Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

POSTGRADUATE TAUGHT STUDENT HANDBOOK

MSc (FHEQ LEVEL 7)

MSc STRUCTURAL ENGINEERING WITH INDUSTRY DEGREE PROGRAMME

SUBJECT SPECIFIC
PART TWO OF TWO
MODULE AND COURSE STRUCTURE
2023-24

DISCLAIMER

The Faculty of Science and Engineering has made all reasonable efforts to ensure that the information contained within this publication is accurate and up-to-date when published but can accept no responsibility for any errors or omissions.

The Faculty of Science and Engineering reserves the right to revise, alter or discontinue degree programmes or modules and to amend regulations and procedures at any time, but every effort will be made to notify interested parties.

It should be noted that not every module listed in this handbook may be available every year, and changes may be made to the details of the modules. You are advised to contact the Faculty of Science and Engineering directly if you require further information.

The 23-24 academic year begins on 25 September 2023

Full term dates can be found here

DATES OF 23-24 TERMS

25 September 2023 – 15 December 2023

8 January 2024 – 22 March 2024

15 April 2024 – 07 June 2024

SEMESTER 1

25 September 2023 – 29 January 2024

SEMESTER 2

29 January 2024 – 07 June 2024

SUMMER

10 June 2024 – 20 September 2024

IMPORTANT

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

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

Please ensure that you read the University webpages covering the topic – procedural guidance here and further information here. You should also read the Faculty Part One handbook fully, in particular the pages that concern Academic Misconduct/Academic Integrity.

Welcome to the Faculty of Science and Engineering!

Whether you are a new or a returning student, we could not be happier to be on this journey with you.

At Swansea University and in the Faculty of Science and Engineering, we believe in working in partnership with students. We work hard to break down barriers and value the contribution of everyone.

Our goal is an inclusive community where everyone is respected, and everyone's contributions are valued. Always feel free to talk to academic, technical and administrative staff, administrators - I'm sure you will find many friendly helping hands ready to assist you. And make the most of living and working alongside your fellow students.

During your time with us, please learn, create, collaborate, and most of all – enjoy yourself!

Professor David Smith
Pro-Vice-Chancellor and Executive Dean
Faculty of Science and Engineering

Faculty of Science and Engineering	
Pro-Vice-Chancellor and Executive Dean	Professor David Smith
Director of Faculty Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Laura Roberts
School of Aerospace, Civil, Electrical, General and Mechanical Engineering	
Head of School	Professor Antonio Gil
School Education Lead	Professor Cris Arnold
Head of Civil Engineering	Professor Eduardo De Souza Neto
Civil Engineering Programme Director	Dr Clare Wood
Year Coordinators	Professor Yuntian Feng

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/

MSc (FHEQ Level 7) 2023/24
Structural Engineering with Industry
MSc Structural Engineering with Industry

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-M24 **Advanced Structural Design** **10 Credits** **Miss X Yin** **CORE**	**EG-M190** **Social, environmental and economic context of research** **10 Credits** **Dr N Wint** **CORE**
EG-M38 **Design and Analysis for Temporary Works** **10 Credits** **Prof C Li** **CORE**	**EG-M192** **Research Case Study** **10 Credits** **Prof HU Karunarathna/Prof Y Feng** **CORE**
EGIM07 **Dynamics and Earthquake Analysis of Structures** **10 Credits** **Prof Y Feng** **CORE**	**EGIM06** **Computational Fluid Dynamics** **10 Credits** **Prof P Nithiarasu** **CORE**
EGIM16 **Communication Skills for Research Engineers** **10 Credits** **Dr SA Rolland/Dr T Lake** **CORE**	**EGIM08** **Plasticity in Structural and Geotechnical Engineering** **10 Credits** **Prof D Peric** **CORE**
EG-M194 **MSc Industrial Experience Preparation** **0 Credits** **Dr V Samaras** **CORE**	
EG-M39 **MSc Industrial Experience** **60 Credits** **Dr V Samaras** **CORE**	
Dissertation	
EG-D12 **MSc Dissertation. Structural Engineering** **60 Credits** **Prof Y Feng** **CORE**	
Total 240 Credits	

Optional Modules
Choose exactly 10 credits

EG-M25	Advanced Structural Analysis	Prof EA De Souza Neto	TB1	10 (CORE)
EGIM03	Solid Mechanics	Prof D Peric	TB1	10 (CORE)

And

Choose exactly 10 credits

MSc Civil students with past FEA Element Analysis background, which includes Swansea University Civil BEng Graduates must elect EG-M23. MSc Civil students without past FEA background knowledge should discuss this module choice with the MSc coordinator.

EG-M23	Finite Element Computational Analysis	Prof R Sevilla	TB1	10
EG-M92	Finite Elements for Civil Engineers	Prof EA De Souza Neto	TB1	10

And

Choose exactly 10 credits

Swansea University Civil BEng Graduates must elect EG-M87. MSc students without past background knowledge should discuss this module choice with the MSc coordinator.

EG-M107	Coastal Processes and Engineering	Prof HU Karunarathna/Prof DE Reeve	TB1	10 (CORE)
EG-M87	Coastal Engineering	Prof DE Reeve	TB1	10 (CORE)

And

Choose exactly 10 credits

EGEM00	Transportation Engineering	Dr Y Hou	TB2	10 (CORE)
EGEM07	Fluid-Structure Interaction	Prof WG Dettmer	TB2	10 (CORE)

EG-D12 MSc Dissertation. Structural Engineering

Credits: 60 Session: 2023/24 June-September

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof Y Feng

Format: Typically 1 hour per week i.e 10-15 hrs total contact time. Each student is to be supervised in accordance with the University's Policy on Supervision, with a minimum of three meetings held. A careful record should be kept, agreed between supervisor and student, of all such formal meetings, including dates, action agreed and deadlines set.

Delivery Method: The module is delivered primarily as an individual research project. The student is expected to liaise with the supervisor on a regular basis, with a minimum University requirement of three formal meetings for full-time students. In the case of part-time students it is recommended that a minimum of four meetings are held. Ideally, contact should be more regular, with at least one meeting a week to discuss the development and progress of the 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: The module aims to develop fundamental research skills. It comprises the development of supervised research work leading to a dissertation in the field of the Master's degree programme. The specific research topic will be chosen by the student following consultation with academic staff, within the wide scope of structural engineering.

Module Content: Study for the dissertation, which may be based on practical, industrial, or literature work, or any combination of these, is primarily carried out over a period of about 12 weeks, with the dissertation being submitted at the end of September. Preparatory work on the dissertation may take place during Part One of the programme but students will only be permitted to submit their dissertation following successful completion of Part One.

In conducting the research project and dissertation the student will be exposed to all aspects of modern information retrieval processes, the organisation and resourcing of research and the organising and presentation of experimental data. The student must make inferences on conclusions, based on the evidence provided and supported by the research work. Furthermore they must assess the significance of this work in relation to the field and make suggestions about how further work could improve or clarify the research problem. The results of the project will be disseminated in a substantial dissertation demonstrating the student's ability to research a subject in depth.

The student will meet regularly with the supervisor to ensure that the project is well developed and organised. Progress will be monitored.

Intended Learning Outcomes: On completion of this module, students should have the ability to:
• Investigate a research topic in detail;
• Formulate research aims;
• Devise and plan a research strategy to fulfil the aims;
• Carry out research 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 research area;
• Resolve or refine a research problem, with reasoned suggestions about how to improve future research efforts in the field; and
• Produce a report (dissertation), with the findings presented in a well organised and reasoned manner.

AHEP3 Learning Outcomes
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: Report (100%)

Assessment Description: The research project and dissertation forms Part Two of the Masters degree.

Students should refer to:
https://www.swansea.ac.uk/academic-services/academic-guide/postgraduate-taught-awards-regulations/standard-taught-masters/

In particular, section 14 will provide further Information about dissertation preparation and submission.

The word limit is 20,000. This is for the main text and does not include appendices (if any), essential footnotes, introductory parts and statements or the bibliography and index.

Each student is to submit an electronic copy of their dissertation through the Turnitin link on Canvas by the deadline of 30th September. The online system will automatically check the similarity of the report.

The dissertation must contain:

• A statement that it is being submitted in partial fulfilment of the requirements for the degree;
• A summary of the dissertation not exceeding 300 words in length;
• A statement, signed by you, showing to what extent the work submitted is the result of your own investigation.
• Acknowledgement of other sources shall be made by footnotes giving explicit references. A full bibliography should be appended to the work;
• A declaration, signed by you, to certify that the work has not already been accepted in substance for any degree, and is not being concurrently submitted in candidature for any degree; and
• A signed statement regarding availability of the thesis.

The dissertation is marked by the supervisor and another member of staff and sent to an External Examiner for moderation. An Internal Exam Board is then held to confirm the mark. Finally, all marks are ratified at the University Postgraduate Taught Examination Board.

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

Assessment Feedback: Informal feedback will be given during regular meetings with supervisors. The supervisor will also provide an assessment of the project drafting skills during the planning of the dissertation. Work will be returned according to specified deadlines and accompanied by constructive comment.

A Feedback session will be given to any student who fails their dissertation and is permitted by the Award Board to resubmit their work.

Failure Redemption: Candidates who fail the dissertation are given an opportunity to resubmit the dissertation within 3 months of the result of the examination if a full-time student or 6 months for part-time students. Such students will be given one formal feedback session, including written feedback on the reasons for failure, immediately following confirmation of the result by the University Postgraduate Taught Examination Board. The opportunity to resubmit will only be offered to students who submit a dissertation and are awarded a fail. Those candidates who do not submit a dissertation will not be offered a resubmission opportunity.

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.
If an extension is deemed appropriate a Postgraduate Taught Masters 'Application for Extension to the Submission Deadline/ Period of Candidature' Form will need to be submitted as follows:
• 30th September – deadline for Part Two students (non-resit students)
• 15th December – deadline for Part Two Students (students who had resits)

EG-M107 Coastal Processes and Engineering

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof HU Karunarathna, Prof DE Reeve

Format: Lectures 2 hours/week
Example classes 1hour/week
Directed private study 4 hours per week

Delivery Method: 20 hours of lectures
10 hours of examples classes/tutorials/office hours
70 hours of directed private study

Module Aims: This module provides an introduction to the subject of coastal engineering. It provides an overview of the main physical processes that shape the coastal environment and the wider context of coastal engineering, together with the underlying tidal theory, wave transformation methods and sediment transport concepts. The programme will consist of a series of lectures and examples classes.

Module Content: • Introduction: historical context, the coastal environment, context of design, hard and soft engineering options for coastal defence and their effects on the coastal environment
• Theory of tides: equilibrium tidal theory; classification of tides; tidal analysis; tidal prediction; dynamic theory of tides
• Linear wave theory: derivation of airy wave equations; water particle motions; approximations for 'deep' and 'shallow' water; energy content and power in a wave, and group velocity; refraction, shoaling, reflection, diffraction and breaking; wave- induced currents; set-up and set-down; nonlinear theories.
• Water level variations: tides; surge; sea level rise; tsunamis.
• Concepts in sediment transport: basic concepts; cross-shore and longshore transport equations.

Intended Learning Outcomes: Upon completion of this module the student will be able to:

• Formulate tidal prediction problems using equilibrium tidal theory, applying tidal classification methods, determining tide levels and estimating total water level.
• Perform wave transformation analysis using linear wave theory.
• Illustrate key wave transformation processes by sketching and apply linear wave theory to calculate the transformation of waves transformation.
• Use the basic concepts of wave and tidal theories in the context of coastal management situations.

AHEP3 Learning Outcomes
SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.
SM2mA 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

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

Assessment Description: Coursework 1 - online submission (10%)
Closed Book Examination (90%). 2 hours.

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

Assessment Feedback: Feedback on coursework via comments in class

Feedback on exam via normal procedure; in subsequent years via overview of generic issues arising from previous examinations

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.

Available to visiting and exchange students.
The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment. Late assignments will not be marked.

EG-M190 Social, environmental and economic context of research

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr N Wint

Format: 30 formal contact hours
10 x 1 hour lectures
10 x 2 hour interactive workshops

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

Lecture and workshops

Module Aims: There is an increasing need for engineers to work towards complex, so called 'wicked problems', for example the secure supply of energy. This necessitates a holistic approach and involves making decisions based on a range of different factors, and consideration for economic, ethical, social, political and environmental, as well as technical limitations.

Obtaining and making sense of such information involves types of knowledge and the use of tools and techniques that have not always been traditionally used within engineering disciplines. For example, ethical issues concerning negative impacts on environment or society may raise questions of value, duty or morality and requires the application of moral reasoning rather than scientific reasoning.

During this module we will make use of a variety of engineering case studies which exemplify the need to consider non-technical aspects of engineering projects. We will use qualitative research approaches and ethical frameworks to help in our engineering decision making. We will also consider the role of the engineer in policy making.

Module Content: Different types of knowledge and research approaches used to obtain different types of knowledge and information
The use of moral reasoning and ethical frameworks
Policy process and the role of the engineer in informing policy

Intended Learning Outcomes: Technical Outcomes
By the end of this module students should be able to:
Knowledge of the stages of a research project and how to select appropriate research methods.

Accreditation Outcomes (AHEP)
Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M / ET1fl)
Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M/ ET2fl)
Awareness that engineering activities should promote sustainable development (EL11M / ET4fl)

Assessment: Coursework 1 (60%)
Coursework 2 (40%)
Participation Exercise (0%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Assessment One: Selection of a contemporary engineering topic/project. Outline of the role of different types of knowledge and information needed to inform project. Ethical, economic, social and environmental evaluations of the engineering issues involved.
Assessment Two: A policy brief (choice of contemporary engineering topic)

PASS/FAIL COMPONENT Minimum attendance and contribution to workshop sessions
Note, that this module cannot be passed if this pass/fail element is not passed. 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 50%

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit
Assessment Feedback: Formative and peer feedback will be given in group/workshop sessions Feedback during Q&As in lecture and example classes. Lecturer available for ad-hoc feedback during office hours. Written feedback on all coursework submitted
Failure Redemption: Students will be provided with the opportunity to resubmit failed components. If engagement in group project activities is below required level, no supplementary will be possible and module will have to be resat in the following year.
Reading List: Singh, Pooja ; Singh, Lalit Kumar, Instrumentation and control systems design for nuclear power plant: An interview study with industry practitioners, Elsevier B.V, 2021-11.ISBN: 17385733 Szopiska-Mularz, Monika, Adaptive reuse of modern movement car parking structures for controlled environment agriculture: Results from an interview study for the innovative design process in cities, 2021.ISBN: 18779166 Zhu, Runhe ; Lucas, Gale M ; Becerik-Gerber, Burcin ; Southers, Erroll G, Building preparedness in response to active shooter incidents: Results of focus group interviews, Elsevier Ltd, 2020-09.ISBN: 22124209 Kim, Ji-Eun ; Kessler, Larry ; McCauley, Zach ; Niiyama, Itsumi ; Boyle, Linda Ng, Human factors considerations in designing a personalized mobile dialysis device: An interview study, Elsevier Ltd, 2020-05.ISBN: 00036870
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. .

EG-M192 Research Case Study

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof HU Karunarathna, Prof Y Feng

Format: No formal lectures involved. Tutorials given by individual MSc research project supervisors (10h)
Directed private study (190h)
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

No formal lectures are involved. Student will meet their individual supervisors regularly (at least weekly) and will be guided the whole course of the module.

Module Aims: The aim of the module is to undertake an in-depth study into the use of research methods in engineering practice by carrying out a detailed literature survey and state of the art examination in a given topic of specialization.

Module Content:

• Literature review on chosen research topic.
• Familiarisation with chosen research topic.
• Planning of MSc thesis.

Intended Learning Outcomes: The student should be able to:

• Investigate a research topic;
• Identify the state-of-the-art and critically evaluate the main problems and necessary steps to move forward with their research topic;
• Formulate research aims;
• Sketch a research plan;
• Undertake a literature review;
• 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 research topic;
• Produce a report, with the findings presented in a well organised and reasoned manner.

AHEP3 Learning Outcomes
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
EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes
G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities
G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD

Assessment: Report (70%)
Oral Examination (30%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Written report (70%)
Oral presentation (30%)

The report should be approximately 20-30 pages depending on the chosen MSc research topic, and the format and layout should follow the general guide provided by the module coordinator.

Page count is preferred to word count due to the nature of the content, i.e.figures, equations, etc.

The report will be electronically submitted to Canvas via Turnitin, and the online system will automatically perform similarity check.

Arranged by the supervisor, an oral examination will take place before 30th May. During the oral examination, the student is requested to give a PowerPoint presentation (no longer than 15 mins) to summarize his/her case study, followed by questions.

The written report (70%) and the oral presentation (30%) will be marked by the supervisor and another faculty member appointed by the supervisor. At the end of the oral examination, the examiners will provide technical feedback (not the final mark) on the case study.

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

Assessment Feedback: Student will be closely guided and supervised by his/her supervisor, through one-to-one tutorial meetings. In addition, technical feedback (not the final mark) will be provided to students during the oral exam.

Failure Redemption: Failure redemption is possible by the resubmission of the research case study.

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

Around 5,000 word report on the chosen MSc research topic.

Recommended Texts to be defined by supervisor according to the chosen research topic.

EG-M194 MSc Industrial Experience Preparation

Credits: 0 Session: 2023/24 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: Moderation of the entire cohort 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 Faculty of Science and 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.

EG-M23 Finite Element Computational Analysis

Credits: 10 Session: 2023/24 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%)
Resit Assessment:	Examination (Resit instrument) (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: Moderation of the entire cohort 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.

Reading List: Fish, Jacob., Belytschko, Ted,, A first course in finite elements [print and electronic book] / Jacob Fish, Ted Belytschko., John Wiley,, c2007..ISBN: 9780470035801
Chandrupatla, Tirupathi R.,, Belegundu, Ashok D.,, Introduction to finite elements in engineering / Tirupathi R. Chandrupatla, Ashok D. Belegundu., Pearson Education,, 2012.ISBN: 9780273763680
Singiresu S. Rao 1944-, The finite element method in engineering Singiresu S. Rao., Elsevier/Butterworth Heinemann, 2005.ISBN: 1280964413
O. C. Zienkiewicz, Robert L Taylor (Robert Leroy), 1934-; J. Z Zhu; O. C Zienkiewicz, The finite element method its basis and fundamentals / O.C. Zienkiewicz, R.L. Taylor, J.Z. Zhu., Elsevier Butterworth-Heinemann, 2005.ISBN: 1281016527
Zienkiewicz, O. C; Taylor, Richard Lawrence; Nithiarasu, Perumal, The finite element method for fluid dynamics by O.C. Zienkiewicz, R. L. Taylor and P. Nithiarasu., Butterworth-Heinemann, 2005.ISBN: 9780750663229
Zienkiewicz, O. C.; Taylor, Robert L. (Robert Leroy); Zhu, J. Z., The finite element method : its basis and fundamentals / O.C. Zienkiewicz, CBE, FRS, R.L. Taylor, J.Z. Zhu., 2013.ISBN: 9781856176330

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-M24 Advanced Structural Design

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-222; EG-224; EG-225; EG-328

Co-requisite Modules:

Lecturer(s): Miss X Yin

Format: Lectures 20 hours (a blend of face to face teaching and video recordings)
Example classes 10 hours (A mix of on campus classes, recorded examples and web-based live sessions will be used)
Directed private study 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

Typically, the course is delivered with a mixture of formal lectures and example classes to advanced structural design. Students will be expected to take accurate notes of all worked examples. Students are also encouraged to attend ICE and IStructE evening lectures to broaden their knowledge in the field of construction industry.

Due to restrictions as a result of the Covid-19 Pandemic, there may be limited access to on campus teaching. Thus, the theoretical lectures for EG-M24 will be delivered in a recorded lecture format, which can be accessed through Canvas. There will be some on campus example classes where possible. The on-campus example classes will be run in conjunction with recorded examples and web-based live sessions.

Module Aims: This module aims to equip students with advanced structural design concepts from first principles, such as prestressed beams, combined torsion, bending and shear, strut and tie, composite sections, fire engineering. Sustainability design considerations will be embedded in the design philosophy. How these translates into applications for projects will be explored. The module is taught in accordance with structural Eurocodes.

Module Content: Concrete Design to BS EN 1992
- Prestressed concrete beams design [7]
- Design of torsion with combination of shear in reinforced concrete structures [2]
- Strut and tie analysis [2]

Steel Design to BS EN 1993, 1994
- Design of steel-concrete composite plate girders - effective length, shear connectors, differential shrinkage effect [5]
- Connections - connection design[2]
- Fire engineering - fire resistance of steel structures [1]

Sustainable design concepts and their applications [1]

Intended Learning Outcomes: Upon completion of this module students should be able to:
• Analyse and select advanced design theories, techniques and software for the analysis and design of complicated reinforced concrete, prestressed concrete, steel structures and steel-concrete composite plate girders.
• Apply concepts of health and safety to specific design exercises such as fire engineering.
• Apply concepts of sustainable design to specific design contexts.
• Design prestressed concrete beams, steel-concrete composite plate girders and connections under complex loading.
• Use Eurocodes for safe and effective design of structural elements and systems
• Apply fundamental engineering design principles, assisted by current Eurocodes to carry out design of structure elements.
• Use engineering principles and analytical techniques, assisted by computing software in complicated structural analysis and design.

AHEP3 Learning Outcomes

MEng
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
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 implement appropriate action
D1 Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics
D2 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
D6 Communicate their work to technical and non-technical audiences
EL2 Knowledge and understanding of the commercial, economic and social context of engineering processes
EL4 Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate
EL5m Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues, and an awareness that these may differ internationally
EL6m Knowledge and understanding of risk issues, including health and safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk
P6 Understanding of appropriate codes of practice and industry standards
P8 Ability to work with technical uncertainty
G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities
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.
EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations
D2m Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations
EL2m Awareness that engineers need to take account of the commercial and social contexts in which they operate.
EL4m Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate
EL5m Awareness of relevant regulatory requirements governing engineering activities in the context of the

particular specialisatio
EL6m 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.
P1m Advanced level knowledge and understanding of a wide range of engineering materials and components.
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 (60%) Assignment 1 (20%) Presentation (20%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Assessment:
Coursework 20%
Presentation 20%
End of module exam 60%

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

Assessment Feedback: Individual oral or written feedback will be given on coursework, prior to the January examination. Examination feedback will be provided via the College of Engineering online feedback system, reflecting on the class performance as a whole to individual exam questions.

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

Reading List: Roberts, John, Structural Design : Extracts from the Structural Eurocodes for students of structural design, Bsi standards, 2010.ISBN: 0580694542
O'Brien, Eugene J.Keogh, Damien L., O'Connor, Alan J, Bridge deck analysis / Eugene J. OBrien and Damien L. Keogh (Department of Civil Engineering, University College, Dublin, Ireland), Alan J. O'Connor (Trinity College, Dublin, Ireland) ; chapter 4 written in collaboration with the authors by Barry M. Lehane (Department of Civil, Structural and Environmental Engineering, Trinity College, Dublin, Ireland)., 2015.ISBN: 1482227231
Nawy, Edward G, Prestressed concrete : a fundamental approach / Edward G. Nawy., Prentice Hall, 2010.ISBN: 0136081509
Mosley, W. H., Bungey, J. H., Hulse, Ray., Reinforced concrete design : to Eurocode 2 / Bill Mosley, John Bungey., Palgrave Macmillan,, 2012.ISBN: 9780230302853
Nowak, Andrzej SCollins, Kevin R, Reliability of structures / Andrzej S. Nowak and Kevin R. Collins., 2013.ISBN: 0415675758

Additional Notes:

This module particularly builds on the work of Year 3 structural design and mechanics modules EG-328 and EG-320. Therefore it may not be suitable for visiting and exchange students, unless student has prior knowledge of structural analysis and design equivalent to modules EG-328 and EG-320. Similarly, students entering directly to Year 4 Civil Engineering should familiarise themselves with the content of those Year 3 modules as soon as possible.

Thus, the theoretical lectures for EG-M24 will be delivered in a recorded lecture format, which can be accessed through Canvas. There will be some on campus example classes where possible. The on-campus example classes will be run in conjunction with recorded examples and web-based live sessions.

EG-M25 Advanced Structural Analysis

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-320

Co-requisite Modules:

Lecturer(s): Prof EA De Souza Neto

Format: Lectures 20 (h); Example classes 10 (h); Directed private study 70 (h)

Delivery Method: The course is delivered by means of lectures and example classes, including a number of synchronous and asynchronous online learning activities.
Course announcements, including office hours details, etc, are made via CANVAS.
Course material, including the course notes and assignment description, lecture and exercise class recordings, will be available for download from CANVAS.

Module Aims: The module develops theory and associated solution techniques relevant to structural problems related to plates, shells and solid applications. The basic theoretical concepts are firstly introduced and the underlying governing equations then developed. The first topic considered is the elastic theory of plate bending, which is of fundamental importance in the design and analysis of a large class of engineering structures. This is followed by the limit analysis of plate structures, which is of prominence in reinforced concrete design. A central aspect of the course is the treatment of the membrane analysis of shell structures. Most shell structures operate by their resistance to membrane action, rather than bending, and the course develops solution procedures for a range of practical shell structure applications encountered in both civil and mechanical engineering environments. The course concludes by developing solution strategies for structures subjected to torsion, with particular emphasis placed on the analysis of thin walled structures, such as those encountered in bridge deck construction and aerospace applications.

Module Content: • Introduction. Equilibrium conditions and the development of the governing equations for plate bending in terms of bending moments. [3]
• Constitutive law and the moment-curvature relations. Governing equations in terms of displacements. [2]
• Boundary conditions for rectangular plates. Navier's solution for simply supported rectangular plates. [2]
• Point loaded simply supported rectangular plates. Development of the governing equations for axisymmetrically loaded circular plates. [2]
• Solution of axisymmetrically loaded circular plate problems. Introduction to the limit analysis of reinforced concrete slabs. [2]
• Virtual work method and equilibrium method for the evaluation of limit loads of slabs. Orthotropically reinforced slabs. [2]
• Introduction to shell behaviour. The theory of shell action under membrane behaviour. Axisymmetrically loaded shells of revolution. [4]
• Introduction to the Linear Theory of Elasticity. [2]
• Torsion of prismatic bars. Thin-walled sections [2]
• Plane stress and plane strain linear elasticity [2]
• Axisymmetric problems. Thermal stresses [2]
• Solution of various elasticity problems [2]

Intended Learning Outcomes: Upon completion of this module students should be able to:
• Use the principles of equilibrium and compatibility, linear elastic law and the concept of generalised strains and stresses to pose well-defined boundary value problems of advanced structural analysis involving plates, shells and solids under plane strain and plane stress conditions.
• Distinguish between axial, bending, shear and torsional load carrying actions and understand how they are transferred within a structure.
• Identify and make use of appropriate methods of analysis for plates, shells and solids and compute relevant stresses and deformations in realistic structures.
• Distinguish between statically determinate and indeterminate structures.
• Identify plastic collapse mechanisms in plain/reinforced plates and compute the corresponding plastic collapse loads.
• Compute the torsional stiffness, stresses and rotations for thin-walled structures subjected to torsional loads.

AHEP3 Learning Outcomes

MEng
SM2m 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.
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
P2m Knowledge of characteristics of particular equipment, processes, or products, with extensive knowledge and understanding of a wide range of engineering materials and components.

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.

Assessment:	Examination 1 (75%) Coursework 1 (25%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Coursework 1: 1 piece of written coursework to be handed in in December..
Examination: Covering all aspects of the module.
Failure to sit an examination or submit coursework by the specified date will result in a mark of 0% being recorded.

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

Assessment Feedback: Exam: Standard College of Engineering exam feedback
Coursework: A copy of the marked/commented coursework will be returned to students for feedback.

Failure Redemption: Exam re-sits according to University regulations. 100% supplementary examination.

Reading List: Timoshenko, Stephen P, Woinowsky-Krieger, S., Theory of plates and shells / [by] S. Timoshenko [and] S. Woinowsky-Kreieger., McGraw-Hill,, 1959.
Timoshenko, Stephen P, Goodier, J. N., Theory of elasticity / [by] S.P. Timoshenko, J.N. Goodier., McGraw-Hill,, 1970.

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

This module particularly builds on the work you have done in the Year 2 Structural Mechanics 2 (a) and (b) modules as well as Year 3 Structural Mechanics 3. You should revise the topics learnt in these modules. This module also assumes that you are familiar with the basic mathematical concepts learnt in Years 1 and 2 mathematics modules.

EG-M38 Design and Analysis for Temporary Works

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof C Li

Format: Lectures: 12 hours

Project Supervision: 8 hours

Reading/Private Study: 50 hours

Preparation for Project Report and Viva: 30

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 that combines live on-campus activities each week and online activities using the Canvas Digital Learning Platform.

The module delivery consists two parts:
(1) A series of subject lectures each covering one topic of the module
(2) A series of supervised discussions and group projects

The module delivery involves strong industrial contributions, including guest lectures delivered by experienced industrial specialists and group projects jointly supervised by industrial experts.

Module Aims: The aim of the module is to gain understanding into temporary works covering broadly:
Temporary works definition
Design philosophies
Underpinning structural mechanics
Design procedure
Types of temporary works
Loads and effects
Risks
Defects and failures
Health and safety law
Internal systems
Computer software and peripherals
Economics of temporary works
Practice

Module Content: Introduction, processes and underlying engineering; why Temporary Works is a distinct discipline
Falsework, formwork, scaffolding & hoardings
Geotechnical
Underground
Marine
Moving, lifting & bridges
Projects

Intended Learning Outcomes: Students should be able:
• Develop the ability to solve practical design and analysis problems in temporary works.
• Choose and compile appropriate theoretical and computational models and tools for building optimal solutions of different types of temporary works including, foundations, site establishment and scaffolding falsework, etc.
• Build and apply practical skills related to design procedures and quality control of temporary works, minimising risk and maximising public safety.
• Plan and conduct design, analysis and monitoring tasks of temporary works in construction practice.
• Evaluate and predict Health & Safety issues and the potential risks arising from temporary works.
• Discuss issues relating to sustainability across all forms of temporary works and propose solutions to minimise impact to the environment and maximise sustainability.

AHEP3 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
EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes
EA4 Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems
EA5m Ability to use fundamental knowledge to investigate new and emerging technologies
D1 Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics
D2 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
D3m 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
D4 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
D5 Plan and manage the design process, including cost drivers, and evaluate outcomes
D7m Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations
D8m Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs
EL6m Knowledge and understanding of risk issues, including health and safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk
P1 Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.)
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
P5 Knowledge of relevant legal and contractual issues
P6 Understanding of appropriate codes of practice and industry standards
P7 Awareness of quality issues and their application to continuous improvement
P8 Ability to work with technical uncertainty
G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities
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.
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
D3m Ability to generate an innovative design for products, systems, components or processes to fulfil new needs.
EL5m Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation
EL6m 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.
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.
P3m Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints.
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

Assessment: Coursework 1 (20%)
Group Work - Project (80%)

Assessment Description: 1 x 20% continuous assessment to be completed individually.

1 x 80% group project. 3 students per group. Assessment via a group written report and group oral presentation.

Engagement will be monitored and will form part of the assessment for the group project.

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

Assessment Feedback: Feedback for the continuous assessment questions will be delivered online.

Feedback for the group project will be given verbally to each group following the oral presentation.

Failure Redemption: There is no opportunity to redeem a failure in this module due to the nature of the work (group work).

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

Available to Visiting Students

EG-M39 MSc Industrial Experience

Credits: 60 Session: 2023/24 Academic Year

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr V Samaras

Format: 10 hours introductory teaching
28 hours individual supervision meetings
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

There will be an intensive period of taught delivery, covering the roles of a professional engineer, health and safety, environmental and ethical concerns, working practices and project / time / resource management.
This will be followed with an industrial experience placement either spent entirely in the University on a collaborative project within the University with shorter industrial site visits or partly within paid industrial employment with close supervision from the University supervisor.

Module Aims: This module provides industrial experience within an Engineering context in the UK. The experience will be gained through a 32 week industrial placement, at least part of which will be spent within the University on a collaborative R&D project undertaken with significant industrial collaboration. Some of the placement may be spent in a paid industrial role in some cases. The module will be assessed on a pass / fail basis against criteria matching the some of the Engineering Council's requirements for professional engineering recognition in the UK.

Module Content: Prior to the placement a number of pre-placement sessions will take place in order to provide further explanation on

Health and Safety assessment.
Placement academic requirement

This will be followed by industrial experience which will extend these abilities in real-world environments. The industrial experience will be guided by an academic supervisor with interaction on a regular basis.

Intended Learning Outcomes: A knowledge and understanding of:
The working environment in an Engineering context

An ability to:
Apply their developed knowledge to an industrial project(s)
Work independently and/or as a member of a team
Make a significant contribution to the project(s)

Learning Outcomes (AHEP)
- 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 (SM9m/SM3fl)
- Ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D11m/D3fl)
- 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 (EL13m/ET6fl)
- Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints (P10m/EP3fl)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

Assessment:	Report (20%) Report (60%) Poster (20%)

Assessment Description: Assessment will be via three pass / fail components. These will comprise:

1 Placement Report: The student is expected within the first few months of the placement to complete a report which includes an overview health and safety as well as his/her main responsibilities in the placement.

2 Final Placement Report: This report summarise the students year in industry placement/ project experience. The report will include a reflective section covering the student's role in the engineering placement / project, highlighting their personal initiative and their role in the evaluation of new engineering concepts.

3 Recorded Presentation: Every student is expected to record and submit through canvas a maximum 5 minutes PowerPoint presentation video summarising his/her MSc Year in Industry placement.

A number of formative assessments will be assigned during the course and based on the nature of student placement/ project.

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

Assessment Feedback: Individual written feedback will be provided for components 1 to 3 above. Verbal feedback on the presentation will be provided.

Failure Redemption: Resubmission of any failed component by August of year 2.

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 Faculty of Science and Engineering.

EG-M87 Coastal Engineering

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG223; EG321; EGA331

Co-requisite Modules:

Lecturer(s): Prof DE Reeve

Format: Group sessions 3 hours/week (lectures and examples class)
Directed private study 6 hours per week
Office hour

Delivery Method: * 2 hours of lectures;
* 1 hour examples class;
* a weekly office hour, in which the module director will be available for general module-related Q&A.

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

Learning materials will be provided on the module pages within Canvas.These will include lecture notes, worked examples, reference papers, reports, industry guidance manuals. This will be the asynchronous component of the module and students will be provided guidance on what materials they should be covering on a week-by-week basis in the Module Guidance document located in the Module directory 'Module Guidance' in Canvas. Students are expected to devote approximately 6 hours per week to mastering the asynchronous material.
Assessment will be through a final exam (100%).

Module Aims: This is the main module on the subject of coastal engineering. The module provides the background for undertaking detailed design of coastal flood defences and coastal protection schemes. It covers random waves, tides and littoral processes, as well as some of the more commonly used design equations. It includes introduces wider issues such as computational modelling of the coast and the impacts of climate change on design. The programme will consist of a series of lectures and problems classes to study worked examples.

Module Content: Indicative syllabus -

Introduction: conceptual design for coastal defence; sustainable shoreline management in the UK; overview of design process.
Short term wave statistics: Rayleigh distribution; time domain parameters and analysis
Characteristics of wind waves and swell; concept of a random sea.
Time and frequency domain parameters, Rayleigh distribution, energy and directional spectra. Introduction to principles of frequency analysis.
Water level variations: tides and surge; harmonic analysis; tidal harmonics.
Long term wave statistics: Extreme events; extreme distributions; calculating extremes
Design wave specification
Design event specification
Flood defences: Types & materials (embankments, revetments and seawalls); wave overtopping; formulae and methods; design criteria.
Littoral sediment transport
Beach models: mathematical and computational
Coastal protection: Types & materials (revetments, groynes, breakwaters); soft engineering options (renourishment, recycling); beach modelling.

Intended Learning Outcomes: Upon completion of this module students should be able to:

• Identify the main categories of coastal defence schemes, their characteristics and their place in wider coastal management practice.
• Use the descriptors of random waves in defining the design wave.
• Apply the basic elements of tidal theory and harmonic analysis.
• Classify the tidal type from the amplitudes of tidal harmonics, and estimate tidal range and main tide levels.
• Determine non-tidal contributions to water level from empirical formulae.
• Calculate wave overtopping volumes.
• Calculate armour requirements.
• Perform calculations for preliminary design of simple sea defences.
• Identify the main options for coastal protection schemes.
• Identify sustainability and 'Soft' engineering options and methods in the context of coastal engineering problems.

AHEP3 Learning Outcomes

MEng
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
SM5m A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations
EA6m Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems
G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities
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.
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
D2m Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations
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 (100%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Exam, marks awarded out of 100 (4 questions each worth 25 marks), January.

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

Assessment Feedback: Feedback on examinations in the normal manner.

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

Reading List: Dominic Reeve (Dominic E.), author., Andrew Chadwick 1960- author.; Christopher Fleming (Christopher A.), author., Coastal engineering : processes, theory and design practice / Dominic Reeve, Andrew Chadwick, and Christopher Fleming., Boca Raton : CRC Press is an imprint of the Taylor & Francis Group, an Informa business, 2018.ISBN: 9781351165501
Dominic. Reeve, Andrew Chadwick 1960-; Christopher Fleming, Coastal engineering : processes, theory and design practice / Dominic Reeve, Andrew Chadwick and Christopher Fleming., Spon Press, 2012.ISBN: 9780415583534
R. S. Thomas author., B. Hall (Brian) author., Seawall design / R.S. Thomas and B. Hall., Construction Industry Research and Information Association, Butterworth-Heinemann, 1992.ISBN: 9781483163239
Robert G. Dean (Robert George), 1930-2015., Robert A. Dalrymple 1945-, Coastal processes with engineering applications / Robert G. Dean, Robert A. Dalrymple., Cambridge University Press, 2002.ISBN: 1107112656
Robert M. Sorensen 1938-, Basic coastal engineering / Robert M. Sorensen., Wiley, 1978.
J. W. Kamphuis, Introduction to coastal engineering and management / J. William Kamphuis., World Scientific, 2010.ISBN: 9789812834843
Robert Kay (Robert C.), Jackie Alder 1954-, Coastal planning and management Robert Kay and Jackie Alder., E & FN Spon, 1999.ISBN: 0429214650
Bill Carter (R. W. G.), Coastal environments / R.W.G. Carter., Academic, 1988.ISBN: 0121618560
Esteban, Miguel ; Takagi, Hiroshi ; Shibayama, Tomoya, Handbook of Coastal Disaster Mitigation for Engineers and Planners, Elsevier Science & Technology, 2015.ISBN: 9780128010600
Barbara Zanuttigh editor., Coastal risk management in a changing climate / edited by Barbara Zanuttigh [and four others]., Kidlington, England : Butterworth-Heinemann, 2015.ISBN: 0123973317
Young C Kim, Coastal and ocean engineering practice edited by Young C. Kim., World Scientific, 2012.ISBN: 1281603570
Peter W. French 1964-, Coastal and estuarine management Peter W. French., Routledge, 1997.ISBN: 1282778498
Coastal Education & Research Foundation (U.S.), Journal of coastal research., Coastal Education and Research Foundation, 1985.ISBN: 15515036
Coastal engineering, Elsevier Scientific Pub. Co., 1977.ISBN: 18727379
American Society of Civil Engineers.; American Society of Civil Engineers. Waterway, Port, Coastal and Ocean Division., Journal of waterway, port, coastal, and ocean engineering / American Society of Civil Engineers., The Society, 1983.ISBN: 0733950X
Estuarine and Brackish-water Sciences Association.; Estuarine and Coastal Sciences Association.; Estuarine and Coastal Sciences Association. Symposium., Estuarine, coastal and shelf science., Academic Press in association with the Estuarine and Brackish-water Sciences Association, 1981.ISBN: 02727714

Additional Notes: Delivery of both teaching and assessment will be on-campus.

A background knowledge of coastal processes and soil mechanics is assumed. The material covered in EG223, EG321 and EGA331 provides this.
Available to visiting and exchange students with suitable pre-requisite knowledge

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

EG-M92 Finite Elements for Civil Engineers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof EA De Souza Neto

Format: Lectures 2 hours per week
Example classes 1 hour per week
Laboratory work 12 hours in total

Delivery Method: The module is delivered by lectures, example classes and computer-based laboratory sessions, which will be included in a number of synchronous and asynchronous online activities.
Lectures, example/lab class video recordings will be made available to students.
Communication and course announcements, including office hours details, will be made via CANVAS.
Course materials, including the course notes and Matlab computer programs will be available for download from CANVAS.

Lectures and examples: 3 hours per week
Laboratory work: 12 hours in total
Directed private study: 3 hours per week

Module Aims: This module provides an introduction to the Finite Element Method of analysis. The material delivered in this module is of particular relevance to civil engineers, with focus on the analysis of structural mechanics and groundwater flow problems. Both theory and its application are covered, including elements of Matlab programming in this context and the use of commercial finite element software of widespread use in industry.

Module Content: Introduction to finite element theory and application. [1]

Origins of finite element methods. Trial solution procedures: 1D axially loaded bar problem; Polynomial approximation; Point collocation, least squares and Galerkin methods. Examples. [3]

Finite elements for the 1D axially loaded bar problem: Galerkin finite element method; Strong and weak forms of differential equations; Shape functions; Load vector; Stiffness matrix; Assembly procedure and system solution; Solution refinement; Matlab code; Examples. [6]

2D seepage flow models: The physical problem and the differential equations; Weak form; Galerking FE method; The linear triangle finite element; Shape functions, load vector and stiffness matrix; Assembly procedure and system solution. Matlab code; Examples. [6]

2D truss models: Finite element formulation; Assembly and system solution; Matlab code; Examples. [3]

2D elasticity models: Plane stress and plane strain states. Finite element procedure. Weak form and FE discretisation. Assembly procedure and system solution. Solution of realistic problems with commercial FE software. Examples. [8]

Revision [3]

Intended Learning Outcomes: Technical Outcomes
Upon completion of this module, the student should be able to:
1. Solve simple problems of structural mechanics and seepage flow by hand using the Finite Element Method;
2. Convert a realistic structural mechanics/groundwater flow engineering problem into a model suitable for FE analysis;
3. Create Matlab code for FE-related operations and incorporate it into an FE analysis program;
4. Use commercial finite element software to set up and analyse more complex/realistic structural mechanics and seepage flow problems.

Accreditation Outcomes (AHEP)
SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.
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.
P1m Advanced level knowledge and understanding of a wide range of engineering materials and components.
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 (60%) Assignment 1 (15%) Assignment 2 (25%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: 1. Assignment 1: Analysis of 2D seepage flow problems using a Matlab computer code (15%).

2. Assignment 2: Analysis of 2D truss and elasticity problems using both Matlab and commercial FE software (25%).

3. Final examination: Open-book exam covering all aspects of the module (60%).

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

Assessment Feedback: Assignments 1 and 2 are submitted via CANVAS. Individual student feedback will be provided through CANVAS.
An overall feedback on the final examination will be given, following the College of Engineering standard exam feedback format.

Failure Redemption: Students are only permitted to redeem a failure as per University regulations. If you are eligible for a resit examination this will take the form of a 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 for late submission of continuous assessment assignments: zero tolerance - no marks awarded for late submissions.

Available to visiting and exchange students.

EGEM00 Transportation Engineering

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr Y Hou

Format: Lectures: 2 hours per week for 10 weeks
Example classes: 1 hour per week for 10 weeks
Office hours: 1 hour per week for 10 weeks

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

Module Aims: This module will deliver advanced knowledge, governing equations, and computation skills in transportation engineering. The tradition design, construction, evaluation and maintenance of major transportation infrastructures, including roads and railways, will be introduced. The improvement and rationality on the sustainable design, construction, evaluation and maintenance of the transportation infrastructures to mitigate the climate emergency will also be introduced. The state-of-the-art machine learning-, material characterisation-, and advanced sensing- relevant research in transportation engineering will be introduced at master level.

Module Content: 1. Traditional and advanced transportation engineering
1.1 Transportation and infrastructures including road, railway, bridge, airway, etc.
1.2 Traditional design, construction, and service in transportation engineering
1.3 Advanced design, construction and service to mitigate the climate emergency

2. Road infrastructures
2.1 Highway design and construction
2.2 Superpave design
2.3 Engineering applications

3. Flexible pavement: construction and maintenance
3.1 Optimal design and construction under normal conditions/extreme weather conditions
3.2 Maintenance services
3.3 Machine learning in flexible pavement
3.4 Advanced sensing in flexible pavement

4. Rigid pavement: construction and maintenance
4.1 Optimal design and construction under normal conditions/extreme weather conditions
4.2 Maintenance services
4.3 Machine learning in rigid pavement
4.4 Advanced sensing in rigid pavement

5. Major distresses in roads
5.1 Summary of major distresses
5.2 Traditional maintenance approaches
5.3 Advanced maintenance methods, including AI and bio-materials

6. Railway infrastructures
6.1 Ballasted railway and infrastructures
6.2 High-speed railway and infrastructures
6.3 Intelligent construction and maintenance of railway infrastructures

Intended Learning Outcomes: Upon completion of the module, students should gain a comprehensive understanding and critical awareness of the following topics, with the ability to apply suitable analysis and problem solving skills where appropriate:

- Transport and typical transportation infrastructures
- Design, construction and service
- Machine learning in transportation engineering
- Advanced sensing in transportation engineering
- Road material and structure design in the Europe, USA and rest of the world
- Design of flexible pavement and rigid pavement
- Measures to mitigate the climate emergency in road engineering
- Ballasted railway and infrastructures
- High-speed railway and infrastructures
- Intelligent design, construction and maintenance in transportation

Accreditation Outcomes (AHEP)
- A comprehensive understanding of the relevant scientific principles of the specialisation (SM1m)
- A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2m)
- 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 (SM3m).
- Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA1m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA2m)
- 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 (D1m)
- Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D2m)
- Awareness of the need for a high level of professional and ethical conduct in engineering (EL1m)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL2m).
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL4m)
- Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (EL5m)
- Advanced level knowledge and understanding of a wide range of engineering materials and components (P1m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P2m)
- Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)
- Monitor and adjust a personal programme of work on an on-going basis (G3m)

Assessment:	Assignment 1 (20%) Examination 1 (60%) Project (20%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: 1. Assignment 1: homework on asphalt properties, traffic calculation, etc. (20%)
2. Project essay: essay on maintenance approach and methods on distresses on transportation infrastructures (20%)
3. Final examination: closed book exam, covering all aspects of the module (60%)

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

Assessment Feedback: Throughout the term, students will receive oral feedback during practical classes and after lecture classes. Assignments 1 & 2: (Submitted via Canvas) - Feedback provided via Canvas with office hours for further verbal feedback. Project essay (Submitted via Canvas) - Feedback provided via Canvas with office hours for further verbal feedback. A standard examination feedback form will be available to 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.
Where possible learning will be reinforced by guest lectures from practicing civil engineers and site visits.
Students are also recommended to attend relevant ICE and IStructE evening lectures.

EGEM07 Fluid-Structure Interaction

Credits: 10 Session: 2023/24 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%)

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

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: 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 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.

Reading List: Blevins, Robert D., Flow-induced vibration / Robert D. Blevins., Krieger Pub. Co.,, 2001 [1990].ISBN: 9781575241838

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

EGIM03 Solid Mechanics

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof D Peric

Format: 2 Lectures and 1 Example Class per week. Directed private study 3h per week.

Delivery Method: Two lectures and one example class per week.
Assessment: 70% from end of teaching block 2 hour examination; 30% from 3 small assignments.

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: • 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. [3]
• 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. [3]
• 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. [3]
• 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. [4]
• Solution of Selected Problems I: Torsion of a Cylindrical Bar. [5]
• Solution of Selected Problems II: 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. [6]

Intended Learning Outcomes: Students should be able to:
• Apply the fundamentals of solid mechanics to problems of elasticity.
• Formulate engineering problems in solid mechanics by considering geometry, equilibrium and constitutive theory.
• Use tensor calculus in the formulation and solution of solid mechanic problems.
• Perform analysis of torsion of arbitrary cross-section.
• Perform analysis of 2-D plane strain and plane stress engineering problems.
• Recognise situations in which closed form solutions are not feasible in solid mechanics, and approximation techniques are necessary.

Accreditation 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
P1 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%)
Resit Assessment:	Examination (Resit instrument) (100%)

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: Moderation of the entire cohort as Check or Audit

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: Exam re-sits according to university regulations.
Normally, supplementary examination will form 100% of the module mark.

Reading List: Peric, D., Introduction to Solid Mechanics, Swansea University, lecture notes, 2009.
Timoshenko, Stephen P, Goodier, J. N., Theory of elasticity, by S.P. Timoshenko and J.N. Goodier., McGraw-Hill,, 1970.ISBN: 0070858055
Gurtin, Morton E., An introduction to continuum mechanics / Morton E. Gurtin., Academic Press,, 1981.ISBN: 9780123097507
Shames, Irving Herman,, Cozzarelli, Francis A.,, Elastic and inelastic stress analysis / Irving H. Shames and Francis A. Cozzarelli., Prentice Hall,, 1992.

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.

EGIM06 Computational Fluid Dynamics

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

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

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: Moderation of the entire cohort 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.

Reading List: Ch. Hirsch, Numerical computation of internal and external flows: fundamentals of computational fluid dynamics / Charles Hirsch., Elsevier/Butterworth-Heinemann, 2007.ISBN: 9780080550022
Hirsch, Charles., Numerical computation of internal and external flows. Volume 1, Fundamentals of numerical discretization / Charles Hirsch., John Wiley & sons,, 1988.ISBN: 9780471917625
Hirsch, Charles., Numerical computation of internal and external flows. Volume 2, Computational methods for inviscid and viscous flows ; Charles Hirsch., John Wiley & sons,, c1990..ISBN: 0471924520
O. C. Zienkiewicz author., Robert L Taylor (Robert Leroy), 1934- author.; Perumal Nithiarasu author., The finite element method for fluid dynamics / O. C. Zienkiewicz, R. L. Taylor, P. Nithiarasu., Oxford : Butterworth-Heinemann, 2014.ISBN: 9781856176354
R. W. Lewis (Roland Wynne), Perumal Nithiarasu; K. N Seetharamu, Fundamentals of the finite element method for heat and fluid flow / Roland W. Lewis, Perumal Nithiarasu, Kankanhalli N. Seetharamu., Wiley, 2004.ISBN: 9780470847893
1. P. Nithiarasu, R.W. Lewis and K.N. Seetharamu, Fundamentals of the finite element method for heat, mass and fluid flow.ISBN: 978-1-118-53543-1

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.

EGIM07 Dynamics and Earthquake Analysis of Structures

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-260

Co-requisite Modules:

Lecturer(s): Prof Y Feng

Format: Lectures & Example classes (30h); Directed private study (30h)

Delivery Method: Mixture of online lectures (live + recorded), face-to-face activities and unscheduled one-to-one (online) tutorials

Module Aims: This module aims to develop the understanding and skills necessary to analyse linear structures under general dynamic, including earthquake loading, and to understand the use of time stepping schemes for linear dynamic and transient problems.

Module Content:

• Introduction: Dynamic effects on structures, Engineering disasters, design issues. [1]

• Single Degree of Freedom Problems (SDOF): the SDOF spring-mass system, equivalent SDOF structures - energy method, analytical solution of SDOF problems, step by step solution methods, earthquake loading, response and design spectra, Eurocode- 8 elastic spectrum. [15]

• Multiple Degree of Freedom Problems: natural modes and frequencies of vibration, modal decomposition, reduction methods, earthquake loading, shear building model, design considerations. [9]

• Distributed Mass Systems: finite element discretisation and formulations. [4]

• Revision [1]

Intended Learning Outcomes: On the completion of the module, students are expected to be able to:

• Evaluate potential disastrous consequences of structural failures under dynamic loadings, such as strong wind, wave and particularly earthquakes.
• Apply the Rayleigh method to simplify a complex structure to a SDOF system; perform earthquake analysis of SDOF systems and apply knowledge of basic dynamic concepts of SDOF systems such as dynamic magnification, resonance and damping.
• Follow Eurocode-8 to conduct elastic earthquake analysis of a regular-shaped multi-story frame structure.
• Use a computer language to analyse the accuracy and stability of the Newmark integration method, and generate an earthquake spectra, based on which to conduct an earthquake analysis of a multi-story building.
• Determine Rayleigh vibration shape functions for simple structures.
• Distinguish between stiffness/mass/damping-dominated problems.
• Identify dynamic loading on bridges, footbridges, floors, etc. resulting from moving loads or rhythmic activities.

AHEP3 Learning Outcomes

MEng
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
EA4 Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems.
D6 Communicate their work to technical and non-technical audiences.
EL4 Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate.
P4 Understanding of the use of technical literature and other information sources.
P6 Understanding of appropriate codes of practice and industry standards.
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.

MSc
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
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
P2m Knowledge of characteristics of particular equipment, processes or products, with extensive knowledge and understanding of a wide range of engineering materials and components
G1 Apply their skills in problem solving, communication, information retrieval, working with others 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 (40%) Project (60%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Exam - 40%

Project - 60%

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

Assessment Feedback: Offer one-to-one sessions to discuss the student's individual project; and use the College's standard module feedback procedure to provide the students with issues associated with the final examination.

Failure Redemption: 1. Students can redeem their failure by taking a supplement exam in August.
2. If students passed the exam component, but failed the individual project, the students have an option to redo the project without taking the supplementary exam.

Reading List: European Union, Eurocode-8 Part 1.
Chopra, Anil K., Dynamics of structures : theory and applications to earthquake engineering / Anil K. Chopra., Prentice Hall,, c2012..ISBN: 9780132858038
Anil K. Chopra author., Dynamics of structures : theory and applications to earthquake engineering / Anil K. Chopra., Harlow : Pearson Education, 2014.ISBN: 9780273774242
Clough, Ray W.,, Penzien, Joseph., Dynamics of structures / Ray W. Clough, Joseph Penzien., McGraw-Hill,, c1993..ISBN: 0071132414
Maguire, J. R., Wyatt, Tom,, Dynamics : an introduction for civil and structural engineers / J.R. Maguire and T.A. Wyatt., Thomas Telford,, 2002.ISBN: 9780727731388

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

Assessment: Written, open book, examination (2 hrs) at the end of Semester 1 accounts for 60% of the marks, the remaining 40% are awarded to an individual project, for which students are expected to solve a dynamical problem using Excel/Matlab etc and write a technical report on their findings. Penalty for late submission of course work is zero mark in the course work.

The detail of the individual project will be provided at the beginning of the course.

EGIM08 Plasticity in Structural and Geotechnical Engineering

Credits: 10 Session: 2023/24 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%)
Resit Assessment:	Examination (Resit instrument) (100%)

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: Moderation of the entire cohort 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.

Reading List: Neto, Eduardo de Souza., Peric, Djordje, Owens, David,, Computational methods for plasticity : theory and applications / Eduardo de Souza Neto, Djordje Peric, David Owens., Wiley,, 2008.ISBN: 9780470694527
J. C. Simo (Juan C.), 1952-, Thomas J. R Hughes, Computational inelasticity / J.C. Simo, T.J.R. Hughes., Springer, 1998.ISBN: 9780387975207
Lubliner, Jacob., Plasticity theory / Jacob Lubliner., Dover Publications,, 2008.ISBN: 9780486462905
Owen, D. R. J., Hinton, E., Finite elements in plasticity : theory and practice / [by] D.R.J.Owen [and] E. Hinton., Pineridge Press,, 1980.
O. C. Zienkiewicz 1921-2009, R. L Taylor (Robert Leroy), 1934- author.; D. D Fox (David Dean), The finite element method for solid & structural mechanics / O.C. Zienkiewicz, R.L. Taylor, D.D. Fox., Amsterdam : Elsevier/Butterworth-Heinemann, 2014.ISBN: 0080951368
O. C. Zienkiewicz author., Robert L Taylor (Robert Leroy), 1934- author.; David Fox author., The finite element method for solid and structural mechanics / O.C. Zienkiewicz, R.L. Taylor and D.D. Fox., Oxford : Elsevier/Butterworth-Heinemann, 2014.ISBN: 9781856176347
Crisfield, M. A., Non-linear finite element analysis of solids and structures / M.A. Crisfield. Vol 1, Essentials., John Wiley,, 1991,.

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.

EGIM16 Communication Skills for Research Engineers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr SA Rolland, Dr T Lake

Format: Lectures (15h), Exercises (15h), Reading / Private Study (30h), Preparation for Assessment (40h)

Delivery Method: The module will be delivered on campus and partially online.

Module Aims: Communication at a research level differs from that at the undergraduate level in that it is usually driven by an output or result rather than the requirement to show knowledge or understanding. The skill of a good communicator at research level lies in efficiently and rigorously conveying the ideas behind the theory and proof of the research output. Verbal, written and visual communication will be explored through a series of lectures and formative exercises.

Module Content: Background to Communication:
• Academic misconduct and research publication ethics.
• Fundamentals of communication.
• Critical thinking in research.

Written Communication:
• The usual layout of reports, theses, journal & conference papers.
• How to write a good abstract for a research output.
• What should be in the introduction?
• Contents of the main body of a research output.
• Effective conclusions
• Writing style
• Cross-referencing, captions, references
• Critical review of self and others
• Design concepts for research posters

Oral Communication:
• The usual layout of a research presentation
• Slide design for a research presentation
• Delivery of a presentation
• Audience engagement.

Intended Learning Outcomes: Technical Outcomes:
By the end of this module the student will be able to:
• Write a paper or equivalent employing the structure and rigour required at research level (assessed by assignments 1 and 4)
• Efficiently communicate the concepts associated with complex ideas (assessed by the first written assignment and the oral presentation)
• Critically evaluate a written output (assessed within the second assessment component)
• Verbally present a complex idea using the presentation structure, slide content and delivery techniques expected of a research engineer (assessed through the oral presentation)

Accreditation Outcomes (AHEP)
- Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M / ET1fl)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M / ET2fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9M / EP2fl)

Assessment: Assignment 1 (30%)
Oral Examination (50%)
Writing (20%)

Assessment Description: The first sit assessment will consist of 3 assignments.

The first assessment component will be a written piece, which will test the students' understanding of the literature-based research process, test their ability to articulate the findings, and draw relevant, well-supported conclusions. This is an individual piece of coursework. This assignment is a precursor to assignment 3 (article).

The oral examination will involve the students presenting the outcome of their chosen research topic (literature-based only, no original research requirement in the module), through an oral presentation. The target duration of the oral presentation will usually be between 8 to 10 minutes. The exact duration will be specified in the assignment descriptor. This is an individual piece of coursework.

The final, third, component will require the student to write a technical article or equivalent. This paper will be between four to five pages in length and will be written to a format described in the assignment descriptor. This is an individual piece of coursework.

The pass mark for a module at Level 4/M is 50%. In addition to this Students must achieve at least 40% in the Oral Examination AND 40% in the Writing assessment to pass the module.

The reassessment will consist of 2 assignments, detailed in a further section.

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

Assessment Feedback: CANVAS will be used to provide individual feedback to the students on all the components that contribute to the final mark. For the first assessment component a class feedback document is also generally included on CANVAS.

As part of the practical sessions the students will receive verbal feedback on their performance. These sessions do not contribute to the final mark.

Failure Redemption: Candidates shall be given one opportunity to redeem a failure in the module during the summer supplementary period.

In addition, the 40 % oral and written assignments of the first must be passed individually to pass the module, and will have to be redeemed even if a pass mark is achieved for the module overall on first sit. A pass mark on both main assessment components will be required to pass the module.

All components are redeemable individually in the event of failure across the module. Students may be required to take supplementary examination of examined components they have already passed if the combination of marks is such that the module may be failed.

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

All lectures and course material will be provided on CANVAS.

The pass mark for a module at Level 4/M is 50%. In addition to this Students must achieve at least 40% in the Oral Examination AND 40% in the Writing assessment to pass the module.

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

2-year MScs with Industry - Student FAQs

<table>
<tr><td>1.Which courses will be offering 2-year MSc with Industry</td><td>a. MSc Electronic and Electrical Engineering with Industry
b. MSc Materials Engineering with Industry
c. MSc Mechanical Engineering with Industry
d. MSc Computational Engineering with Industry
e. MSc Civil Engineering with Industry
f. MSc Structural Engineering with Industry
g. MSc Virtual Reality with Industry</td></tr>
<tr><td>2. What is the Course break down:</td><td>
<table>
<tr><th>Year</th><th></th><th>Credits</th><th>Description</th></tr>
<tr><td>1</td><td>Taught Modules</td><td>120</td><td>As per existing MSc</td></tr>
<tr><td>1</td><td>EG-M194 Preparatory Module</td><td>0</td><td>EG-M194 MSc Industrial Preparation - A pre-placement module providing support and guidance.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>2</td><td>Module dissertation

EG-D05
EG-D06
EG-D03
EG-D04
EG-D12
EG-D13</td><td>60</td><td>Same as existing 1-year MSc dissertation. Deadline is September 30th, or if a student resit examinations then the deadline extended to December 15th.
Dissertation projects can be assigned before placements are secured so students may complete the two elements separately.
If a placement is secured in time to undertake the dissertation and the industrial experience within the same placement then this will be possible.</td></tr>
<tr><td>2</td><td>EG-M39 Industrial experience module</td><td>60</td><td>32 weeks of industrial experience. This can either be with a paid industrial placement, or via an internal placement at the University.

In some cases, the entire 32 weeks will be based at the University and in others it could be based entirely in Industry. All students placed in Industry will be under close guidance of academic staff at Swansea.

The industrial experience module (EG-M39) will be assessed with three components on a pass / fail basis, and the learning outcomes and assessment will be closely linked to the requirements of professional engineering accreditation.</td></tr>
<tr><td colspan="4">Total Credits 240</td></tr>
</table>
</td></tr>
<tr><td>3. Who will be providing support to me during my placement?</td><td>The academic coordinator of the ‘with Industry’ programme will oversee the support and monitoring. They will also act as supervisor for the industrial experience module and they guide students via weekly interactions. Attendance will be monitored by the academic supervisor, in conjunction with the placement company as relevant. UKVI requirements will be met with regular meetings with the supervisor (face to face). There will also be resource within Academic Registry to monitor the students in Year 2 to ensure UKVI compliance.</td></tr>
</table>

4. Are there any conditions for progression to Year 2?:	To remain on the MSc with Industry, students will need to have successfully completed Part 1 and to have secured an appropriate placement(s). Any student who does not meet these criteria will be transferred to the normal one-year MSc.
5. What about my Visa?	Swansea University will support the application for a 2-year Visa.
6. What are the entry requirements	Entry requirements for the 2-year MSc schemes will be a 2:1 in a relevant degree (higher than the 1-year MSc entry requirement).
7. What is the application process?	Intake will be capped at 10 students per MSc and we are anticipating high demand. If we cannot offer the 2-year MSc we may be able to offer the existing 1-year MSc courses.
8. Will I be able to work alongside my study?	You will be able to work for 20 hours per week on top of the MSc.
9. How will I secure a placement?	Where possible, placements will be secured in advance of recruitment. Some placement opportunities will be available as students apply and competitive applications against these will take place. The remaining placement projects will need to be secured by students with support of University staff and this process will take place during October – June of the first year.
10. Is my placement guaranteed?	No. It is the responsibility of the student to secure a suitable placement with the assistance of University staff. Any student who does not meet these criteria will be transferred to the normal one-year MSc working to the same dissertation deadline as the 1-year MSc.
11. What is the course timeline?	**YEAR 1**

Sept – June	Year 1 Taught Modules (120 credits) and also alongside this MSc Industrial Experience Preparation module (EG-M194). The pre-placement sessions will take place to prepare you ahead of the placement and will cover academic requirements that you will have to fulfil during your time in industry.
Oct – June	Process to apply for and secure placement/s (subject to successful completion of Part 1 in June)
June/August	Exams and check point for Part 1 completion. - If you've passed all modules (no toleration allowed) - Board confirmation of completion of Part 1. - Board confirmation of placement secured. If both confirmed, then you can proceed to dissertation and placement year. If placement has not been secured, then you will be transferred to standard 1-year MSc and submit the dissertation in line with the deadline. If Part 1 is not completed due to academic failure, then you will fail the degree. You may be awarded a post-graduate certificate as an exit qualification.

	YEAR 2	
	Y2 June – September	Part A: Dissertation (60 credits): September submission: Learning outcomes and assessment as per 1-year MSc dissertation. Part B: Industrial experience - module EG-M39 (60 credits): 32 weeks of industrial experience Assessment points (Three pass/fail components): 1 - Placement Report: The student is expected within the first few months of the placement to complete a report which includes an overview health and safety as well as your main responsibilities in the placement (December 20%) 2 - Final Placement Report: This report summarises the students year in industry placement/ project experience. The report will include a reflective section covering the student's role in the engineering placement / project, highlighting their personal initiative and their role in the evaluation of new engineering concepts (May 60%) 3 - Recorded Presentation: Every student is expected to record and submit through Canvas a maximum 5-minutes PowerPoint presentation video summarising your MSc Year in Industry placement (May 20%)

12. What happens if I pass Part 1 but have not secured a suitable placement or project?	You will be transferred to the standard 1-year MSc Course and have until September to complete the dissertation. If you were required to undertake resit examinations the dissertation deadline will be moved on to December.
13. What happens if I fail to complete Part 1 by June?	You will be entered in for resit examinations for the taught modules will take place in August and you will have until December to complete your dissertation.
14. What happens if I fail to complete Part 1 following resits in August?	If you fail to pass all August resists, then you will fail the degree. You may be awarded a post-graduate certificate as an exit qualification.
14. What happens if I fail any of Year 2 assessments	You will have one opportunity to repeat or resubmit assessment (capped at 50%). These must be completed by August of Year 2, so within the UKVI time allowance. If you fail any repeat / resubmission, then you will fail the degree and may be awarded a post-graduate certificate as an exit qualification.
15. What happens if I drop out of Year 2 at any point in Year 2?	Drop out will result in failure of the degree. You may be awarded a post-graduate certificate as an exit qualification. If student has valid extenuating circumstances Extensions may be applied / deferred fairly and extensions to UKVI time allowance will be sought on an individual basis
16. What if I don't complete the Industrial Module (EG-M39)?	Failure to complete the industrial experience module (EG-M39) will lead to failure of the degree, even if the dissertation module has been passed. After June of Year 1, there will be no scope to transfer from the 2-year MSc to the 1-year MSc equivalent.