



**Swansea University
Prifysgol Abertawe**

**FACULTY OF SCIENCE AND
ENGINEERING**

**UNDERGRADUATE TAUGHT STUDENT
HANDBOOK**

YEAR 4 (FHEQ LEVEL 7)

**CIVIL ENGINEERING
DEGREE PROGRAMMES**

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

DISCLAIMER

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

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

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

The 23-24 academic year begins on 25 September 2023

Full term dates can be found [here](#)

DATES OF 23-24 TERMS

25 September 2023 – 15 December 2023

8 January 2024 – 22 March 2024

15 April 2024 – 07 June 2024

SEMESTER 1

25 September 2023 – 29 January 2024

SEMESTER 2

29 January 2024 – 07 June 2024

SUMMER

10 June 2024 – 20 September 2024

IMPORTANT

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

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

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

Welcome to the Faculty of Science and Engineering!

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

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

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

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

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



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

STUDENT SUPPORT

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

Standard Reception opening hours are Monday-Friday 8.30am-4pm.

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

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

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

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

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

<https://myuni.swansea.ac.uk/fse/>

READING LISTS

Reading lists for each module are available on the course Canvas page and are also accessible via <http://ifindreading.swan.ac.uk/>. We've removed reading lists from the 23-24 handbooks to ensure that you have access to the most up-to-date versions.

We do not expect you to purchase textbooks, unless it is a specified key text for the course.

THE DIFFERENCE BETWEEN COMPULSORY AND CORE MODULES

Compulsory modules must be **pursued** by a student.

Core modules must not only be **pursued**, but also **passed** before a student can proceed to the next level of study or qualify for an award. Failures in core modules must be redeemed.

Further information can be found under “Modular Terminology” on the following link -

<https://myuni.swansea.ac.uk/academic-life/academic-regulations/taught-guidance/essential-info-taught-students/your-programme-explained/>

Year 4 (FHEQ Level 7) 2023/24
Civil Engineering
MEng Civil Engineering[H201]
MEng Civil Engineering with a Year Abroad[H207]
MEng Civil Engineering with a Year in Industry[H204]

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-M23 Finite Element Computational Analysis 10 Credits Prof R Sevilla CORE	EG-M35 Flood Risk Management 10 Credits Dr Y Xuan/Prof HU Karunarithna CORE
EG-M24 Advanced Structural Design 10 Credits Miss X Yin CORE	EG-M52 Strategic Engineering Management 10 Credits Dr CAC Wood/Mr C Lewis CORE
EG-M87 Coastal Engineering 10 Credits Prof DE Reeve CORE	EGEM00 Transportation Engineering 10 Credits Dr Y Hou CORE
EGIM07 Dynamics and Earthquake Analysis of Structures 10 Credits Prof Y Feng CORE	EGIM08 Plasticity in Structural and Geotechnical Engineering 10 Credits Prof D Peric CORE
EG-M120 Group Project (Civil) 30 Credits Mr TJ Fasham CORE	
Total 120 Credits	

Optional Modules

Choose exactly 10 credits

EG-M25	Advanced Structural Analysis	Prof EA De Souza Neto	TB1	10 (CORE)
EG-M38	Design and Analysis for Temporary Works	Prof C Li	TB1	10 (CORE)

EG-M120 Group Project (Civil)

Credits: 30 Session: 2023/24 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Mr TJ Fasham

Format: Group allocation and team building at start of the project followed by practical sessions group and individual work, meetings with Industrialists as arranged. At least 6 meetings per session with academic and industrial supervisors.

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

Project briefing (academic supervisor), group meetings, preparation of initial and final design (supervision and group work), report writing, poster and viva presentations and/or interview sessions.

After a team and project allocation within the disciplines there will be an initial discussion with the academic and/or industrial supervisors. Students will be in direct contact with the supervisors as appropriate. Thereafter, regular group meetings will be arranged typically biweekly during the term time. The project progression will be made in accordance with the project requirements and guideline. The project requirements for students, i.e. deliverables with respective submission deadline, could vary from one discipline specific course to another. Details on these will be announced by the discipline specific coordinator(s) at the project briefing session and/or via Canvas.

Module Aims: This module enables students to participate in a group activity involving a multi-disciplinary approach to achieve a solution to a specific design problem. In most instances it will involve either direct interaction with industry or will be an industrially-related project. Issues other than providing a purely technical solution to the problem will have to be considered in order to achieve a satisfactory outcome to the project.

Module Content: Formulating a full design specification that meets all the likely requirements throughout the working life of the 'product' or 'system'. Consideration of aspects such as: material selection, failure and risk, safety and environmental impact, buildability, sustainability, health and safety, maintenance and serviceability, also fitness for purpose and cost implications. Production of a construction/fabrication strategy and details. This will include but not limited to drawings and modelling using digital technologies. Consideration of Economic Considerations and Business Plan.

Projects will introduce additional constraints as reflected in statutory and industry norms and may vary from project to project. Discipline specific briefings will be provided in such cases.

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

- 1) Demonstrate a comprehensive knowledge and understanding of the 'total design' process and project management skills in relation to decision-making and business development in a typical group environment.
- 2) Critically evaluate the design problems and understand how to apply a range of mathematical and statistical methods, tools and notations proficiently and lead to the solution of engineering design problems.
- 3) Demonstrate self-direction and originality in tackling and solving problems, use of computational models relevant to the engineering discipline and an appreciation of their limitations, and act autonomously in planning and implementing tasks at a professional or equivalent level.
- 4) Identify, classify and describe the performance of systems, subsystems and components through the use of analytical methods and modelling techniques.
- 5) Identify any constraints such as environmental and sustainability limitations, health and safety, security and risk issues, intellectual property, codes of practice and standards wherever relevant and applicable.
- 6) Generate an innovative design for products, systems, components or processes to fulfill new needs (i.e. to be verified against the design specification and validated against the customer requirement).
- 7) Apply advanced problem-solving skills, technical knowledge relevant to the engineering discipline 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.
- 8) Deal with complex issues both systematically and creatively, use fundamental knowledge to investigate new and emerging technologies, make sound engineering judgement in the absence of complete data, and communicate their conclusions clearly.
- 9) Plan for effective project implementation. This includes an ability to:
 - Identify the factors affecting the project implementation (e.g. commercial, economic and social context of engineering processes)
 - Lead on preparing and agreeing implementation plans and method statements
- 10) Plan, budget, organise, direct and control tasks, people and resources to deliver a project. This includes an ability to:
 - Agree quality standards, programme and budget including cost drivers, and evaluate outcomes
 - Organise and lead work teams, coordinating project activities (understanding of different roles within a project team and take initiative and personal responsibility)
 - Ensure that variations from quality standards, programme and budgets are identified, and that corrective action is taken

AHEP3 Learning Outcomes

MEng

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

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

EA4 Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems

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

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,

<p>maintenance and disposal</p> <p>D5 Plan and manage the design process, including cost drivers, and evaluate outcomes</p> <p>D6 Communicate their work to technical and non-technical audiences</p> <p>D7m Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations</p> <p>D8m Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs</p> <p>EL1 Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct</p> <p>EL2 Knowledge and understanding of the commercial, economic and social context of engineering processes</p> <p>EL4 Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate</p> <p>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</p> <p>P1 Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.)</p> <p>P2m Knowledge of characteristics of particular equipment, processes or products, with extensive knowledge and understanding of a wide range of engineering materials and components</p> <p>P4 Understanding of the use of technical literature and other information sources</p> <p>P6 Understanding of appropriate codes of practice and industry standards</p> <p>P7 Awareness of quality issues and their application to continuous improvement</p> <p>P8 Ability to work with technical uncertainty</p> <p>P9m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments</p> <p>P10m Ability to apply engineering techniques taking account of a range of commercial and industrial constraints</p> <p>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</p> <p>G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities</p> <p>G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD</p> <p>G3m Monitor and adjust a personal programme of work on an on-going basis</p> <p>G4 Exercise initiative and personal responsibility, which may be as a team member or leader</p>
<p>Assessment: Group Work - Project (100%)</p>
<p>Assessment Description: Assessment will be, as a baseline, 50% for the group and 50% for the individual's contribution to the group. Individual contribution to the project will be assessed by the supervisor (e.g. on the basis of a) individual concept development, analysis and report, b) 'time management' project leader reports, and c) end-of-term presentations; or interviewing the team members individually to check on each student's contributions to the project; and/or adopting the peer review assessment to moderate the group mark).</p>
<p>The actual breakdown of marks will be provided by the module coordinators at the start of Semester 1.</p>
<p>Moderation approach to main assessment: Universal Non-Blind Double Marking of the whole cohort</p>
<p>Assessment Feedback: Feedback will be given by supervisors as regular part of meetings with students. Formal verbal/written feedback will be provided on the assessed parts of the project.</p>
<p>Failure Redemption: There is no failure redemption for this module. Failure in this module would normally result in an exit qualification due to insufficient credits having been attained.</p>
<p>Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.</p>
<p>The The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.</p>
<p>NOT AVAILABLE to visiting and exchange students.</p>

EG-M23 Finite Element Computational Analysis

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-323

Co-requisite Modules:

Lecturer(s): Prof R Sevilla

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

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

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

The module is delivered by lectures and example classes.

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

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

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

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

Module Content:

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

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

- Use the weighted residual method to solve an engineering problem governed by partial differential equations.
- Convert a realistic elasticity, heat conduction, seepage flow and ideal fluid flow engineering problems into finite element models.
- Solve elasticity, heat transfer, seepage flow and ideal fluid flow problems by hand using the finite element method.
- Use a software to set up and produce finite element solutions of engineering problems.
- Analyse/assess the output of finite element simulations.

Accreditation Outcomes (AHEP)

MEng

SM1 scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies

SM2m Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems

SM3m Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively

SM4m Awareness of developing technologies related to own specialisation

SM5m A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations

SM6m Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects

EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes

EA2i Ability to apply quantitative methods in order to understand the performance of systems and components

EA3m Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and implement appropriate action

EA4 Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems

EA6m Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems

P1 Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.)

P3 Ability to apply relevant practical and laboratory skills

P4 Understanding of the use of technical literature and other information sources

P9m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments

P11m Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader

G1 Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities

G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD

G3m Monitor and adjust a personal programme of work on an on-going basis

G4 Exercise initiative and personal responsibility, which may be as a team member or leader

MSc

SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.

SM2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.

SM3m Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.

EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in

engineering and to assess their limitations
 EA3m Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods.
 D1m Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies
 P2m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments.
 P4m Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader.
 G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
 G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
 G3 Monitor and adjust a personal programme of work on an on-going basis.

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

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

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

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

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

Assessment Feedback:
 Examination - Standard university exam feedback form.

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

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

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

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

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

Available to visiting and exchange students.

This module requires a prior knowledge of:

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

EG-M24 Advanced Structural Design

Credits: 10 Session: 2023/24 September-January

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

Co-requisite Modules:

Lecturer(s): Miss X Yin

Format: Lectures 20 hours (a blend of face to face teaching and video recordings)
Example classes 10 hours (A mix of on campus classes, recorded examples and web-based live sessions will be used)
Directed private study 30 hours.
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

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

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

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

Module Content: Concrete Design to BS EN 1992

- Prestressed concrete beams design [7]
- Design of torsion with combination of shear in reinforced concrete structures [2]
- Strut and tie analysis [2]

Steel Design to BS EN 1993, 1994

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

Sustainable design concepts and their applications [1]

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

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

AHEP3 Learning Outcomes

MEng

SM2m Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems

EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes

EA2 Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

EA3m Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and implement appropriate action

D1 Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics

D2 Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards

D6 Communicate their work to technical and non-technical audiences

EL2 Knowledge and understanding of the commercial, economic and social context of engineering processes

EL4 Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate

EL5m Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues, and an awareness that these may differ internationally

EL6m Knowledge and understanding of risk issues, including health and safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk

P6 Understanding of appropriate codes of practice and industry standards

P8 Ability to work with technical uncertainty

G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities

G4 Exercise initiative and personal responsibility, which may be as a team member or leader

MSc

SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.

EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations

D2m Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations

EL2m Awareness that engineers need to take account of the commercial and social contexts in which they operate.

EL4m Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate

EL5m Awareness of relevant regulatory requirements governing engineering activities in the context of the

particular 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.
G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities

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

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

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

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

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

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

Additional Notes:

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

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

EG-M25 Advanced Structural Analysis

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-320

Co-requisite Modules:

Lecturer(s): Prof EA De Souza Neto

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

Delivery Method: The course is delivered by means of lectures and example classes, including a number of synchronous and asynchronous online learning activities.

Course announcements, including office hours details, etc, are made via CANVAS.

Course material, including the course notes and assignment description, lecture and exercise class recordings, will be available for download from CANVAS.

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

Module Content: • Introduction. Equilibrium conditions and the development of the governing equations for plate bending in terms of bending moments. [3]

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

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

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

AHEP3 Learning Outcomes

MEng

SM2m Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems.

EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes.

EA2 Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

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

MSc

SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.

SM2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.

EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations

P1m Advanced level knowledge and understanding of a wide range of engineering materials and components.

Assessment: Examination 1 (75%)
Coursework 1 (25%)

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

Assessment Description: Coursework 1: 1 piece of written coursework to be handed in in December..

Examination: Covering all aspects of the module.

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

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

Assessment Feedback: Exam: Standard College of Engineering exam feedback

Coursework: A copy of the marked/commented coursework will be returned to students for feedback.

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

Reading List: Timoshenko, Stephen P, Woinowsky-Krieger, S., Theory of plates and shells / [by] S.

Timoshenko [and] S. Woinowsky-Kreieger., McGraw-Hill,, 1959.

Timoshenko, Stephen P, Goodier, J. N., Theory of elasticity / [by] S.P. Timoshenko, J.N. Goodier.,

McGraw-Hill,, 1970.

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

This module particularly builds on the work you have done in the Year 2 Structural Mechanics 2 (a) and (b) modules as well as Year 3 Structural Mechanics 3. You should revise the topics learnt in these modules.

This module also assumes that you are familiar with the basic mathematical concepts learnt in Years 1 and 2 mathematics modules.

EG-M35 Flood Risk Management

Credits: 10 Session: 2023/24 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 policies 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: 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 of the whole cohort

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.

Reading List: Shaw, Elizabeth M., Hydrology in practice / Elizabeth M Shaw ... [et al.], Spon., 2011.ISBN: 9780415370424

Dominic. Reeve, Risk and reliability : coastal and hydraulic engineering / Dominic Reeve., Taylor & Francis, 2009.ISBN: 9780415467551

Centre for Ecology and Hydrology, Flood Estimation Handbook, Centre for Ecology and Hydrology, 1999.ISBN: 9781906698003

Butler, David., Davies, John W., Urban drainage / David Butler and John W. Davies., Spon Press., 2011.ISBN: 9780415455268

Novak, Pavel., Guinot, V., Jeffrey, A., Reeve, D. E., Hydraulic modelling : an introduction ; principles, methods and applications / P. Novak ... [et al.], Spon Press., 2010.ISBN: 9780419250203

IPCC, IPCC Fourth Assessment Report: Climate Change 2007 (AR4).

EA, National Flood and Coastal Erosion Risk Management Strategy for England.

EU Floods Directive.

Jha, Abhas KumarBloch, Robin, Lamond, Jessica, ebrary, Inc, Cities and flooding a guide to integrated urban flood risk management for the 21st century / Abhas K. Jha, Robin Bloch, Jessica Lamond., World Bank, 2012.ISBN: 0821394770

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: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof C Li

Format: Lectures: 12 hours

Project Supervision: 8 hours

Reading/Private Study: 50 hours

Preparation for Project Report and Viva: 30

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

Delivery Method: All Programmes will employ a blended approach that combines live on-campus activities each week and online activities using the Canvas Digital Learning Platform.

The module delivery consists two parts:

(1) A series of subject lectures each covering one topic of the module

(2) A series of supervised discussions and group projects

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

Module Aims: The aim of the module is to gain understanding into temporary works covering broadly:

Temporary works definition

Design philosophies

Underpinning structural mechanics

Design procedure

Types of temporary works

Loads and effects

Risks

Defects and failures

Health and safety law

Internal systems

Computer software and peripherals

Economics of temporary works

Practice

Module Content: Introduction, processes and underlying engineering; why Temporary Works is a distinct discipline

Falsework, formwork, scaffolding & hoardings

Geotechnical

Underground

Marine

Moving, lifting & bridges

Projects

Intended Learning Outcomes: Students should be able:

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

AHEP3 Learning Outcomes

MEng

SM1m A comprehensive knowledge and understanding of the scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies

EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes

EA4 Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems

EA5m Ability to use fundamental knowledge to investigate new and emerging technologies

D1 Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics

D2 Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards

D3m Work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies

D4 Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal

D5 Plan and manage the design process, including cost drivers, and evaluate outcomes

D7m Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations

D8m Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs

EL6m Knowledge and understanding of risk issues, including health and safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk

P1 Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.)

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

P4 Understanding of the use of technical literature and other information sources

P5 Knowledge of relevant legal and contractual issues

P6 Understanding of appropriate codes of practice and industry standards

P7 Awareness of quality issues and their application to continuous improvement

P8 Ability to work with technical uncertainty

G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities

G4 Exercise initiative and personal responsibility, which may be as a team member or leader

MSc

SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.

SM2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the

forefront of the specialisation.

EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations

EA2m Ability to use fundamental knowledge to investigate new and emerging technologies.

EA3m Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods.

D1m Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies

D3m Ability to generate an innovative design for products, systems, components or processes to fulfil new needs.

EL5m Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation

EL6m Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk.

P1m Advanced level knowledge and understanding of a wide range of engineering materials and components.

P2m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments.

P3m Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints.

P4m Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader.

G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities

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

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

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

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

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

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

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

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

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

Available to Visiting Students

EG-M52 Strategic Engineering Management

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-3065

Co-requisite Modules:

Lecturer(s): Dr CAC Wood, Mr C Lewis

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 it 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 (25%)
	Assignment 2 (12%)
	Assignment 3 (10%)
	Assignment 4 (35%)
	Assignment 5 (18%)

Assessment Description: There are two main assignments, assignment 1 is split into 4 elements (assignments 1A, 1B, 1C & 1D) below) its total mark is 82.5% of the module. This is split as noted.

- Assignment 1A: Procurement & Contract Selection – 25.0% - Group work
- Assignment 1B; Tender Presentation to Bid - 12% - Group work and individual presentation performance - April
- Assignment 1C – Tender Report to Bid - 10.0% - Group Work
- Assignment 1D - Tender Response documents – 35.0% - A group exercise to produce project documentation/ reports. The core component is assessed via production of project related documentation, focusing on completing a hypothetical bid response to a project provided to the students. Group Work.
- Assignment 2 - A description of what design life is ... - 18% - students will need to research this topic and suggest what this means across the whole project life cycle. Individual Work.

Specific rules for passing this module:

This module is assessed by a combination of assignments and presentations. To pass the module, students must achieve at least 50% overall as well as passing every component 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: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Assignments 1A to 1D : 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 2: 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: Group coursework on procurement, contracts and tender documents (Split into 4 components)

Assignment 2: Individual coursework – A description of what design for life is in the construction sector.

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: 2023/24 September-January

Pre-requisite Modules: EG223; EG321; EGA331

Co-requisite Modules:

Lecturer(s): Prof DE Reeve

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

Delivery Method: * 2 hours of lectures;

* 1 hour examples class;

* a weekly office hour, in which the module director will be available for general module-related Q&A.

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

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

Assessment will be through a final exam (100%).

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

Module Content: Indicative syllabus -

Introduction: conceptual design for coastal defence; sustainable shoreline management in the UK; overview of design process.

Short term wave statistics: Rayleigh distribution; time domain parameters and analysis

Characteristics of wind waves and swell; concept of a random sea.

Time and frequency domain parameters, Rayleigh distribution, energy and directional spectra. Introduction to principles of frequency analysis.

Water level variations: tides and surge; harmonic analysis; tidal harmonics.

Long term wave statistics: Extreme events; extreme distributions; calculating extremes

Design wave specification

Design event specification

Flood defences: Types & materials (embankments, revetments and seawalls); wave overtopping; formulae and methods; design criteria.

Littoral sediment transport

Beach models: mathematical and computational

Coastal protection: Types & materials (revetments, groynes, breakwaters); soft engineering options (renourishment, recycling); beach modelling.

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

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

AHEP3 Learning Outcomes

MEng

SM2m Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems

SM5m A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations

EA6m Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems

G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities

G4 Exercise initiative and personal responsibility, which may be as a team member or leader

MSc

SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.

SM3m Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.

EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations

D2m Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations

G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities

Assessment: Examination (100%)

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

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

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

Assessment Feedback: Feedback on examinations in the normal manner.

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

Reading List: Dominic Reeve (Dominic E.), author., Andrew Chadwick 1960- author.; Christopher Fleming (Christopher A.), author., Coastal engineering : processes, theory and design practice / Dominic Reeve, Andrew Chadwick, and Christopher Fleming., Boca Raton : CRC Press is an imprint of the Taylor & Francis Group, an Informa business, 2018.ISBN: 9781351165501

Dominic. Reeve, Andrew Chadwick 1960-; Christopher Fleming, Coastal engineering : processes, theory and design practice / Dominic Reeve, Andrew Chadwick and Christopher Fleming., Spon Press, 2012.ISBN: 9780415583534

R. S. Thomas author., B. Hall (Brian) author., Seawall design / R.S. Thomas and B. Hall., Construction Industry Research and Information Association, Butterworth-Heinemann, 1992.ISBN: 9781483163239

Robert G. Dean (Robert George), 1930-2015., Robert A. Dalrymple 1945-, Coastal processes with engineering applications / Robert G. Dean, Robert A. Dalrymple., Cambridge University Press, 2002.ISBN: 1107112656

Robert M. Sorensen 1938-, Basic coastal engineering / Robert M. Sorensen., Wiley, 1978.

J. W. Kamphuis, Introduction to coastal engineering and management / J. William Kamphuis., World Scientific, 2010.ISBN: 9789812834843

Robert Kay (Robert C.), Jackie Alder 1954-, Coastal planning and management Robert Kay and Jackie Alder., E & FN Spon, 1999.ISBN: 0429214650

Bill Carter (R. W. G.), Coastal environments / R.W.G. Carter., Academic, 1988.ISBN: 0121618560

Esteban, Miguel ; Takagi, Hiroshi ; Shibayama, Tomoya, Handbook of Coastal Disaster Mitigation for Engineers and Planners, Elsevier Science & Technology, 2015.ISBN: 9780128010600

Barbara Zanuttigh editor., Coastal risk management in a changing climate / edited by Barbara Zanuttigh [and four others]., Kidlington, England : Butterworth-Heinemann, 2015.ISBN: 0123973317

Young C Kim, Coastal and ocean engineering practice edited by Young C. Kim., World Scientific, 2012.ISBN: 1281603570

Peter W. French 1964-, Coastal and estuarine management Peter W. French., Routledge, 1997.ISBN: 1282778498

Coastal Education & Research Foundation (U.S.), Journal of coastal research., Coastal Education and Research Foundation, 1985.ISBN: 15515036

Coastal engineering, Elsevier Scientific Pub. Co., 1977.ISBN: 18727379

American Society of Civil Engineers.; American Society of Civil Engineers. Waterway, Port, Coastal and Ocean Division., Journal of waterway, port, coastal, and ocean engineering / American Society of Civil Engineers., The Society, 1983.ISBN: 0733950X

Estuarine and Brackish-water Sciences Association.; Estuarine and Coastal Sciences Association.;

Estuarine and Coastal Sciences Association. Symposium., Estuarine, coastal and shelf science., Academic Press in association with the Estuarine and Brackish-water Sciences Association, 1981.ISBN: 02727714

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

A background knowledge of coastal processes and soil mechanics is assumed. The material covered in EG223, EG321 and EGA331 provides this.

Available to visiting and exchange students with suitable pre-requisite knowledge

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

EGEM00 Transportation Engineering

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr Y Hou

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

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

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

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

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

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

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

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

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

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

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

Accreditation Outcomes (AHEP)

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

Assessment: Assignment 1 (20%)
Examination 1 (60%)
Project (20%)

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

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

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

Assessment Feedback: Throughout the term, students will receive oral feedback during practical classes and after lecture classes. Assignments 1 & 2: (Submitted via Canvas) - Feedback provided via Canvas with office hours for further verbal feedback. Project essay (Submitted via Canvas) - Feedback provided via Canvas with office hours for further verbal feedback. A standard examination feedback form will be available to all students after the examination.

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

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

Where possible learning will be reinforced by guest lectures from practicing civil engineers and site visits. Students are also recommended to attend relevant ICE and IStructE evening lectures.

EGIM07 Dynamics and Earthquake Analysis of Structures

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-260

Co-requisite Modules:

Lecturer(s): Prof Y Feng

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

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

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

Module Content:

- Introduction: Dynamic effects on structures, Engineering disasters, design issues. [1]
- Single Degree of Freedom Problems (SDOF): the SDOF spring-mass system, equivalent SDOF structures - energy method, analytical solution of SDOF problems, step by step solution methods, earthquake loading, response and design spectra, Eurocode- 8 elastic spectrum. [15]
- Multiple Degree of Freedom Problems: natural modes and frequencies of vibration, modal decomposition, reduction methods, earthquake loading, shear building model, design considerations. [9]
- Distributed Mass Systems: finite element discretisation and formulations. [4]
- Revision [1]

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

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

AHEP3 Learning Outcomes

MEng

EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes

EA2 Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

EA4 Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems.

D6 Communicate their work to technical and non-technical audiences.

EL4 Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate.

P4 Understanding of the use of technical literature and other information sources.

P6 Understanding of appropriate codes of practice and industry standards.

G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities.

G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.

MSc

SM1m A comprehensive knowledge and understanding of the scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies

SM2m Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems

SM3m Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively

EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes

EA2 Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

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

G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities

G2 Plan self-learning and improve performance, as the foundation for lifelong learning/CPD

G3m Monitor and adjust a personal programme of work on an on-going basis

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

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

<p>Assessment Description: Exam - 40%</p>
<p>Project - 60%</p>
<p>Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit</p>
<p>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.</p>
<p>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.</p>
<p>Reading List: European Union, Eurocode-8 Part 1. Chopra, Anil K., Dynamics of structures : theory and applications to earthquake engineering / Anil K. Chopra., Prentice Hall,, c2012..ISBN: 9780132858038 Anil K. Chopra author., Dynamics of structures : theory and applications to earthquake engineering / Anil K. Chopra., Harlow : Pearson Education, 2014.ISBN: 9780273774242 Clough, Ray W., Penzien, Joseph., Dynamics of structures / Ray W. Clough, Joseph Penzien., McGraw-Hill,, c1993..ISBN: 0071132414 Maguire, J. R., Wyatt, Tom,, Dynamics : an introduction for civil and structural engineers / J.R. Maguire and T.A. Wyatt., Thomas Telford,, 2002.ISBN: 9780727731388</p>
<p>Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.</p> <p>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.</p> <p>The detail of the individual project will be provided at the beginning of the course.</p>

EGIM08 Plasticity in Structural and Geotechnical Engineering

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof D Peric

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

Delivery Method: Two lectures and one example or laboratory class per week.

Assessment: 50% from end of teaching block 2 hour examination; 50% from 2 projects.

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

Module Content:

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

Intended Learning Outcomes: Students should be able:

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

AHEP 3 Learning Outcomes

MEng

SM1m A comprehensive knowledge and understanding of the scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies

SM2m Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems

SM3m Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively

SM4m Awareness of developing technologies related to own specialisation

SM5m A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations.

EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes

EA2 Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

EA3m Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and to implement appropriate action.

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

P4 Understanding of the use of technical literature and other information sources

G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities

MSc

SM1m A comprehensive understanding of the relevant scientific principles of the specialisation.

Sm2m A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.

EA1m Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations.

P1m Advanced level knowledge and understanding of a wide range of engineering materials and components.

P2m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments.

G1 Ability to apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities.

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

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

Assessment Description:

Examination 1 - Standard 2 hour university examination worth 50% of the final mark. This is a closed book examination.

The coursework will consist of two individual projects that will require both hand calculation and computer simulations. Computer simulation will require certain amount of programming and use of the existing finite element software package Elfen. The project reports should consist of two parts: (i) a discussion related to general aspects of formulation and computational treatment of the problem under consideration, (ii) description of numerical solution of an individual problem.

Coursework 1 - Hand calculation and numerical solution in MATLAB will be used to obtain solution of simple 1-D elasto-plastic problem. Coursework 1 will contribute 20% of the final mark.

Coursework 2 - Short hand calculation and computer simulation in commercial code will be used to obtain solution of a 2-D engineering problem. Coursework 2 will contribute 30% of the final mark.

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

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

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

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

Normally, a supplementary examination will form 100% of the module mark.

Reading List: Neto, Eduardo de Souza., Peric, Djordje, Owens, David., Computational methods for plasticity : theory and applications / Eduardo de Souza Neto, Djordje Peric, David Owens., Wiley,, 2008.ISBN: 9780470694527

J. C. Simo (Juan C.), 1952-, Thomas J. R Hughes, Computational inelasticity / J.C. Simo, T.J.R. Hughes., Springer, 1998.ISBN: 9780387975207

Lubliner, Jacob., Plasticity theory / Jacob Lubliner., Dover Publications,, 2008.ISBN: 9780486462905

Owen, D. R. J., Hinton, E., Finite elements in plasticity : theory and practice / [by] D.R.J.Owen [and] E. Hinton., Pineridge Press,, 1980.

O. C. Zienkiewicz 1921-2009, R. L Taylor (Robert Leroy), 1934- author.; D. D Fox (David Dean), The finite element method for solid & structural mechanics / O.C. Zienkiewicz, R.L. Taylor, D.D. Fox., Amsterdam : Elsevier/Butterworth-Heinemann, 2014.ISBN: 0080951368

O. C. Zienkiewicz author., Robert L Taylor (Robert Leroy), 1934- author.; David Fox author., The finite element method for solid and structural mechanics / O.C. Zienkiewicz, R.L. Taylor and D.D. Fox., Oxford : Elsevier/Butterworth-Heinemann, 2014.ISBN: 9781856176347

Crisfield, M. A., Non-linear finite element analysis of solids and structures / M.A. Crisfield. Vol 1, Essentials., John Wiley,, 1991,.

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

Zero tolerance will apply for late submissions of the assignments.

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