Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

STUDENT HANDBOOK

MSc (FHEQ LEVEL 7)

MSC CIVIL ENGINEERING JANUARY DEGREE PROGRAMME

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

DISCLAIMER

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

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

It should be noted that not every module listed in this handbook may be available every year, and changes may be made to the details of the modules. You are advised to contact the Faculty of Science and Engineering directly if you require further information. It is likely that the module descriptors for the September-January modules will be updated by module coordinators later in the year.

The 22-23 academic year begins on 19 September 2022

Full term dates can be found here

DATES OF 22-23 TERMS

19 September 2022 – 16 December 2022

9 January 2023 – 31 March 2023

24 April 2023 – 09 June 2023

SEMESTER 1

19 September 2022 – 27 January 2023

SEMESTER 2

30 January 2023 – 09 June 2023

SUMMER

12 June 2023 – 22 September 2023

IMPORTANT

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

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

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

policy and this can be found on the Community HUB on Canvas, under Course Documents.

Welcome to the Faculty of Science and Engineering!

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

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

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

At Swansea University and in the Faculty of Science & Engineering, we believe in working in partnership with students. We work hard to break down barriers and value the contribution of everyone. Our goal is an inclusive community where everyone is respected, and everyone's contributions are valued. Always feel free to talk to academic staff, administrators, and your fellow students - I'm sure you will find many friendly helping hands ready to assist you.

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

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

Professor Johann (Hans) Sienz
Interim Pro-Vice Chancellor/Interim Executive Dean
Faculty of Science and Engineering

Faculty of Science and Engineering	
Interim Pro-Vice Chancellor/Interim Executive Dean	Professor Johann Sienz
Head of Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Paul Holland
School of Aerospace, Civil, Electrical, General and Mechanical Engineering **Head of School: Professor Antonio Gil**	
School Education Lead	Professor Cris Arnold
Head of Civil Engineering	Professor Eduardo De Souza Neto
Civil Engineering Programme Director	Dr Clare Wood
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 9am-5pm.

The **Student Support Team** provides dedicated and professional support to all studentsin the Faculty of Science and Engineering. Should you require assistance, have any questions, be unsure what to do or are experiencing difficulties with your studies or in your personal life, our team can offer direct help and advice and also signpost you to further sources of support within the University. There are lots of ways to get information and contact the team:

Email: studentsupport-scienceengineering@swansea.ac.uk (Monday–Friday, 9am–5pm)

Call: +44 (0) 1792 295514 and also 01792 6062522 (Monday-Friday, 10am–12pm, 2–4pm).

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

The current student **webpages** also contains useful information and links to other resources:

https://myuni.swansea.ac.uk/college-of-engineering/coe-student-info/

READING LISTS:

Reading lists for each module are available on the course Canvas page, and are also accessible via http://ifindreading.swan.ac.uk/. We've removed reading lists from the 21-22 handbooks to ensure that you have access to the most up-to-date versions. Access to print material in the library may be limited due to CV-19; your reading lists will link to on-line material whenever possible. For Engineering courses, we do not expect you to purchase textbooks, unless it is a specified key text for the course.

MSc (FHEQ Level 7) 2022-23
MSc Civil Engineering - January
Coordinator: Prof Y Feng

Jan-June 22-23	Sept-Jan 23-24
EG-M35 **Flood Risk Management** **10 Credits** **CORE**	**EG-M24** **Advanced Structural Design** **10 Credits** **CORE**
EGIM08 **Plasticity in Structural and Geotechnical Engineering** **10 Credits** **CORE**	**EG-M25** **Advanced Structural Analysis** **10 Credits** **CORE**
EG-M190 **Social, Environmental and Economic context of Research** **10 Credits** **CORE**	**EG-M107** **Coastal Processes and Engineering** **10 Credits** **CORE**
EG-M52 **Strategic Engineering Management** **10 Credits** **CORE**	**EGIM16** **Communication Skills for Research Engineers** **10 Credits** **CORE**
EG-M192 **Research Case Study** **10 Credits** **CORE**	**EG-M92** **Finite Elements for Civil Engineers** **10 Credits** **CORE**
Dissertation July–September 23-24	
EG-D04 **MSc Dissertation** **60 Credits** **CORE**	
Total 180 Credits	

Choose exactly 10 credits:

EG-M38	**Design and Analysis for Temporary Works**	**Sept-Jan 23-24**	**10 CORE**
EGIM07	**Dynamics and Earthquake Analysis of Structures**	**Sept-Jan 23-24**	**10 CORE**

AND

Choose exactly 10 credits:

EGEM07	**Fluid-Structure Interaction**	**Jan-June 22-23**	**10 CORE**
EGEM00	**Transportation Engineering**	**Jan-June 22-23**	**10 CORE**

EG-D04 MSc Dissertation - Civil and Computational Engineering

Credits: 60 Session: 2022/23 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.

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. 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.

Deadlines as follows:

MSc Civil, Structural and Computational Engineering (without resits) - September 30th

MSc Civil, Structural and Computational Engineering (with resits) - December 15th

Moderation approach to main assessment: Universal double-blind marking

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 College of 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: 2022/23 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: Universal second marking 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 College of 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: 2022/23 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: Universal second marking 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.
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: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof HU Karunarathna

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

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-M23 Finite Element Computational Analysis

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules: EG-323

Co-requisite Modules:

Lecturer(s): Prof R Sevilla

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

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

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

The module is delivered by lectures and example classes.

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

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

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

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

Module Content:

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

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

Accreditation Outcomes (AHEP)

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

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

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

Assessment: Examination 1 (60%)
Assignment 1 (40%)
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: Universal second marking as check or audit

Assessment Feedback:
Examination - Standard university exam feedback form.

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

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

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

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

Available to visiting and exchange students.

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

EG-M24 Advanced Structural Design

Credits: 10 Session: 2022/23 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) (60%) Assingment resit (40%)
Assessment Description: Assessment: Coursework 20% Presentation 20% End of module exam 60%
Moderation approach to main assessment: Universal second marking 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: Exam re-sits according to university regulations. A supplementary examination will form 100% of the module mark.
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: 2022/23 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: Universal second marking 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.

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-M35 Flood Risk Management

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules: EG-190; EG-219; EG-329

Co-requisite Modules: EG-M87

Lecturer(s): Dr Y Xuan, Prof HU Karunarathna

Format: Lectures 20 hours;
Example classes 10 hours;
Directed private study 20 hours;
Private study 40 hours;
Preparation for assessment: 10 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 on-line versions of sessions delivered on-campus

Note: due to the uncertainty associated with COVID pandemic, delivery methods are subject to change.
Lectures (on-line): Synchronous, Zoom-based lectures, 2 hours per week
Example classes (on-line): Synchronous, Zoom-based example class, 1 hour per week
Example classes (on campus): Optional, availability subject to COVID regulation & pre-booking, 1 hour per week.
Office hours (on-line, optional): Zoom-based, one-to-one or group support (subject to appointment), 1 hour per week.
Asynchronous self study: Pre-recorded videos and learning materials are provided on Canvas, 2 hours per week.

PC labs (on Campus, optional): 3 hours in total with guidance.
PC labs (on-line): 3 hours in total, with Zoom-based support.

Assessment: 70% from end of teaching block exam, 30% from two courseworks (10% and 20% split) during the teaching block. Note the form of the exam is expected to be a taking-home, individual assessment and the max time allowed for completing the assessment is 4 hours (subject to change).

Feedback: students will receive feedback on their coursework and the exam using standard format; where appropriate, individual feedback will be given.

Module Aims: Recent years have seen an increasingly volatile climate and hence severe floods across the UK and worldwide, which also accompanies with a constant demand for expertise and know-hows for flood risk management. We intend to use this module to facilitate civil and environmental engineering students with necessary engineering skills and techniques for flood risk management with special focuses on current practice and national polices related and climate change impact and sustainability issues. Any student wanting to pursue or develop in a related career, e.g., water managers, consultancy in flood risk management is encouraged to take the module.

Module Content: 1. Introduction to flood risk management: concepts and approaches
2. Water systems and hydrometry
3. Water system modelling for flood risk management
4. Flood risk, extreme value and reliability analysis
5. GIS and flood risk mapping
6 Flood forecasting/Warning and communication systems
7. Options, policies and measures for flood risk management
8. Global environment change impact on flood risk and resilience

Intended Learning Outcomes: Upon completion of the module, students are expected to be able to:
1. understand and interpret the concept of flood risk management, relevant policies of the UK and EU;
2. understand and be acquainted with the necessary modelling techniques for flood forecasting and flood risk management;
3. use FEH method to estimate flood for both gauged and ungauged river catchments;
4. be accustomed to GIS and use GIS tools to produce flood hazard map and/or analysis;
5. understand and apply the probability (extreme value) theory for flood risk analysis;
6. establish and enhance the awareness of the sustainability issues in flood risk management;
7. demonstrate the understanding of the climate change and their impacts on flood risk management; further to assess the non-stationarity in flood risk management;

AHEP3 Learning Outcomes

MEng
SM1m A comprehensive knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies.
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.
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.
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
EL2 Knowledge and understanding of the commercial, economic and social context of engineering processes.
EL6m Knowledge and understanding of risk issues, including health & 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 (e.g. 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.
P6 Understanding of appropriate codes of practice and industry standards.
P8 Ability to work with technical uncertainty.
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 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 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
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
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

Assessment: Coursework 1 (10%)
Examination 1 (70%)
Coursework 2 (20%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Note: due to the uncertainty associated with the COVID19 situation, the components below may be subject to further changes. Student will be timely informed when such changes are needed.

Coursework 1: A group-based, written coursework counts to 10% of total marks. Canvas submission only. Each group comprises 4-6 students. Zero tolerance for late submission.

Coursework 2: A group-based, written coursework counts to 20% of total marks. Canvas submission only. Each group comprises 4-6 students. Canvas submission only. Zero tolerance for late submission.

Examination 1: An individual assessment that counts to 70% of total marks taking place in May-June (subject to time table). This component cannot be exempted.

Examination (resit): An individual assessment designed for the resit. The resit is used to redeem the failure and counts 100% to the final mark.

Moderation approach to main assessment: Universal non-blind double marking

Assessment Feedback: Coursework: students will receive feedback via Canvas according to university regulations.
Examination: feedback will be provided using standard university exam feedback form.

Failure Redemption: Exam resits according to university regulation.
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.

EG-M38 Design and Analysis for Temporary Works

Credits: 10 Session: 2022/23 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 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 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 (40%)
Group Work - Project (60%)

Assessment Description: 1 x 40% continuous assessment to be completed individually.

1 x 60% 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: Second marking as sampling or moderation

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).

Failure of this module will mean that the student must repeat the module or repeat the year during the next academic session. Failure to attend classes and activities related to this module will mean that the student will fail the module; hence the student will repeat the module/year, subject to University regulations.

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-M52 Strategic Engineering Management

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules: EG-3065

Co-requisite Modules:

Lecturer(s): Miss X Yin

Format: Core Lectures: 20 hours
Discussion sessions: 10 hours
Private Study: 70 hours
It is hoped that the majority of contact hours will be face to face, involving lectures, seminars, practical sessions and Academic Mentoring sessions. Delivery may however be a blend of live activities online and on-campus if necessary.

Delivery Method: The aim is to employ face to face learning practices, although programmes may utilise a blended approach. This will involve 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.

Series of lectures and recorded lectures (if required), plus notes on CANVAS with timetabled discussion sessions.

Interactive project processes, with working tutorials, including a number of workshop sessions.

Module Aims: Module Aims:
This module will set out the framework of the construction industry and go some way to prepare students for what they are likely to face when they work with a contractor/consultant after leaving university. It will give them an insight of the modern construction industry and the direction of travel of the industry.

They will learn what is behind the full project process, including how to identify risk, follow a brief, price work, programme work, and general good practice for effective project management. The module will allow them to see how a project is structured, as well as identifying the essential skills that are required in the workplace to become a valuable employee and project team member.

The students will consider the future direction of the construction industry, including investigating the development of information management and sustainability. They will also consider the required continual personal development to keep pace with the changes.

The programme consists a series of lecture/tutorial classes, group/individual work, and presentation with feedback.

Module Content: Module Content:
Introduction - Lectures 1 & 2
• Introduction, structure and objectives of the module
• Structure and stakeholders in the Civil Engineering industry.
• Overview of how different types of projects work..
• The direction of the construction sector and required personal development over the next 5 to 10 years

Management and Leadership – How construction companies work - Lectures 3, 4, 5 & 6
• Governance, Quality systems and Project Execution Plans
• Project life cycle
• Tender briefing

Commercial & human resources - Lectures 7 & 8
• Work winning & tendering for work
• Team building & culture and organisational structures
• Management of contracts

Engineering and construction processes - Lectures 9, 10,11 & 13
• Planning / how do you plan a job...
• Management of contracts
• Management of projects and construction management
• Change control & risk
• Corporate Social Responsibility

Application of of civil & structural engineering - Lectures 14, 15, 16 & 19
• Digital engineering / data and information management
• Modern methods of construction
• Design management
• Stakeholder management
• A day in the life of an engineer
• Risk Management

The Engineer in society - Engineering Council / The role of the institutions - Professional reviews / tests. - Lecture 20

Lectures 6, 12, 17 & 18 relate to assignment 1 - tender briefing, mid bid review, settlement meeting etc..

Lectures 21 & 22 are the tender review and Q&A / feedback sessions respectively.

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

• Understand the ways construction companies work and the main gateways in quality management systems.
• Understand the way work is priced, and the various ways in which works can be procured.
• Identify risk and how to manage itt and be familiar with the project / risk management process.
• Understand the interrelationship of contracts on a project.
• Have an awareness of the potential future direction of the construction industry (information management) & the likely skill development (CPD)
• Present a settlement document to senior management.
• Produce project documentation clearly and professionally.
• Understand the importance of health and safety within the construction industry, the issues related to health and safety, and how it is managed.
• Understand how different types of civil engineering contracts are managed.
• Be familiar with the effect of change on a project.
• Understand the importance of personal development and human resources in construction.

AHEP3 Learning Outcomes but with a nod to AHEP 4 learning outcomes ES 7 to 11 and EP 14 to 10

MEng
SM4m Awareness of developing technologies related to own specialisation
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
D5 Plan and manage the design process, including cost drivers, and evaluate outcomes
D6 Communicate their work to technical and non-technical audiences
EL1 Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct
EL2 Knowledge and understanding of the commercial, economic and social context of engineering processes
EL3m Knowledge and understanding of management techniques, including project and change management, that may be used to achieve engineering objectives, their limitations, and how they may be applied appropriately
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
EL7m Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction
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
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, 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
G4 Exercise initiative and personal responsibility, which may be as a team member or leader

MSc
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.
EL1m Awareness of the need for a high level of professional and ethical conduct in engineering
EL2m Awareness that engineers need to take account of the commercial and social contexts in which they operate.
EL3m Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation
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 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
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:
Assignment 1 (5%)
Assignment 2 (13%)
Assignment 3 (13%)
Assignment 4 (18%)
Assignment 5 (35%)
Coursework 6 (18%)

Assessment Description: There are two main assignments, assignment 1 is split into 5 elements (assignments 1 to 5 below) its total mark is 82.5% of the module. This is split as noted..
- Assignment 1 - Tender plan and permission to bid - 5% - Group work
- Assignment 2 - Team progress report and meeting - 12.5% - Group work
- Assignment 3 - Settlement presentation - 12.5% - individual work - This is an opportunity to present proposals, progress, and lessons learnt. This will be in advance (April) of submission of the final version of the Assignment 5 deliverables, so comments from the panel can be taken on board. This assignment will be marked based on a combination of group performance and individual contribution.
- Assignment 4 - Settlement document - 17.5% - Group work but individual mark
- Assignment 5 - Tender documents - 35% - Group work but individual mark - : A group exercise to produce project documentation / reports. The core component is assessed via production project related documentation / reports, focusing on stipulated stages of a hypothetical project provided to the students. Although is a group project, the marks will be allocated for individual contribution.
- Assignment 6 - A description of what design life is .....17.5% - individual work - students will need to research this topic and suggest what this means across the whole project life cycle.

Specific rules for passing this module:
This module is assessed by a combination of assignments and presentations. In order to pass the module, students must achieve at least 50% overall as well as passing every components of this module. Failure to do so will result in failure of the whole module. However each component failed can be redeemed by the submission of a written assignment on an individual basis, but the mark will be capped at 50%.

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

Assessment Feedback:
Assignments 1 to 5 : Students will receive feedback during the discussion sessions during the workshops / tutorial sessions. Feedback may also be given via Canvas on the submissions. The project deliverables will be defined to mimic a 'real' project, with reports / documentation to be produced for certain (stipulated) stages of project delivery. There will be on going tutorials & workshops, plus guidance will be available via email as required. Feedback will also be given via Canvas on the final submission, there will also be a feedback and tender opening meeting at the end of the module. .

Assignment 6: students will need to research what design life is and suggest what this means across the whole project life cycle. Feedback will be given via canvas. Turnitin will be used to look for any collusion.

Failure Redemption: Each component maybe redeemed independently, by written submission.

In order to pass the module, students must achieve at least 50% overall, as well as passing every components of this module. Failure to do so will result in failure of the whole module. However each component failed can be redeemed by a written submission on an individual basis, but the mark will be capped at 50% for that element.

Additional Notes: We will make every effort to engage with students where changes are necessary, and any changes will be communicated as soon as possible. Delivery of both teaching and assessment may be blended, including both live and self-directed activities online and on-campus.

There are 2 assignments as part of this module:

Assignment 1: Will be project based, and involve working as group to manage the preparation and submission of a tender (although for some elements the marks will be awarded on an individual basis). Work will involve producing project related documentation / reports, as well as a presentation to table proposals, progress. there will be a tender opening meeting and module/tender feedback/lessons learnt.

Assignment 2: An individual piece of work on what is design life ? - the is no formal definition of design or of design life, students will be asked to explore what this means for different stakeholders in the construction industry.

This module is assessed by a combination of assignments, formally submitted documents, and a presentation. Non submittal of deliverables, late submission, or failure to attend to presentation sessions: ZERO TOLERANCE.

The module is available to exchange students.

EG-M87 Coastal Engineering

Credits: 10 Session: 2022/23 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 an individual course work (20%); a group coursework (20%); and a final exam (60%).

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: Coursework 1 (20%)
Group Work - Coursework (20%)
Examination (60%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Individual coursework submitted in hard format, Marks awarded out of 20, October, 20% of total marks
Group coursework submitted in hard format, marks awarded out of 20, November, 20% of total marks
Exam, marks awarded out of 60 (3 questions each worth 20 marks), January, 60% of total marks

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

Assessment Feedback: Individual coursework: Feedback will be provided in writing on the submitted work

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

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.
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EG-M92 Finite Elements for Civil Engineers

Credits: 10 Session: 2022/23 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: Universal second marking 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.

EGEM07 Fluid-Structure Interaction

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof WG Dettmer

Format: Lectures and example classes: 30 hours

Directed private study and revision: 70 hours

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

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

This module is based on lectures and on-line example classes supported by additional on-line content.

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

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

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

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

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

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

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

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

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

Assignments 1, 2 and 3:
General feedback on the assignment will be given in a lecture.
Individual feedback will be given in office hours.

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

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

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

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

EGIM07 Dynamics and Earthquake Analysis of Structures

Credits: 10 Session: 2022/23 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: Universal second marking 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.

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: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof D Peric

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

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

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

Module Content:

• Introduction: Historical Perspective. Physical Motivation. Rate Independent Plasticity. Rate Dependence. Creep. Rheological Models. [2]
• 1-D Mathematical Model: Yield Criterion. Flow Rule. Loading / Unloading Conditions. Isotropic and Kinematic Hardening Models. 1-D Elasto-Plastic Boundary Value Problem. [1]
• Computational Aspects of 1-D Elasto-Plasticity: Integration Algorithms for 1-D Elasto-Plasticity. Operator Split. Return Mapping. Incremental Elasto-Plastic BVP. Consistent Tangent Modulus. [5]
• Classical Model of Elasto-Plasticity: Physical Motivation. Classical Mathematical Model of Rate-Independent. Elasto- Plasticity: Yield Criterion. Flow Rule. Loading / Unloading Conditions. [6]
• Computational Aspects of Elasto-Plasticity: Integration Algorithms for Elasto-Plasticity. Operator Split. The Trial Elastic State. Return Mapping. Incremental Elasto-Plastic BVP. Consistent Tangent Modulus. [3]
• Plane Strain Von Mises Elasto-Plastic Model: Continuum. Integration Algorithm. Operator Split. The Trial Elastic State. Return Mapping; Incremental Elasto-Plastic BVP: Consistent Tangent Modulus. [4]
• Integration Algorithms for Generalised Elasto-Plasticity. [1]
• Generalisations and Applications of Plasticity: Plasticity in Engineering Practice: Geomechanics. Structural Mechanics. Impact Dynamics and Crashworthiness. [8]

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

AHEP 3 Learning Outcomes

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

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

Assessment: Examination 1 (50%)
Assignment 1 (20%)
Assignment 2 (30%)
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: Universal second marking as check or audit

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

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

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

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

EGIM16 Communication Skills for Research Engineers

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

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

Format: Lectures (10h), Exercises (20h), 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, visual and group communication will be explored through a series of lectures and formative exercises.

Module Content:

Written Communication: [6 hours]
• 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: [6 hours]
• The usual layout of a research presentation
• Slide design for a research presentation
• Delivery of a presentation, do's and don'ts
• Maintaining the audience's interest.

Other topics: [3 hours]
• Attending & chairing meetings
• Conferences – submissions and attendance
• Submission of papers and peer review.

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)
• Demonstrate an awareness of the other modes of communication of ideas at a research level such as posters and group discussions (assessed in the second assessment component)

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 and ability to apply quantitative techniques where appropriate (EL11M / ET4fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9M / EP2fl)

Assessment: Assignment 1 (10%)
Assignment 2 (10%)
Oral Examination (40%)
Writing (40%)

Assessment Description:
The first sit assessment will consist of 4 assignments.

The first assessment component will be a short written piece, up to two pages long, which will test the students understanding of the concepts with respect to the written work and to allow feedback to the participants in the module prior to the final assessment. This is an individual piece of coursework.

The second component will feature a small number of tasks which are aimed to evaluate the students understanding of the other ideas, beyond the written word and oral presentations, which are covered in the module. This will include the critical review of a written output. Other possible tasks include group meetings and the creation of a poster. The coursework may be done individually or in groups, this will be confirmed at the time of setting the work.

The oral examination will involve the students presenting an example of the work they have undertaken in the past, typically a project, 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, fourth, component will require the student to write a paper 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, details of which are provided in a later section.

Moderation approach to main assessment: Second marking as sampling or moderation

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.
All components are redeemable individually in the event of failure across the module.

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.

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