Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE TAUGHT STUDENT HANDBOOK

YEAR 3 (FHEQ LEVEL 6)

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 Harshinie Karunarathna

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 3 (FHEQ Level 6) 2023/24
Civil Engineering

BEng Civil Engineering[H200,H205]
BEng Civil Engineering with a Year Abroad[H206]
BEng Civil Engineering with a Year in Industry[H202]
MEng Civil Engineering[H201]
MEng Civil Engineering with a Year Abroad[H207]
MEng Civil Engineering with a Year in Industry[H204]

Semester 1 Modules	Semester 2 Modules
EG-3067 **Finite Elements for Civil Engineers** **10 Credits** **Prof EA De Souza Neto** **CORE**	**EG-3065** **Civil Engineering Design Practice and Management II** **20 Credits** **Miss X Yin/Dr J Li** **CORE**
EG-321 **Geomechanics II** **10 Credits** **Prof AJ Gil** **CORE**	**EG-320** **Structural Mechanics III** **10 Credits** **Prof Y Feng** **CORE**
EG-328 **Superstructure Design** **10 Credits** **Dr WG Bennett/Miss X Yin** **CORE**	**EG-326** **Engineering of Foundation** **10 Credits** **Prof D Peric** **CORE**
EG-329 **Hydrology and Unsteady Flow** **10 Credits** **Dr Y Xuan/Dr J Li** **CORE**	
EGA331 **Coastal processes and engineering** **10 Credits** **Prof HU Karunarathna/Prof DE Reeve** **CORE**	
EG-353 **Research Project** **30 Credits** **Dr AC Tappenden/Dr M Fazeli/Prof PJ Holliman** **CORE**	
Total 120 Credits	

EG-3065 Civil Engineering Design Practice and Management II

Credits: 20 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Miss X Yin, Dr J Li

Format: 72 formal contact hours
128 self-study and groupwork 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

Primarily online. teaching via zoom, group design classes and Computer labs. Weekly lectures and practical design classes will be held to help with the understanding of design methodologies and individual aspects of the project work. Where necessary individual group tutorial sessions can be organised in addition to the lectures and design classes. Face to face Q&A session maybe organised if permitted.

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

All drawing and calculation work will be evenly split between all members of the group. Students will be awarded marks for team work. In the cases of uneven distribution of work, individual marks will be adjusted depending on the outcome of peer reviews of work load distribution. Staged submissions and group interviews will be used to moderate between group members if necessary.

Module Aims: Civil Engineering projects can be amongst the most complex projects you can find in any sphere of work. An understanding of the different elements of a project from conceptual design through to construction requires consideration of design efficiency, buildability and effective risk management.

This module will cover a number of design design elements such as civils, superstructure, drainage and foundation design, together with consideration of the practicality of project delivery. The design work is linked with typical construction activities such as programming, method and site logistics to provide students with a realistic experiences of the whole project.

Module Content: Group design projects which includes the following elements:

• Conceptual/Scheme design – conceptual design based on a real-life project provided by industrial partners. Develop viable conceptual design options and give recommendations based on engineering knowledge and judgement. Design options must pay due consideration to health & safety and sustainability and justification given to ethical design.

• Superstructure design – using the knowledge and skills developed from a number of design modules, this part of the course and assessment focuses on structural design. Familiarisation with commercial software for the analysis and design of concrete and steelworks to Eurocode, analytical results must be verified by hand calculations.

• Foundation design – using on the knowledge and skills developed from EG-326 Engineering of Foundations, this part of the course and assessment focuses on the foundation design required for the superstructure. Conceptual design to give outline sizing of different foundation options, recommendation of suitable solution and design development to provide a foundation solution.

• Drainage design – using on the knowledge and skills developed from EG-329 Hydrology and Unsteady Flow, this part of the course and assessment focuses on drainage design. Scheme design for storm water run-off for the whole site, individual drainage element design including considerations for SuDs.

Construction Management - Develop a detailed construction plan for the above designed elements. the students will need to understand the specification of different site plant in order to identify appropriate plant and labour resources for proposed construction. They will develop a logistics plan to consider the site constraints, site set up and construction sequence in order to develop an NEC4 compliant programme of their proposed design elements.

Relevant sketches, calculations with correct references to Eurocode and AutoCAD drawings to communicate the final design are required for each coursework submission.

Intended Learning Outcomes: An appreciation of the relevant design, construction and management processes.

Knowledge of the design considerations necessary for different types of projects such as outline schemes and design of enabling works, superstructure, foundations and drainage systems.
• Project/client brief and how it translates to design parameters.
• Development of design concepts for different type of projects.
• How health & safety, sustainability, ethics and buildability should be taken into consideration in the design concepts of different types of projects.

Knowledge of construction project management activities and how to plan them:
• Identifying appropriate plant and labour resources for construction
• Developing a logistics plan to consider constraints, site set up and construction sequence
• Programming the construction of the designed elements

Develop ability to:
• Visualise, through hand sketching and physical modelling of the structural form to identify problems, and to disassemble a structure for element design.
• Make planning and design decisions by utilising knowledge of steel, reinforced concrete, geotechnics and fluids for design calculations by hand or commercial software.
• Verify analytical results with hand calculations.
• Have the awareness or 'feel' for expected sizes; critical scrutiny of calculations.
• Use working knowledge of Eurocode Standards to check or 'size' elements for final designs.
• Communication of design decisions by production of formal drawings using AUTOCAD.

Continue to develop skills in:

• Working as a member of a team including division of work, checking of group-members' work and working to deadlines.
• Time management of both individual and group work. Delivering to project deadlines.
• Communication of design ideas and basis of design calculations using hand sketches.

Accreditation Outcomes (AHEP)
Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments (SM1b)
Understanding of engineering principles and the ability to apply them to analyse 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 (EA1b)
Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4)
Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (D1)
Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (D2)
Work with information that may be incomplete or uncertain and quantify the effect of this on the design (D3)
Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal (D4)
Plan and manage the design process, including cost drivers, and evaluate outcomes (D5)
Communicate their work to technical and non-technical audiences (D6)
Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct (EL1)

Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering objectives (EL3)
Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques (EL6)
Knowledge of characteristics of particular materials, equipment, processes or products (P2b)
Understanding of the use of technical literature and other information sources (P4)
Understanding of appropriate codes of practice and industry standards (P6)
Understanding of, and the ability to work in, different roles within an engineering team (P11)
Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)
Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

Assessment:	Group Work - Project (40%) Group Work - Project (30%) Group Work - Practical (20%) Group Work - Examination (10%)

Assessment Description: This coursework is conducted and assessed in groups.

Group Project 1 (40%) – Scheme design & construction activity
Group Project 2 (30%) – Element design 1 & construction activity
Group Practical Class Assessment (20%) – Element design 2 & construction activity
Group day assessment (10%) – Human Centred Design Assessment Day

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

Assessment Feedback: Student groups will receive detailed oral feedback throughout the project during weekly scheduled design classes. If deemed necessary, additional group tutorials will be provided and some groups may also be invited to a formal group interview at the end of each stage of the project, so that a fair distribution of marks may be awarded within the group.

Students will receive written feedback on each group project submission.

A combination of Canvas group work tools and Microsoft Teams will be used as communication platforms for students to share their individual work with their group and the instructor, and receive feedback.

Failure Redemption: This module is non-redeemable.

Reading List: Building, Chartered Institute of; Chartered Institute of Building (Great Britain) Content Provider, Code of Practice for Project Management for Construction and Development, Wiley, 2014.ISBN: 9781118378199
Tomlinson, M. J., Boorman, R., Foundation design and construction / M.J. Tomlinson ; with contributions by R. Boorman., Prentice Hall,, 2001.ISBN: 9780130311801
B. S. Massey (Bernard Stanford) author., A. J Ward-Smith (Alfred John), author., Mechanics of fluids / Bernard S. Massey ; revised by John Ward-Smith., Spon Press, 2012.ISBN: 9781315272542
Alan Hayward (Alan T. J.), Frank Weare; Anthony Oakhill, Steel detailers' manual Alan Hayward and Frank Weare., Wiley-Blackwell, 2011.ISBN: 1283408058
Alan Hayward (Alan T. J.), Frank Weare; Anthony Oakhill, Steel detailers' manual / Alan Hayward and Frank Weare ; revised by Anthony Oakhill., Wiley-Blackwell, 2011.ISBN: 9781405175210
W. H. Mosley, Ray Hulse; J. H Bungey, Reinforced Concrete Design : to Eurocode 2., Palgrave Macmillan, 2012.ISBN: 9781137017499
Mosley, W. H., Bungey, J. H., Hulse, Ray., Reinforced concrete design : to Eurocode 2 / Bill Mosley, John Bungey., Palgrave Macmillan,, 2012.ISBN: 9780230302853
Butler, David,, Davies, John W., Urban drainage / David Butler and John W. Davies., Spon Press,, 2011.ISBN: 9780415455268

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

Not available to visiting and exchange students, unless the student has completed the Level 3 Semester 1 Civil Engineering modules EG-326 and EG-328 or equivalent.

Penalty for late project submissions - zero tolerance.

Practical work: Practical design classes and lecture hours to help with understanding of design work (linked to modules EG-326, EG-328) and project work. Students to familiarise themselves with the requirements of British and Eurocode Standards and with software in design.

Project work:

Design projects, in groups, with design elements including civils, superstructure, foundation and drainage design and construction management elements including programming, logistics and method.

Class assessment:

A group class assessment to test student's ability to use basic engineering principles to develop solutions to problems and analyse their effectiveness. The time-constrained format of the assessment will provide students with some realistic experience of delivering solutions under pressure.

Scheduling day assessment:

A day-long assessment simulating design and management focusing on human centred design.

The project work submissions will be phased for marking to ensure satisfactory progress by each member of the group.
The class assessment will be intermixed with lecture hours. Groups may be interviewed after each stage submission.

Notes from relevant design guides / Eurocodes / details on case studies of good practice may be made available to students by the lecturer involved via Canvas / during lectures.

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.

EG-3067 Finite Elements for Civil Engineers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-221; EG-223

Co-requisite Modules:

Lecturer(s): Prof EA De Souza Neto

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

Delivery Method: The module is delivered by lectures, example classes and computer-based laboratory sessions.
Lectures, example classes and computer exercises/tutorials will be video-recorded and made available to students.
Communication and course announcements, including office hours details, will be made via CANVAS.
Course materials, including the course notes and Matlab computer programs will be available for download from CANVAS.

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

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

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

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

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

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

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

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

Revision [3]

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

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Awareness of developing technologies related to own specialisation (SM4m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4)
- Communicate their work to technical and non-technical audiences (D6)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2b)
- Ability to work with technical uncertainty (P8)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Assessment:	Examination 1 (60%) Assignment 1 (15%) Assignment 2 (25%)
Resit Assessment:	Examination (Resit instrument) (100%)

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

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

3. Final examination: Comprising all aspects of the module (60%).

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

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

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Reading List: Chandrupatla, Tirupathi R., 1944-, Belegundu, Ashok D., 1956-, Introduction to finite elements in engineering, Pearson Education, 2012.ISBN: 9780273763680
Fish, Jacob, author., Belytschko, Ted, 1943-2014, author., A first course in finite elements, John Wiley & Sons, 2007 - 2007.ISBN: 9780470510841
Cook, Robert D. (Robert Davis), Finite element modeling for stress analysis, Wiley, 1995.ISBN: 0471107743
Burnett, David S., Finite element analysis : from concepts to applications, Addison-Wesley, 1987.ISBN: 0201108062
Hinton, E. (Ernest), Owen, D. R. J., Finite element programming, Academic Press, 1977.

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

Penalty for late submission of continuous assessment assignments: zero tolerance - no marks awarded for late submissions.

Available to visiting and exchange students.

EG-320 Structural Mechanics III

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-225

Co-requisite Modules:

Lecturer(s): Prof Y Feng

Format: Lectures 2 hours per week
Example classes 1 hour per week
Office hours: 1 hour per week
Directed private study and preparation for assessment: 6 hours per week

Delivery Method: - mixture of online lectures (live and recorded), face-to-face activities (Based on campus) and one-to-one unscheduled online tutorials.
- Assessment: possible exam-at-home assessment (100%) at the end of the semester

Module Aims: This module aims to provide a fundamental understanding of the principles of structural instability and the principles of limit state analysis and elasto-plastic bending. Study of structural instability will include the potential energy approach and stability analysis of beam/columns, rigid bar/spring systems. Statical and kinematic solution approaches to plastic collapse problems wlll be analysed and applied in the solution of the plastic collapse of beams/frameworks.

Module Content:
- Introduction to stability theory.
- Total potential energy; Energy method for the calculation of equilibrium conditions and the stability of the equilibrium position
- Application to simple rigid bar-spring models and beam/columns.
- Introduction to limit state analysis. The theory of elasto-plastic bending.
- The bounding theorems of limit analysis.
- Statical and kinematic solution approaches. Solution of continuous beams by the statical method.
- Introduction to mechanisms. Determination of independent and combined mechanisms.
- Use of the principle of virtual work to determine collapse loads.
- Problem solution for portal framed structures.
- Solution procedures for gable (pitched roof) frameworks.

Intended Learning Outcomes:
After completing this module you should be able to demonstrate a knowledge and understanding of:
- The principles of structural stability theory.
- The principles of limit state analysis of steel structures.
- Elasto-plastic theory of bending of sections

Students will need to demonstrate ability to:
- Identify the various independent and combined mechanisms by which plastic structural collapse can occur.
- Distinguish between axial and bending load carrying actions in framed structures.
- Identify the appropriate methods of analysis for linear and stability analysis of pin-jointed frameworks.
- Position loads on structures in order to obtain worst load case conditions.
- Apply the theory of elasto-plastic bending to determine shape factors for various sections.
- Use the equilibrium method to determine the limit load of continuous beam structures.
- Use the kinematic approach to determine the limit load of framed (portal and gable) structures.
- Calculate the buckling load for simple beam/columns.

Accreditation Outcomes (AHEP)
- Awareness of developing technologies related to own specialisation (SM4m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2b)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2b)
- Understanding of the use of technical literature and other information sources (P4)
- Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities (G1)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)

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

Assessment Description: There are two assessment components for the module. 80% of the total mark comes from the final closed-book examination in May/June. Another 20% comes from a written lab report on one experiment after having doen two experiments: 1) Bulking of a column/frame, 2) Plastic collapse of a portal frame

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

Assessment Feedback:
Students will receive feedback after submitting answers to Homework Questions issued through the course. Individual feedback and model answers will be provided within three weeks of submission. Examination feedback will be provided using the College of Engineering online feedback system, with general information provided on examination performance in each question and statistics on overall class performance

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Reading List: Martin. Williams, J. D Todd (Joseph Derwent), Structures : theory and analysis / M.S. Williams and J.D. Todd., Macmillan, 2000.ISBN: 9780333677605
Coates, R. C., Coutie, M. G., Kong, F. K., Structural analysis / R.C. Coates, M.G. Coutie, F.K. Kong., Chapman & Hall,, 1988.ISBN: 0412379805
Rhodes, J., Virtual work and energy concepts / J. Rhodes., Chatto and Windus,, 1975.

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

Not available to visiting and exchange students.
This module particularly builds on the work done in the Level 2 Structural Mechanics 2 (a) and (b) modules. Students should revise the topics learnt in these modules. This module also assumes students are familiar with the basic mathematical concepts learnt in the levels one and two mathematics modules.

EG-321 Geomechanics II

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-223; GEL200

Co-requisite Modules:

Lecturer(s): Prof AJ Gil

Format: Lectures: 2 hours per week
Example classes: 1 hour per week
Office hours: 1 hour per week
Directed private study and preparation for assessment: 6 hours per week

Delivery Method: • Based on campus attendance (whenever required) and online material.
• Assessment: 20% from continuous assessment; 80% from end of semester open-book examination.

Module Aims: This module builds upon the "Basic Soil Mechanics" module taught in Level 2 Civil Engineering. It is designed to strengthen the knowledge on the behaviour of soils and to give basic understanding of some geotechnical structures (e.g. retaining walls). The theories of lateral earth pressure (Mohr-Coulomb and Rankine) will be explained in detail as well as their implications into the design of earth retaining structures and the stability of slopes. The students will have the opportunity to resolve realistic geotechnical problems by means of their own designed computer program (e.g. through the use of the computer software MatLab).

Module Content:

• Review of basic concepts of continuum mechanics: stress (normal and shear), Mohr-circle representation, strain (normal and shear), constitutive relationships (Hooke's law), deviatoric and pressure stress components, isotropic state of stress. [3 hours]

• Shear strength of soils - Idealised stress-strain relationship. Mohr-Coulomb failure criterion in terms of stresses on a plane and in terms of principal stresses. Effect of drainage. Triaxial tests: CD, CU and UU tests. Influence of dilatancy on strength. Stress paths, peak and residual strengths of soils. [8 hours]

• Theory of earth pressures - Earth pressure at rest. Rankine's theory of active and passive earth pressure. Mohr-circles and planes of failure. Active and passive pressures for the cases of cohesionless and cohesive soils. Influence of surcharge on earth pressure. Considerations in the analysis and design of sheet piled walls. Free-earth support method, anchored sheet piled walls. Sustainability. [12 hours]

• Stability of slopes - Limiting equilibrium methods in stability of slopes. Stability of slopes in sandy soils. Flow parallel to the surface and at the surface. Submerged slopes and depressed water tables. Circular failure in clay soils. Multi-layered slopes and submerged slopes. Determination of the minimum factor of safety. Effective stress methods. The method of slices. Design charts, computer programs, factors of safety, introduction to embankment dams. [7 hours]

Intended Learning Outcomes: Technical Outcomes
Upon completion of this module, students should be able to:
• Recognise, utilise and define the theoretical aspects underpinning the mechanical behaviour of soils, including shear strength of soils, Terzaghi's principle, Mohr-Coulomb failure theory, cohesive and non-cohesive soil behaviour and lateral earth pressure theories (e.g. Mohr-Coulomb and Rankine).
• Differentiate the various soil's states of stress, including stress paths, deviatoric stress and isotropic state of stress.
• Utilise effectively soil's strength concepts, such as peak and residual strengths and dilatancy.
• Recognise, use and distinguish the two prototypical lateral earth pressure scenarios (i.e.active and passive cases).
• Assess the stability of slopes.
• Develop industry computer software from scratch.
• Utilise computer software to resolve realistic geotechnical problems, otherwise unsolvable by hand.
• Appreciate the importance of sustainability within the field of geomechanics.

Accreditation Outcomes (AHEP)
SM1b Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
SM2b 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.
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
D3b Work with information that may be incomplete or uncertain and quantify the effect of this on the design
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
D6 Communicate their work to technical and non-technical audiences
EA1b Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA2b Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
EA3b Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action
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
EA6M Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems
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
P1 Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.)
P2b Knowledge of characteristics of particular materials, equipment, processes or products
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
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
G4 Exercise initiative and personal responsibility, which may be as a team member or leader

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

Assessment Description: Examination 1: Open-book open examination (80%). Adhering to the University Examination Guidelines, students are permitted to bring the following to the examination: class notes and textbooks are permitted.

Assignment 1: Development of a MatLab computer program for the analysis of a realistic geotechnical structure (e.g. embedded wall) and preparation of a 10-page engineering report summarising the main results and drawing some technical conclusions regarding the structural performance of the structure (20%). This is a group project.

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

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

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Reading List: I. M. Smith (Ian Moffat), 1940-, Smith's elements of soil mechanics / Ian Smith., Chichester, West Sussex : John Wiley & Sons Ltd, 2014.ISBN: 9781118848852
Barnes, Graham (Graham E.), author., Soil mechanics : principles and practice, Palgrave Macmillan Education, 2016.ISBN: 9781137512208
Jonathan. Knappett, R. F Craig (Robert F.); R. F Craig (Robert F.)., Craig's soil mechanics / J. A. Knappett and R. F. Craig., Spon Press, 2012.ISBN: 9780415561266
Liu, Cheng., Evett, Jack B., Soils and foundations / Cheng Liu; Jack B. Evett., Person Education,, 2008.ISBN: 9780135015209
Coduto, Donald P., Yeung, Man-chu Ronald., Kitch, William A., Geotechnical engineering : principles and practices / Donald P. Coduto, Man-chu Ronald Yeung, William A. Kitch., Pearson,, 2011.ISBN: 9780131354258

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

• The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
• Available to visiting and exchange students.
• Assessment of external students: 100% from end of semester open-book examination.
• Notes, worked examples and past papers for this module can be found on CANVAS

EG-326 Engineering of Foundation

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-223; EG-321

Lecturer(s): Prof D Peric

Format: Lectures 2 hours per week.
Example Classes 1 hour per week.
Directed private study 3 hours per week.

Delivery Method: Two lectures and one example class per week.
Assessment: 100% from end of semester 2 hour examination.

Module Aims: This module focuses on basic principles and methodologies for analysis and design of engineering foundations. Mechanical concepts underlying the bearing capacity and serviceability are established from the continuum mechanics principles, and applied to the design of engineering foundations. Both shallow and deep foundations are considered, subject to different soil characteristics, loading conditions and construction techniques. Basic techniques of design for realistic foundations will be established by employing the Eurocode.

Module Content:

• Review of soil mechanics: effective stress principle; drained and undrained conditions; overburden pressure [2]
• Bearing capacity of shallow foundations: Failure types in the soil: General shear, punch and local failure. Methods for the evaluation of the bearing capacity for general shear failure type: Upper and Lower Bound methods. [9]
• Bearing capacity equations: Hansen equation. Influence of depth, footing geometry, water table; bearing capacity of footings on sands and on layered soils. [6]
• Settlement analyses of shallow foundations: Total and differential settlement. Settlements of footings on clay deposits: stress analysis beneath shallow foundations; Immediate settlement; Consolidation settlement. Settlements of footings on sand deposits: Schmertmann method. Settlement of footings on layered soils; allowable settlement; accuracy of settlement predictions. [7]
• Piled foundations: Types of piled foundations: Bored piles and driven piles. Base resistance and shaft friction. Negative skin friction. Capacity of pile groups. [6]

Intended Learning Outcomes: technical Outcomes
At the conclusion of the module, students should be able to:
• Identify basic principles underlying bearing capacity and settlement of shallow foundations.
• Identify basic principles underlying bearing capacity and settlement of deep (piled) foundations.
• Identify possible failure mechanisms and assess causes of excessive settlements of foundations.
• Design shallow (strip/pad) foundation so that it has an adequate margin of safety against collapse.
• Design deep (pile) foundation so that it has an adequate margin of safety against collapse.
• Distinguish between ultimate (general or local shear failure) and allowable bearing capacity.
• Predict the likely settlement of a simple shallow foundation during the working life of the structure being supported.
• Distinguish between immediate and long-term settlement.

Accreditation Outcomes (AHEP)
SM2b 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
EA1b Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA2b Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
EA3b Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action
P2b Knowledge of characteristics of particular materials, equipment, processes or products
P4 Understanding of the use of technical literature and other information sources
P6 Understanding of appropriate codes of practice and industry standards

Assessment:	Examination 1 (100%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Examination 1 - Standard 2 hour university examination worth 100% final mark. This is a closed book examination

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

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

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Reading List: Powrie, William, Soil mechanics : concepts and applications / William Powrie., CRC Press/Taylor & Francis, 2014.ISBN: 1466552093
Atkinson, J. H., The mechanics of soils and foundations / John Atkinson., Taylor & Francis,, 2007.ISBN: 9780415362566
Barnes, Graham (Graham E.), author., Soil mechanics : principles and practice, Palgrave Macmillan Education, 2016.ISBN: 9781137512208
Bowles, Joseph E., Foundation analysis and design / Joseph E. Bowles., McGraw-Hill,, 1996.ISBN: 0071140522
Tomlinson, M. J., Boorman, R., Foundation design and construction / M.J. Tomlinson ; with contributions by R. Boorman., Prentice Hall,, 2001.ISBN: 9780130311801
M. J. Tomlinson (Michael John), John Woodward 1936-, Pile design and construction practice Michael Tomlinson and John Woodward ., Taylor & Francis, 2007.ISBN: 9780415385824

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 of Level 2 module EG-223 (Soil Mechanics) and EG-321 (Geomechanics). Therefore it may not be suitable for visiting and exchange students, unless student has prior knowledge of geomechanics equivalent to modules EG-223 and EG-321.
Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

EG-328 Superstructure Design

Credits: 10 Session: 2023/24 September-January

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

Co-requisite Modules: EG-M120

Lecturer(s): Dr WG Bennett, Miss X Yin

Format: Lectures 1-2 hours per week.
Example classes 1-2 hours per week.
Directed private study 3 hours per week
One hour office hour per week..

Delivery Method: Problem solving and discussion example classes will accompany lecture sessions and the recordings made available through canvas.
Course materials, including the course notes, will be available for download from Canvas. This will include a mixture of asynchronous prepared reading material, instructional videos, and interactive elements e.g. quizzes.
Communication and course announcements, including office hours details, will be made via Canvas.

Module Aims: This module develops a range of design techniques, understanding of structural behaviour for steel and concrete structural building frames from low rise to tall building applications, forms of bridges, as well as concepts of sustainability design for buildings and bridges and approaches to net zero carbon.

Module Content: • Structural concepts - Framing of single storey and tall buildings, braced and unbraced buildings. Reinforced concrete frame buildings with shear walls and lift cores. Forms of Bridges.
• Autodesk Robot - Introduction to the software, tools, and applications
• Sustainability in design for buildings and bridges, and approaches to achieving net zero carbon emissions.
• Reinforced concrete retaining walls - types of wall, pressure acting on wall, principal modes of failure and their design approach to BS EN 1997.
• Fundamental approaches to the design of foundations to BS EN 1997
• Prestressed Concrete Theory and Design

Intended Learning Outcomes: After completing this module, the students will be able to:
• Recognise, describe and evaluate how different structural systems provide vertical and lateral stability.
• Utilise Autodesk Robot to carry out structural analysis of 3D designs
• Describe the main methods to evaluate sustainability within civil engineering projects, and approaches to achieving net zero carbon emissions in construction.
• Apply the principles described in BS EN 1997 to evaluate the stability and design of retaining walls and foundations.
• Describe the different types of prestressed concrete and their performance.

Assessment: Examination 1 (60%)
Assignment 1 (20%)
Assignment 2 (20%)

Assessment Description: Assessment: 20% project group assignment on structural forms, and 20% individual assignment on sustainability in the civil engineering industry. Remaining 60% of the module marks are obtained by means of an end of teaching block examination.
This module operates on a zero-tolerance policy for late submission/plagiarism/collusion/commissioning of coursework i.e. zero marks awarded.

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 Canvas community site, reflecting on the class performance as a whole to individual exam questions.

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 60% supplementary examination. There is no resit opportunity for the assignment components. Assignment marks will be retained from the teaching block 1 assessments.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 60% supplementary examination. There is no resit opportunity for the assignment components. Assignment marks will be retained from the teaching block 1 assessments.

Reading List: Westbrook, Roger., Walker, Derek,, Structural engineering design in practice : project design examples / Roger Westbrook and Derek Walker., Longman,, 1996.ISBN: 0582236304
W. H. Mosley, Ray Hulse; J. H Bungey, Reinforced Concrete Design : to Eurocode 2., Palgrave Macmillan, 2012.ISBN: 9781137017499
Mosley, W. H., Bungey, J. H., Hulse, Ray., Reinforced concrete design : to Eurocode 2 / Bill Mosley, John Bungey., Palgrave Macmillan,, 2012.ISBN: 9780230302853
Jonathan. Knappett, R. F Craig (Robert F.); R. F Craig (Robert F.)., Craig's soil mechanics / J. A. Knappett and R. F. Craig., Spon Press, 2012.ISBN: 9780415561266
Tomlinson, M. J., Boorman, R., Foundation design and construction / M.J. Tomlinson ; with contributions by R. Boorman., Prentice Hall,, 2001.ISBN: 9780130311801
Chanakya. Arya, Design of structural elements : concrete, steelwork, masonry and timber designs to British standards and Eurocodes / Chanakya Arya., Spon Press, 2009.ISBN: 9780415467209
Buick Davison editor.; Graham W. Owens (Graham Wynford) editor.; Steel Construction Institute (Great Britain), Steel designers' manual / the Steel Construction Institute ; edited by Buick Davison, Graham W. Owens., Chichester : John Wiley & Sons, Ltd, 2012.ISBN: 9781119249863
L. H. Martin (Laurence Harold), J. A Purkiss, Structural design of steelwork to EN 1993 and EN 1994 / L.H. Martin, J.A. Purkiss., Butterworth-Heinemann, 2008.ISBN: 9780750650601
Lam, Dennis., Structural steelwork : design to limit state theory / Dennis Lam, Thien-Cheong Ang, Sing-Ping Chiew..ISBN: 9780415531917
Nethercot, D. A., Limit states design of structural steelwork / David A. Nethercot., Spon Press,, 2001.ISBN: 9780419260905
L. Gardner (Leroy), D. A Nethercot; Institution of Civil Engineers (Great Britain), Designers' guide to Eurocode 3 : design of steel buildings EN 1993-1-1, -1-3 and -1-8 / Leroy Gardner and David A. Nethercot., ICE : Thomas Telford, 2011.ISBN: 9780727741721
Gardner, L. (Leroy), Nethercot, D. A, Designers' guide to EN 1993-1-1 : Eurocode 3, design of steel structures : general rules and rules for buildings, Thomas Telford, 2005.ISBN: 0727731637
Institution of Structural Engineers (Great Britain), issuing body, Manual for the geotechnical design of structures to Eurocode 7., The Institution of Structural Engineers, 2013.ISBN: 1906335230
Manual for the design of building structures to Eurocode 1 and basis of structural design., Institution of Structural Engineers, 2010.ISBN: 1906335079
Hendy, Chris RSmith, D. A, Eurocodes Expert (Organization), Designers' guide to EN 1992-2 : Eurocode 2: Design of concrete structures. Part 2, Concrete bridges / C.R. Hendy and D.A. Smith., Thomas Telford, 2013.ISBN: 0727731599
Hendy, C. R. (Chris R.)Murphy, C. J. (Chris J.), Designers' guide to EN 1993-2 : eurocode 3 : design of steel structures. Part 2. Steel bridges / C.R. Hendy and C.J. Murphy., Thomas Telford, 2007.ISBN: 0727731602
Hendy, C. RJohnson, R. P. (Roger Paul), Designers' guide to EN 1994-2 : Eurocode 4: design of steel and composite structures : part 2: general rules and rules for bridges / C.R. Hendy and R.P. Johnson., Thomas Telford, 2006.ISBN: 0727731610
Brettle, M. E, Brown, D. G. (Donald George), Steel Construction Institute (Great Britain), Steel building design : worked examples for students, in accordance with Eurocodes and the UK National Annexes / edited by M. E. Brettle, D. G. Brown., The Steel Construction Institute, 2009.ISBN: 1859421911
Guinee, J. B; ebrary, Inc, Handbook on life cycle assessment operational guide to the ISO standards / Jeroen B. Guinee (final editor)., Kluwer Academic Publishers, 2002.ISBN: 1402002289
Robert. Crawford, Life Cycle Assessment in the Built Environment, Taylor and Francis, 2011.ISBN: 9780203868171
Robert Crawford 1978-, Life cycle assessment in the built environment / Robert H. Crawford., Spon Press, 2011.ISBN: 9780415557955
R. I. Gilbert 1950- author., N. C Mickleborough (Neil C.), author.; Gianluca Ranzi 1972- author., Design of prestressed concrete to Eurocode 2 / Raymond Ian Gilbert, Neil Colin Mickleborough, Gianluca Ranzi., Boca Raton, FL : CRC Press, 2017.ISBN: 1466573104

Additional Notes: This module particularly builds on the work of year 2 modules EG-222 and EG-224. Therefore it may not be suitable for visiting and exchange students, unless student has previous knowledge of structural analysis and design equivalent to modules EG-222 and EG-224. Similarly, students entering directly to year 3 Civil Engineering should familiarise themselves with the content of those year 2 modules as soon as possible.

EG-329 Hydrology and Unsteady Flow

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-201

Co-requisite Modules:

Lecturer(s): Dr Y Xuan, Dr J Li

Format: Lectures 2 hours per week
Blended Learning + Office Contact 1 hour per week
Directed private study 3 hours per week

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

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

Lectures (online): Mix of synchronous, Zoom-based live sessions and recorded lectures, 2 hours per week
Example classes (online): Synchronous, Zoom-based online example classes, 1 hour per week
Optional on campus (subject to attendance), face to face discussion of examples and other related questions.
Office hours (online, optional): Zoom-based one-to-one support subject to appointment 1 hour per week

Assessment: Coursework 1 - Drainage Design Exercise 20%, Coursework 2 - Hydrology 10% , Exam 1- 70% from end of teaching block examination
Feedback: throughout the term, students will receive feedback in the form of marked coursework.

Module Aims: This module comprises two components: Hydrology (80%) and Water Engineering Design (20%)

Hydrology: 1. Introduction of important concepts in hydrology, such as hydrological cycle, rainfall runoff process, hydrological design; 2. Ensuring students to be able to solve common hydrological problems following the general practice guideline in engineering hydrology; 3. Encouraging critical thinking on issues related to development issues, with special emphasis on water supply problems under the climate change impacts.

Water Engineering Design:Storm water design calculations. Design of paved and roof drainage systems. Application of rational method hydrology open channel flow in urban drainage. Preliminary design calculations. British and Eurocode applications. Case studies and design of SuDs components

Module Content:
Hydrological cycle and water budget [1]; Precipitation analysis and design storms [2];
Evaporation and transpiration [2]; Infiltration and effective rainfall [1]
Flood estimation [1]; Catchment analysis [4]
Rainfall runoff modelling and Unit Hydrograph [2]
River routing and reservoir routing [2]
Hydrological modelling.[1]
SuDs and Drainage Design [4]

Intended Learning Outcomes: Technical Outcomes
Upon completion of the module, students should be able to:
1. Demonstrate a knowledge and proven understanding of the following key concepts. Students should be able to interpret them in a correct context, which will be assessed via either the final written exam or the coursework.
Hydrological cycle and key hydrological processes such as precipitation, evapo-transpiration, infiltration, runoff; rainfall-runoff relationship; water budget and water supply using reservoirs; design storm and flood estimation; flood routing; risk analysis; hydrological modelling; climate change and sustainability issues and the impact on water resources.
2. Apply key engineering methods learned to solve water problems relating to civil engineering:
(1) Water use budgeting ;(2) Catchment analysis; (3) Design storms and estimating flood; (4) Water demand analysis and estimate suitable reservoir size; (5) Using Unit Hydrograph to predict runoff process; (6) Flood routing in open channel flow and reservoir routing;(7) Risk estimation of extreme hydrological events.
3. Apply the SuDs principle and successfully carry out a small Urban drainage design project.

Accreditation Outcomes (AHEP)
SM1b Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
SM2b 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
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.
EA1b Understanding of engineering principles and the ability to apply them to analyse 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
EA3b Ability to apply quantitative and computational methods in order to solve engineering problems and to 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
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
D3b Work with information that may be incomplete or uncertain and quantify the effect of this on the design.
D5 Plan and manage the design process, including cost drivers, and evaluate outcomes
D6 Communicate their work to technical and non-technical audiences
D7m Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations.
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
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
P6 Understanding of appropriate codes of practice and industry standards
P8 Ability to work with technical uncertainty
P9m A thorough understanding of current practice and its limitations, and some appreciation of likely new developments
P11b Understanding of, and the ability to work in, different roles within an engineering team
G1 Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities

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

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

Assessment Description: Coursework 1: Urban drainage design work to be completed in small groups which are normally self-organised with 4-6 students, covering drainage scheme design for storm water run-off, contributing 20% to the final mark.

Coursework 2: A group-based written coursework contributing 10% to the final mark. Groups are normally proposed by the fellow students with a size of 4-6 students. Canvas submission only, no late submission will be accepted.

Examination 1: This will be an individual assessment after the teaching block with 70% contribution to the final mark. This component cannot be exempted.

Resit Examination: An individual assessment designed for the resit. The resit is used to redeem the failure and counts 100% to the final mark. Please note, the mark of the resit is capped. The drainage design part is not assessed by the resit exam.

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

Assessment Feedback: Coursework 1 - Feedback will be given on an individual basis via CANVAS.
Coursework 2 - Feedback will be given on an individual basis via CANVAS.
Examination 1 - Standard university exam feedback form.

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Reading List: Wilson, E. M., Engineering hydrology / E.M.Wilson., Macmillan,, 1990.ISBN: 9780333517178
David Butler 1959-, John W Davies, Urban drainage / David Butler and John W. Davies., Spon Press, 2011.ISBN: 9780415455268
Chow, Ven Te,, Open-channel hydraulics / Ven Te Chow, Blackburn Press,, 2008, 1959..ISBN: 9781932846188
Elizabeth M Shaw, Hydrology in practice / Elizabeth M Shaw ... [et al.]., Spon, 2011.ISBN: 9780415370424
Philip B. Bedient 1948-, Wayne Charles Huber; Baxter E Vieux, Hydrology and floodplain analysis / Philip B. Bedient, Wayne C. Huber, and Baxter E. Vieux., Prentice Hall, 2013.ISBN: 9780273774273

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.

Students must have completed Year 1 TB2 maths modules in order to take this module.

EG-353 Research Project

Credits: 30 Session: 2023/24 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr AC Tappenden, Dr M Fazeli, Prof PJ Holliman

Format: Formal Lectures 16 hours;
Directed private study (incl. meetings with supervisors) 284 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

Weekly briefings on all aspects of project work, risk assessment, planning, research methods, and ethics as it applies to engineering and research work.

English for academic purposes, writing up, referencing and presenting, the engineering institutions, continuing professional development.

These will be backed up by regular one-on-one meetings with a supervisor who will provide guidance and feedback on an ongoing basis.

Module Aims:
The module involves the application of scientific and engineering principles to the solution of a practical problem associated with engineering systems and processes.

The student will gain experience in working independently on a substantial, individually assigned task, using accepted planning procedures. It will require and develop self-organisation and the critical evaluation of options and results, as well as developing technical knowledge in the chosen topic.

Module Content:
A series of compulsory weekly briefings in Semester 1 will cover topics such as:

- Introduction to the module
- Health, Safety and Risk Assessment
- Project Planning
- Using the Library for Research
- Engineering and Research Ethics
- Academic Integrity
- Referencing

There will also be a series of sessions delivered as part of the Academic Success Programme in Semester 2 to help students with writing of their final paper and preparing for their viva.

The schedule for all taught sessions will be available on Canvas, all briefings will be recorded and also available on Canvas.

Intended Learning Outcomes:
Learning Outcomes are mapped to those required to partially satisfy the educational requirements for Engineering Council Registration as a Chartered Engineer as part of an Accredited BEng Honours Degree Standard (UK HEQF Level 6) as defined by the UK Standard for Professional Engineering Competence (UK-SPEC) and the Accreditation of Higher Education Programmes 3rd Edition (AHEP 3).

The AHEP Learning Outcomes are categorised under six headings:
• Science and mathematics (SM1b, SM2b, SM3b)
• Engineering analysis (EA1b, EA2, EA3b, EA4b)
• Design (D1, D2, D3b, D4, D5, D6)
• Economic, legal, social, ethical and environmental context (EL1, EL2, EL3, EL4. EL5, EL6)
• Engineering practice (P1, P2, P3, P4, P5, P6, P7, P8, P11)
• Additional general skills (G1, G2, G3, G4)

Precisely which subset of skills and learning outcomes will be covered in any particular project will vary, but all projects are expected to demonstrate the following Learning Outcomes at a threshold level:

• SM1b (all assessment components)
• SM3b (all assessment components)
• EA1b (all assessment components)
• EA2 (final paper and viva)
• EA3b (final paper and viva)
• D6 (final paper and viva)
• EL1 (ethics assessment)
• EL3 (project plan, project management)
• P1 (final paper and viva)
• P2 (final paper and viva)
• P4 (final paper and draft introduction)
• P8 (final paper, viva and project management)
• G1 (all assessment components)
• G2 (all assessment components)
• G3 (all assessment components)
• G4 (all assessment components)

Please see the Accreditation of Higher Education Programmes 3rd Edition for full descriptions of the above Learning Outcomes.

Assessment:	Project Planning Statement (5%) Project Management (0%) Progress Report (5%) Project Management (5%) Ethics Assessment (0%) Final Paper (50%) Oral Presentation (30%) Project Management (5%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Credit bearing assessments:
- Project Planning Statement (5%)
- Progress Report (5%)
- Project Management 1 (5%)
- Final Paper (50%)
- Oral Presentation/Viva (30%)
- Project Management 2 (5%)

Non-credit bearing assessments:
- Ethics Assessment (pass/fail COMPULSORY assessment, must be passed to pass the module)
- Project Management check-in (0%)

Full assessment criteria will be on Canvas.

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

Assessment Feedback:
Continuous feedback on progress will be delivered via meetings with supervisors.

Written feedback on assessment components will be delivered via the Feedback Studio.

There will be a formal opportunity to submit a Draft paper for preliminary review to provide detailed feedback to the student and provide the student with an opportunity to make modifications to the paper before final submission.

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.

Reading List: R. J. Moffat author., Roy W. Henk author., Planning and executing credible experiments : a guidebook for engineering, science, industrial processes, agriculture, and business / Robert J. Moffat, Roy W. Henk., Hoboken, NJ : John Wiley & Sons, Inc., 2021.ISBN: 9781119532842
Engineering Council, The UK Standard for Professional Engineering Competence.
James D. Lester Jr., 1959- author., James D. Lester Sr., 1935-2006, author., Writing research papers : a complete guide / Jim D. Lester, James D. Lester, Harlow : Pearson Education Limited, 2014.ISBN: 9781292054117
Barrass, Robert., Scientists must write : a guide to better writing for scientists, engineers and students / Robert Barrass., Routledge,, 2002.ISBN: 9780415269964
How to Write a Paper, Engineering Department, University of Cambridge, 2005.
Alasdair Montgomery, Giles Lloyd-Brown, Allison Jones, Philippa Price, Library Support for Engineers. Avoiding Plagiarism (Cardiff University).
Engineering Council, Accreditation of Higher Education Programmes.
Pears, Richard, author., Shields, Graham J., author., Cite them right : the essential referencing guide, Bloomsbury Academic, 2022 - 2022.ISBN: 9781350933446
Jean-Luc. Lebrun, Scientific writing 2.0 a reader and writer's guide / Jean-Luc Lebrun., World Scientific, 2011.ISBN: 1283433826
Gastel, Barbara, author., Day, Robert A., 1924-2021, author., How to write and publish a scientific paper, Greenwood, 2022.ISBN: 9781440878848
Martha. Davis, Kaaron J Davis; Marion M Dunagan, Scientific papers and presentations Martha Davis, Kaaron J. Davis, Marion M. Dunagan., Academic Press, 2012.ISBN: 1283716720
Martha Davis 1935-, Kaaron J Davis; Marion M Dunagan, Scientific papers and presentations / Martha Davis, Kaaron J. Davis and Marion M. Dunagan., Amsterdam : Elsevier/AP, 2012.ISBN: 9780123847270
How to write a Paper in Scientific Journal Style and Format.
McGraw-Hill Companies., AccessEngineering., Columbus, OH : McGraw-Hill Global Education Holdings, LLC, 2009.

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

Only available to students following an Engineering Degree Programme.

The nature of the research project varies from one student to another. Projects may involve design, theoretical, experimental or computational studies.

The academic staff of the Faculty of Science and Engineering produce a list of project descriptors and students are given a chance to select a project over the summer before the start of the academic year. Alternatively students are offered the opportunity to define the topic of their own research project.

Students must attend all relevant weekly briefings, a detailed schedule of which will be available on Canvas.

Each student will be allocated a supervisor and it is recommended that students meet their supervisors at least once a fortnight to discuss progress.

There are a number of compulsory submissions (a project plan; an ethics assessment; a draft introduction; a progress report; a 10-page research paper; evidence of project management and a viva examination). Precise assessment criteria, deadlines, submission formats and instructions will be disseminated via Canvas.

The Faculty of Science and Engineering ZERO TOLERANCE penalty policy for late submission of coursework and continuous assessment will apply to all assessment elements apart from the final paper submission and viva.

Any late submissions on the final paper (not covered by extenuating circumstances) will be capped at 40%.

If a student fails to attend their scheduled Viva (not covered by extenuating circumstances) rescheduling may be permitted but both elements (presentation and defense) will be capped at 40%.

EGA331 Coastal processes and engineering

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

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

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

20 hours worth of asynchronous on-line lectures
10 hours of face to face or synchronous examples classes/tutorials/ office hours
70 hours of directed private study

Module Aims: This module introduces the fundamentals of wave and tidal mechanics including linear wave theory, wave transformation, nearshore processes, theory of tides and coastal water level variations which are essential to coastal engineering. The concepts introduced here provide an overview of the main physical processes that shape the coastal environment and
forms the basis of learning more complex coastal zone management, coastal zone processes modelling and coastal designs in Level M.

Module Content:

• Introduction: historical context, the coastal environment, context of design, hard and soft engineering options for coastal defence and their effects on the coastal environment.

• Linear wave theory: airy wave equations, water particle motions, approximations for 'deep' and 'shallow' water, energy content and power in a wave, group velocity, brief introduction to nonlinear theories.

• Wave transformation: refraction, shoaling, reflection, diffraction.

• Coastal Processes: wave breaking, wave-induced currents, set-up and set-down.

• Theory of tides: equilibrium tidal theory, classification of tides, tidal analysis, tidal prediction, dynamic theory of tides

• Water level variations: tides, surge, sea level rise, tsunamis.

Intended Learning Outcomes: Technical Outcomes
Upon completion of this module students should be able to:
• Apply linear wave theory to determine essential wave parameters required for coastal management situations.
• Understand the limitations of linear wave theory and their consequences.
• Use linear wave theory to perform wave transformation to determine nearshore waves.
• Determine location of wave breaking, wave set-up/set-down and nearshore currents using principles of nearshore processes.
• Use equilibrium theory of tides.
• Apply equilibrium tidal theory to formulate tidal prediction problems, apply tidal classification methods, determine tide levels and to estimate total water level.
• Distinguish surges and tsunamis.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.) (P1)
- Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities (G1)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)

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

Assessment Description: Coursework 1 - online submission (10%)
Closed Book Examination (90%). The examination duration will be 2 hrs.

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 40% in the examination component, and a minimum of 40% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 40%.

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

Assessment Feedback: Feedback on coursework is provided automatically via Canvas.

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

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

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
Reeve, Dominic., Chadwick, Andrew,, Fleming, Christopher., Coastal engineering : processes, theory and design practice / Dominic Reeve, Andrew Chadwick and Christopher Fleming., Spon Press,, 2012.ISBN: 9780415583534
Dominic Reeve (Dominic E.) author., Andrew Chadwick 1960- author.; Christopher Fleming author., Coastal engineering : processes, theory and design practice / Dominic Reeve, Andrew Chadwick and Christopher Fleming., Spon Press, 2004.ISBN: 0415268400

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

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