beltrami-Mitchells Compatibility Conditions; Formulation of the BVP; Uniqueness of Solution; Solution of Selected Problems: Torsion of a Cylindrical Bar; The Plane Problem of Elasticity: Problem Description. State of Plane Strain. State of Plane Stress. Characterisation of the Stress Field. Airy's Solution. Formulation in Polar Coordinates. [12]

Intended Learning Outcomes: Students should be able to:
- Learn and understand fundamentals of solid mechanics with applications to elasticity.
- Formulate engineering problems in solid mechanics by considering geometry, equilibrium and constitutive theory.
- Develop practical skills related to tensor calculus.
- Perform analysis of torsion of arbitrary cross-section.
- Perform analysis of 2-D plane strain and plane stress engineering problems.
- Appreciate difficulties in obtaining the closed form solution in solid mechanics, and realise the necessity for approximation techniques.
- Develop a sound basis for approximation methods and finite element method, in particular.

Learning Outcomes (AHEP)
SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.
SM2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.
EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations
P1m Advanced level knowledge and understanding of a wide range of engineering materials and components.

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

Assessment Description: Examination 1 - Standard 2 hour university examination worth 70% of the final mark. Exam question related to the solution of a boundary value problem is a closed book question. For the remainder of the exam the use of lecture notes and worked exercises is permitted.
Coursework 1, 2 and 3 - Each students will need to complete three individual assignments that will require hand calculation. Each assignment will contribute 10% of the final mark, making assignments worth 30% of the final mark.

Moderation approach to main assessment: Universal double-blind marking

Assessment Feedback: Examination 1 - Standard university exam feedback form.

Coursework 1, 2 and 3 - Marked assignments with comments will be provided to students for inspection.

Failure Redemption: Normally, 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.

Failure to attend activities that are a module requirement will normally mean that you cannot sit the final exam in the module.

Zero tolerance will apply for late submissions of the assignments.

Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

EGEM07 Fluid-Structure Interaction

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

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 or 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 based on lectures and on-line example classes supported by additional on-line content.

Module Aims: The understanding and the computer simulation of fluid-structure interaction (FSI) is of increasing importance in
many areas of modern engineering including Civil, Aerospace and Mechanical Engineering. In this module, various phenomena, such as divergence, roll stability of floating bodies, vortex-induced vibrations, galloping and flutter, oscillating pipes and wind turbines, are studied and a number of basic numerical solution strategies are developed. In the context of high-fidelity finite element or finite volume based computational strategies, the module focuses on the challenges arising from the strong coupling between the fluid flow and the solid structure.

Module Content: FSI phenomena and instabilities:
• hydrostatic pressure, lift and drag forces, pitching moment,
• structural divergence,
• added mass,
• oscillating pipes,
• water hammer,
• roll stability of floating bodies,
• vortex-induced vibration, lock-in,
• galloping and flutter,
• wind turbines

Computational FSI:
• Blade Element Momentum theory for wind turbines,
• 1D finite element models for divergence and oscillating pipes,
• general concepts for spatial and temporal discretisation,
• Gauss-Seidel iteration, relaxation, convergence, Aitken acceleration,
• numerical added mass instability

Intended Learning Outcomes: Upon successful completion of this module, students will be expected, at threshold level, to be able to:
• assess the stability of different FSI systems (assessed in the assignment and in the exam, SM1, EA2),
• develop numerical solution methods for basic FSI problems (assessed in the assignment, EA1, EA2, EA3),
• assess the suitability of computational strategies for different FSI problem classes (assessed in the exam, EA4).

Assessment: Examination 1 (70%)
Assignment 1 (10%)
Assignment 2 (10%)
Assignment 3 (10%)

Assessment Description: Examination:
The examination forms 70% of the module mark.

Assignments 1, 2 and 3: Examples and Applications
These are individual pieces of coursework to be completed on-line. Each is worth 10% of the module mark.

Moderation approach to main assessment: Universal second marking 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 1, 2 and 3:
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: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

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

Lecture notes, Matlab code, examples, exercises, worked solutions and past examination papers will be available on Canvas.

EGIM02 Advanced Computational Methods for Engineers

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules: EG-228; EG-399

Co-requisite Modules:

Lecturer(s): Dr F Zhao

Format: Synchronous / Lectures 20h
Asynchronous & Directed Private Study 80h

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

Online based lectures and example classes, the course material will be available for download from Canvas.
Assessment: 30% continuous assessment assignments, 70% open book examination.
Practical Work: Exercises/project will involve coding some of the methods presented in MATLAB.

Module Aims: Introduction to advanced computational (numerical) methods including ordinary and partial differential equations at masters level. The course provides an understanding of fundamental methods that form the basis of common solution techniques used in many simulators and commercial packages with wide application in science and engineering.

Module Content:

- Review of Basic Numerical Methods.
- Newton's method
- Numerical Integration
- Discretization of Ordinary Differential Equations
- Discretization of Partial Differential Equations
- (All Types Elliptic, Hyperbolic and Parabolic)
- Finite difference and Finite volume methods
- Consistency, stability and convergence
- An Introduction to the Solution of Linear Systems
- Gaussian elimination
- Relaxation methods

Practical Work: Exercises/project will involve coding some of the methods presented in MATLAB
NOTE: Knowledge of some MATLAB or scientific programming is assumed.

Intended Learning Outcomes: Technical Outcomes
Demonstrate a knowledge and understanding of:
• The basic principles of: numerical integration, numerical solution of ordinary and partial differential equations. Truncation error and solution error. Consistency, stability and convergence. Direct and iterative solution of Linear systems of equations.
• Demonstrate the ability to (thinking skills): Understand and formulate basic numerical procedures and solve fundamental problems.
• Demonstrate the ability to (practical skills): Understand practical implications and behaviour of numerical methods and their solutions. Logically formulate numerical methods for solution by computer with MATLAB.
• Demonstrate the ability to (key skills): Study independently, use library resources. Effectively take notes and manage working time.

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 (SM1m)
-Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems (SM2m)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively (SM3m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Understanding of concepts from a range of areas including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects (SM6m)

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

Assessment Description: Assessment is comprised of an open book examination (70%) and 1 assignment (30%) involving analysis and computation.

Assignment 1. Questions on key components and concepts of the course material covered during the semester.

The examination and assessments tests knowledge and understanding of all the material presented.

Formative exercises are also set each week which also involve questions on key components and concepts of the course material to aid and reinforce learning and understanding.

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

Assessment Feedback: Feedback on assessed work is given in example classes and via canvas.
Feedback on formative exercises is also given in example classes.
Specific issues and questions are answered throughout the module including example classes.
Feedback on formal examinations is given via a web feedback template.

Failure Redemption: The supplementary open book exam paper is sat during the month of August following the first exam sat in January.
A supplementary examination will normally form 100% of the module mark and is capped at 50%.

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

Lecture notes provided.

Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

Students must have completed Year 1 maths modules and EG-228 matlab or equivalent in order to take this module.

EGIM04 Advanced Fluid Mechanics

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof K Morgan

Format:
Synchronous Learning 20hr
Blended learning 10hr
Continuous assessment 15h
Directed private study 35h
Preparation for assessment 20h

Delivery Method: Standard lectures

Module Aims: This module provides an introduction to the development of basic mathematical models for describing the flow of fluids. The techniques that are available for developing analytical and simple numerical solutions will be presented and the solutions obtained will be used to gain an understanding of flows of different types.

Module Content: • Introduction. Vectors and tensors (2hr)

• Basic concepts and integral theorems (2hr)

• Governing equations (2hr)

• Ideal fluid flow (4hr)

• Inviscid compressible flow: method of characteristics (2hr)

• Inviscid compressible flow: shock waves (2hr)

• Incompressible viscous flow (2hr)

• Incompressible boundary layer theory (2hr)

• Compressible boundary layer theory (2hr)

Intended Learning Outcomes: By the end of the module, the student will be able to:

• Demonstrate an understanding of the fundamentals of theoretical fluid mechanics, including the nature of ideal and compressible and viscous fluid flow (assessed by assignment and written examination).

• Demonstrate the ability to formulate problems involving different classes of flows and a knowledge of the analytical tools that can produce solutions to basic models (assessed by assignment and written examination).

• Demonstrate the ability to use classical and simple numerical techniques to solve problems in fluid mechanics (assessed by assignment and written examination).

Learning Outcomes (AHEP)
SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.
SM2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.
SM3m Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.
EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations
EA3m Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods.
EL1m Awareness of the need for a high level of professional and ethical conduct in engineering
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
G3m Monitor and adjust a personal programme of work on an on-going basis

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

Assessment Description: Coursework 1. This will require the solution to questions on the material covered during weeks 1 to 3 of lectures (6 hours of the syllabus).

Coursework 2. This will require the solution to questions on the material covered during weeks 4 to 6 of lectures (6 hours of the syllabus).

Coursework 3. This will require the solution to questions on the material covered during weeks 7 to 8 of lectures (4 hours of the syllabus).

Examination 1. This will take the form of a take-home examination testing your understanding of all the material presented in the course.

If the Coursework is not submitted by the prescribed date, a mark of zero will be recorded. If an extenuating circumstances request is granted for coursework not submitted by the prescribed date, an extension cannot be put in place,. However, in this case, the marks available for the written Examination will be appropriately scaled.

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

Assessment Feedback: Individual feedback on your submitted coursework within 1 week of the submission deadline.

Electronic feedback on the class examination performance during the scheduled feedback weeks.

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

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

Some previous knowledge of MATLAB can prove useful

Failure to sit an examination or to submit work by the specified date will normally result in a mark of 0% being recorded

EGIM06 Computational Fluid Dynamics

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules: EGIM02; EGIM04

Lecturer(s): Prof P Nithiarasu

Format: Lectures and examples 30 hours.

Delivery Method: A total of 30 hours of lectures and examples. Two individual mini-projects on the implementation of computational fluid dynamics algorithms.
Assessment: Written closed-book examination (70%), projects (30%).
Penalty for late submission of continuous assessment assignment:
No marks awarded for late submissions.
Directed private study: 30 hours
Private laboratory work: 12 hours

Module Aims: This module provides a concise overview on the basic principles of computational fluid mechanics. The topics include finite difference and finite element methods, compressible and incompressible flows. Training will also be provided on the implementation of computational fluid dynamics algorithms.

Module Content: Introduction to CFD [1]
CFD model and applications [1]
Navier-Stokes equations [2]
Mathematical nature of equations [3]
Examples [2]
Spatial and temporal discretizations and examples [4]
Mini-project briefs [1]
Finite difference and finite volume schemes and examples [4]
Finite element schemes and examples [4]
Stabilized solution algorithms and examples [4]
Advanced topics [2]
Review and assessment [2]

Computer laboratory work: associated with mini-projects.
Project work: Mini-projects on computer implementation.

Intended Learning Outcomes: At the end of the module the student should be able to;
• Apply the knowledge of fluid dynamics equations, including initial and boundary condition, spatial and temporal discretizations and relevant mathematical aspects to the solution of practical fluid dynamic problems.
• To identify and evaluate the key issues relevant to discretization both in space and time.
• Create a computer code using any one programming language to solve fluid dynamic problems.
• Use computer codes to produce correct solutions.

Learning Outcomes (AHEP)
SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.
SM2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.
SM3m Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.
EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations
EA2m Ability to use fundamental knowledge to investigate new and emerging technologies.
EA3m Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods.
D1m Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
G3m Monitor and adjust a personal programme of work on an on-going basis.

Assessment:	Examination 1 (70%) Assignment 1 (15%) Assignment 2 (15%)
Assessment Description: (i) Mini-project 1: Computer implementation of finite difference schemes (15%). (ii) Mini-project 2: Computer implementation of a finite element scheme (15%). (iii) Final examination: Closed book exam (70%).	
Moderation approach to main assessment: Universal second marking as check or audit	
Assessment Feedback: Feedback given on mini-projects 1 and 2. A overall feedback on the final examination will be posted online.	
Failure Redemption: Resit may be allowed in exceptional circumstances - subject to university regulations. Assessment - 100% examination.	
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. Penalty for late submission of continuous assessment assignment: No marks awarded for late submission. Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.	

EGIM08 Plasticity in Structural and Geotechnical Engineering

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof D Peric

Format: Lectures (20h); Example classes and Laboratory work (10h). Directed private study 3h per week.

Delivery Method: Two lectures and one example or laboratory class per week.
Assessment: 50% from end of teaching block 2 hour examination; 50% from 2 projects.

Module Aims: This module is concerned with basic concepts and methods of computational plasticity. Essential steps required in numerical integration of elasto-plastic constitutive models are first discussed in a one-dimensional setting. Concepts of plasticity under multiaxial stress states are introduced and several yield criteria are described including von Mises, Tresca, Mohr-Coulomb and Drucker-Prager yield criteria. Details of numerical integration are provided for the von Mises yield criterion. Understanding of basic concepts and practical applications are strengthened through the programming exercises focusing on one-dimensional problems, and use of computational codes under multiaxial state of stress. Computer simulations of structural and geotechnical problems are performed, with the objective of understanding the concepts of engineering failure and limit state.

Module Content:

• Introduction: Historical Perspective. Physical Motivation. Rate Independent Plasticity. Rate Dependence. Creep. Rheological Models. [2]

• 1-D Mathematical Model: Yield Criterion. Flow Rule. Loading / Unloading Conditions. Isotropic and Kinematic Hardening Models. 1-D Elasto-Plastic Boundary Value Problem. [1]

• Computational Aspects of 1-D Elasto-Plasticity: Integration Algorithms for 1-D Elasto-Plasticity. Operator Split. Return Mapping. Incremental Elasto-Plastic BVP. Consistent Tangent Modulus. [5]

• Classical Model of Elasto-Plasticity: Physical Motivation. Classical Mathematical Model of Rate-Independent. Elasto- Plasticity: Yield Criterion. Flow Rule. Loading / Unloading Conditions. [6]

• Computational Aspects of Elasto-Plasticity: Integration Algorithms for Elasto-Plasticity. Operator Split. The Trial Elastic State. Return Mapping. Incremental Elasto-Plastic BVP. Consistent Tangent Modulus. [3]

• Plane Strain Von Mises Elasto-Plastic Model: Continuum. Integration Algorithm. Operator Split. The Trial Elastic State. Return Mapping; Incremental Elasto-Plastic BVP: Consistent Tangent Modulus. [4]

• Integration Algorithms for Generalised Elasto-Plasticity. [1]

• Generalisations and Applications of Plasticity: Plasticity in Engineering Practice: Geomechanics. Structural Mechanics. Impact Dynamics and Crashworthiness. [8]

Intended Learning Outcomes: Students should be able:
• Identify and select different constitutive models for describing material behaviour including von Mises, Tresca, Mohr-Coulomb and Drucker-Prager elasto-plastic models.
• Apply fundamentals of computational modelling of inelastic materials with emphasis on rate independent plasticity.
• Identify and apply different methodologies for discretisation of different time evolution problems, and rate-independent elasto-plasticity in particular.
• Formulate and implement a computational procedure for integration of rate-independent elasto-plasticity in 1-D.
• Perform analysis of engineering problems in elasto-plasticity by employing a commercial finite element package.
• Determine failure modes in engineering structures and geomechanics.

AHEP 3 Learning Outcomes

MEng
SM1m A comprehensive knowledge and understanding of the 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
SM2m 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
SM3m Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively
SM4m Awareness of developing technologies related to own specialisation
SM5m A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations.
EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes
EA2 Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
EA3m Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and to implement appropriate action.
P2m Knowledge of characteristics of particular equipment, processes or products, with extensive knowledge and understanding of a wide range of engineering materials and components
P4 Understanding of the use of technical literature and other information sources
G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities

MSc
SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.
Sm2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.
EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations.
P1m Advanced level knowledge and understanding of a wide range of engineering materials and components.
P2m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments.
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities.

Assessment:	Examination 1 (50%) Assignment 1 (20%) Assignment 2 (30%)

Assessment Description:
Examination 1 - Standard 2 hour university examination worth 50% of the final mark. This is a closed book examination.
The coursework will consist of two individual projects that will require both hand calculation and computer simulations. Computer simulation will require certain amount of programming and use of the existing finite element software package Elfen. The project reports should consist of two parts: (i) a discussion related to general aspects of formulation and computational treatment of the problem under consideration, (ii) description of numerical solution of an individual problem.
Coursework 1 - Hand calculation and numerical solution in MATLAB will be used to obtain solution of simple 1-D elasto-plastic problem. Coursework 1 will contribute 20% of the final mark.
Coursework 2 - Short hand calculation and computer simulation in commercial code will be used to obtain solution of a 2-D engineering problem. Coursework 2 will contribute 30% of the final mark.

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

Assessment Feedback: Examination 1 - Standard university exam feedback form.
Coursework 1 and 2 - Marked assignments with comments will be provided to students for inspection.

Failure Redemption: Exam re-sits according to university regulations.
Normally, 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.

Zero tolerance will apply for late submissions of the assignments.
Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

EGIM10F Communications skills in a foreign language - French

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof R Sevilla, Prof AJ Rothwell

Format: Lecture hours: 3 hours per week
Directed private study and preparation for assessment: 2 hours per week

Delivery Method: - Based on campus.
- Lecture/seminar.

Module Aims: In this module, students will be exposed to basic communication skills in French. This module is designed for students with little or no previous knowledge of the chosen foreign language.

The aim of the module is to enable students to acquire a basic vocabulary and an understanding of fundamental grammatical structures so as to allow them to communicate in a written and spoken manner. Students will also acquire awareness of contemporary foreign culture from the range of materials used.

Module Content: This module is designed for students with little or no previous knowledge of the French language. Its aim is to enable students to acquire a basic vocabulary and an understanding of fundamental grammatical structures so as to allow them to communicate in written and spoken French. Students will also acquire awareness of contemporary French culture from the range of materials used. Students wishing to pursue further study of French will be able to do so on completion of this module by taking MLF102.

The module will follow the 12 unit study programme of Voilà and will be supplemented by extra grammar exercises and oral / aural tasks produced in-house or available on recommended websites.

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

- Demonstrate awareness of French vocabulary appropriate to a range of everyday situations (assessed in oral and vocabulary examination).
- Demonstrate a knowledge of the fundamentals of French grammar (assessed in oral, written and grammar examination).
- Express themselves orally in French in general conversational situations (assessed in oral examination).
- Express themselves in written French with reference to everyday situations (assessed in written examination).
- Demonstrate a knowledge of contemporary French culture through familiarity with a range of print and media resources.

Accreditation Outcomes (AHEP)
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
G3m Monitor and adjust a personal programme of work on an on-going basis.

Assessment: Examination (100%)

Assessment Description: Class Test 1
Coursework
Oral Examination
Examination

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

Assessment Feedback: - Individual feedback will be given on all submitted coursework via direct written feedback information.
- Examination feedback will be provided using the College of Engineering on-line feedback system, with general information provided on examination performance in each question and statistics on overall class performance

Failure Redemption: In compliance with College of Engineering progression regulations any student failing to pass in the June
examination period may be invited to sit a supplementary examination in August of the same year, at the discretion of the Erasmus Mundus Board of Studies.

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

- The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
- Available to Erasmus Mundus MSc in Computational Mechanics students.

EGIM10G Communications skills in a foreign language - German

Credits: 10 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof R Sevilla, Prof AJ Rothwell

Format: Lecture hours: 3 hours per week
Directed private study and preparation for assessment: 2 hours per week

Delivery Method: - Based on campus.
- Lecture/seminar.

Module Aims: In this module, students will be exposed to basic communication skills in German. This module is designed for students with little or no previous knowledge of the chosen foreign language.

The aim of the module is to enable students to acquire a basic vocabulary and an understanding of fundamental grammatical structures so as to allow them to communicate in a written and spoken manner. Students will also acquire awareness of contemporary foreign culture from the range of materials used.

Module Content: Students following this module will have four contact hours per week.

The course book Passwort 1 will be used, and the module will cover activities from chapters 1-6.
The grammar points covered are tenses (present, simple past and present perfect) conjugations, the cases (nominative and accusative), modal verbs, syntax rules, prepositions and simple negations

The classes will be conducted mainly in German.

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

- Demonstrate awareness of German vocabulary appropriate to a range of everyday situations (assessed in oral and vocabulary examination).
- Demonstrate a knowledge of the fundamentals of German grammar (assessed in oral, written and grammar examination).
- Express themselves orally in German in general conversational situations (assessed in oral examination).
- Express themselves in written German with reference to everyday situations (assessed in written examination).
- Demonstrate a knowledge of contemporary German culture through familiarity with a range of print and media resources.

Accreditation Outcomes (AHEP)
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
G3m Monitor and adjust a personal programme of work on an on-going basis.

Assessment: Examination (100%)

Assessment Description: Class Test 1 - Held under exam conditions
Oral Examination
Examination 1

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

Assessment Feedback: - Individual feedback will be given on all submitted coursework via direct written feedback information.
- Examination feedback will be provided using the College of Engineering on-line feedback system, with general information provided on examination performance in each question and statistics on overall class performance

Failure Redemption: In compliance with College of Engineering progression regulations any student failing to pass in the June
examination period may be invited to sit a supplementary examination in August of the same year, at the discretion of the Erasmus Mundus Board of Studies.

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

- The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
- Available to Erasmus Mundus MSc in Computational Mechanics students.

EGIM10S Communications skills in a foreign language - Spanish

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof R Sevilla, Mrs TA May

Format: Lecture hours: 3 hours per week
Directed private study and preparation for assessment: 2 hours per week

Delivery Method: - Based on campus.
- Lecture/seminar.

Module Aims: In this module, students will be exposed to basic communication skills in Spanish. This module is designed for students with little or no previous knowledge of the chosen foreign language.

The aim of the module is to enable students to acquire a basic vocabulary and an understanding of fundamental grammatical structures so as to allow them to communicate in a written and spoken manner. Students will also acquire awareness of contemporary foreign culture from the range of materials used.

Module Content: 1. The alphabet
2. Pronunciation.
3. Nouns & agreements
4. Adjectives & prepositions
5. Grammatical persons
6. The present tense of regular verbs
7. The present tense of irregular verbs
8. Stem changing present tense verbs
9. Numbers
10. Future tense

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

- Demonstrate awareness of Spanish vocabulary appropriate to a range of everyday situations (assessed in oral and vocabulary examination).
- Demonstrate a knowledge of the fundamentals of Spanish grammar (assessed in oral, written and grammar examination).
- Express themselves orally in Spanish in general conversational situations (assessed in oral examination).
- Express themselves in written Spanish with reference to everyday situations (assessed in written examination).
- Demonstrate a knowledge of contemporary Spanish culture through familiarity with a range of print and media resources.

Accreditation Outcomes (AHEP)
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
G3m Monitor and adjust a personal programme of work on an on-going basis.

Assessment: Examination (100%)

Assessment Description: Oral Examination
Class Test 1 - Held under exam conditions
Examination 1

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

Assessment Feedback: - Individual feedback will be given on all submitted coursework via direct written feedback information.
- Examination feedback will be provided using the College of Engineering on-line feedback system, with general information provided on examination performance in each question and statistics on overall class performance

Failure Redemption: In compliance with College of Engineering progression regulations any student failing to pass in the June
examination period may be invited to sit a supplementary examination in August of the same year, at the discretion of the Erasmus Mundus Board of Studies.

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

- The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
- Available to Erasmus Mundus MSc in Computational Mechanics students.

EG-M102 Industrial project

Credits: 30 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof R Sevilla, Refer To Dept

Format: Student placed in a company or research institution during a minimum of 7 weeks.

Delivery Method: The module is delivered primarily as an individual project.

Depending on the project the student would be expected to carry out this research individually and to complete the necessary risk assessments and training required to work on an industrial site or within laboratory facilities of the University.

Module Aims: Practical training is an essential element in the curriculum providing inside knowledge in computational mechanics project development and management.

Students will be placed in engineering industries, consultancies or research institutions that have an interest and expertise in computational mechanics and will carry out an agreed practical project.

The project can start as soon as the May-June exams finish and it must last for a minimum of 7 weeks, working full time.

Module Content: Please refer directly to the department

Intended Learning Outcomes: On completion of this module, students should have the ability to:
• investigate an industrial topic in detail;
• formulate project aims;
• devise and plan a project strategy to fulfil the aims;
• carry out work - undertake a literature search, a laboratory based or computer based investigation or a combination of these;
• gather, organize and use evidence, data and information from a variety of primary and secondary sources;
• critically analyse information;
• make conclusions supported by the work and identify their relevance to the broader area;
• produce a report, with the findings presented in a well organised and reasoned manner.

Accreditation Outcomes (AHEP)
SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.
SM2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.
EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
G3m Monitor and adjust a personal programme of work on an on-going basis.

Assessment: Other (100%)

Assessment Description: Written report (100%)

The report should around 5,000 words, depending on the chosen topic.

The format and layout should follow the general guide provided by the University for an MSc dissertation.

The written report will be marked by the module coordinator and another faculty member appointed by the coordinator .

After submission of the report, the examiners will provide technical feedback (not the final mark).

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

Assessment Feedback: Informal feedback will be given during regular meetings with the industrial supervisor.

After submission of the report, the examiners will provide technical feedback (not the final mark).

Failure Redemption: Due to the nature of the project there will be no mechanism for redeeming a failure should a student fail.
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. The nature of the project will very much depend upon the placement but can involve structural mechanics, solid mechanics, fluid mechanics or electromagnetics, etc. Typically, students will be trained by the relevant industry in the use of their in-house or commercial computational mechanics software.

EG-M194 MSc Industrial Experience Preparation

Credits: 0 Session: 2022/23 Academic Year

Pre-requisite Modules: EG-M39

Co-requisite Modules:

Lecturer(s): 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 module aims to prepare students for the 60 credit industrial experience module - EG-M39 MSc Industrial Experience
which is required as part of the MSc with Industry programmes.

Preparation will include meetings with the assigned academic staff member who will act as supervisor for the industrial experience module and they will guide students via weekly interactions.

Module Content: NA

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)
- Plan and carry out a personal programme of work, adjusting where appropriate (G3)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)

Assessment: Participation Exercise (100%)

Assessment Description: Pass/Fail for engagement.

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

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: NA

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 to students undertaking one of the 2-year MSc schemes "with industry" within the College of Engineering.

This module is non-credit bearing and has no assessments, instead it aims to prepare students for the 60 credit industrial experience module - EG-M39 MSc Industrial Experience which is required as part of the MSc with Industry programmes.