Civil Engineering Modules for Visiting Students 2026/27

These modules cover the key civil engineering subjects such as structures, hydraulics, geotechnics, construction materials, mathematics and surveying. Students also study the design and construction of sustainable infrastructures, focusing on water engineering, transport, highway and the energy sector.

Level 4 modules are introductory and develop skills in engineering analytics and mathematics, structures, mechanics and materials, fluid mechanics and soil mechanics. There is an emphasis on practical work, including laboratories and model-making.

At level 5, modules cover digitisation in Civil Engineering Construction using REVIT and BIM related software, practical-focused studies covering specific civil engineering subjects such as structural analysis, construction materials, geotechnics, hydraulics and water engineering, engineering geodesy and geographic information system (GIS).

Level 6 modules provide an in-depth study and application of core civil engineering disciplines: advanced structural modelling and design, geotechnical and environmental engineering, and infrastructure such as transportation and highways.

Updated August 2026/PJW

Entry requirements: GPA of 2.75 or above (out of 4.0) or equivalent

Pre-requisites:

- **Level 4:** prior introductory university-level study of mathematics is very useful.
- **Level 5:** prior study of civil engineering subjects is required (at level 4 or equivalent).
- **Level 6:** substantial prior study of civil engineering is required.
- **For levels 5 and 6,** any specific pre-requisites for individual modules will be detailed in each module description.

Taught at: Penrhyn Road Campus

Key:

KEY TO MODULE DESCRIPTORS
SUITABILITY OF MODULE FOR STUDENTS VISITING KU ON STUDY OPTION ____

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

Civil Engineering Modules for Visiting Students 2026/27

1: Indicates module is suitable for students visiting KU on Study Option 1 (Whole Year)
2: Indicates module is suitable for students visiting KU on Study Option 2 (Autumn)
3: Indicates module is suitable for students visiting KU on Study Option 3 (Spring)

Notes:

1. *All modules are at undergraduate level only.*
2. *Students enrolled on Study Option 1 are required to study the entire module.*
3. *Whilst the University makes every effort to ensure that this information is correct at the time of updating (August 2026), it cannot accept responsibility for omissions or subsequent changes. Module availability and content may be subject to change, as part of the University's policy of continuousimprovement and development.*
4. *Details of assessment for students enrolled on either Study Option 2 or 3 where provided are indicative only and may also be subject to change as part of the above policy.*

MODULE CODE	LEVEL	MODULE TITLE	SUITABILITY KEY
CE4011	4	Fluid and Soils Mechanics	1, 2, 3
EG4022	4	Sustainability for Professional Practice	1, 3
CE4023	4	Structural Analysis and Design 1	1, 2, 3
CE4024	4	Maths and & Engineering Analytics	1, 2
CE4025	4	Introduction to Mechanics & Materials	1, 3
CE5020	5	Digital Construction & BIM	1, 2
CE5021	5	Hydraulics and Water Engineering	1, 2
CE5022	5	Engineering Geodesy and GIS	1, 3
CE5023	5	Structural Analysis & Design 2	1, 2
CE5024	5	Geotechnics and Materials	1, 2, 3
CE6020	6	Advance Structural Modelling and Design	1, 2
CE6021	6	Geotechnical & Environmental Engineering	1, 3

CE6024	6	Highway, Transport and Traffic Engineering	1, 2
CE6027	6	Integrated Group Design Project	1, 3

LEVEL 4 – INTRODUCTORY

Module Code: CE4011

Module Title: Fluid and Soils Mechanics

Credits:

- Full Year: 8 (US) 15 (ECTS)
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 4

Prerequisites: prior study of university-level physics is useful

Suitability:

- Study Abroad/International Exchange students for Study Options 1 or 2 or 3
- Not open to Erasmus students (as Level 4, unless home university agrees)

Content:

The module introduces the fundamental properties of fluids and soils, covering the basic equations used in fluid mechanics and the essential aspects of soil mechanics. It also includes the concept of dimensions and the SI units of measurement utilised in science and engineering. Where possible, lectures will relate academic work to the 'real world' of civil engineering, through the introduction of case studies and research. Theoretical topics are supported by laboratory practical(s) that also provide instruction in safe laboratory working practices, analysis of test data and appropriate reporting.

➢ **Autumn Semester: Fluid Mechanics**

- Fluid mechanics: properties of fluids – density, viscosity, bulk modulus
- Hydrostatics problems, buoyancy
- Pressure measurement - manometry
- Conservation of mass (continuity equation)
- Bernoulli (energy) Equation – examples in pressurised flow
- Conservation of momentum – examples in pressurised flow
- Flow measurement for free-surface and pressurised flow

- Laboratory work on Venturi Meter, jet impact, Bernouli Equation and sharp-crested weirs

➢ **Spring Semester: Soil Mechanics**

- Soil mechanics: Origin and nature of soils; weathering and deposition
- Description and classification of soils; plasticity and sieve analysis
- Phase relationships and soil compaction
- Laboratory measurement of basic soil properties: moisture content, specific gravity, field density, void ratio, particle size, consistency limits
- Introduction to the principles of effective stress
- Site investigation: soil sampling, borehole logs; ground water monitoring; typical format of a standard site investigation report
- In-situ test methods and equipment: standard penetration, cone penetration, dynamic probing, field vane, pressuremeter test and geophysical methods
- Civil Engineering case studies relating to fluid and soil mechanics
- Laboratory use; safe effective working practice, data collection and analysis
- Dimensions and SI Units and the production of succinct laboratory reports

Teaching: weekly three-hour lecture and (most weeks) a two-hour practical session

Assessment:

➢ Study Option **1:**

- Fluid Mechanics lab write-up 1 (20%)
- Fluid Mechanics lab write-up 2 (20%)
- Soil Mechanics lab report and presentation (20%)
- In-class test (40%)

➢ Study Option **2**:

- Fluid Mechanics lab write-ups

➢ Study Option **3:**

- in-class test
- Soil Mechanics lab report and presentation

Note: methods of assessment listed are indicative only and may be subject to change

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Civil Engineering Modules for Visiting Students 2026/27

Module Code: EG4022

Module Title: Sustainability for Professional Practice

Credits:

- Single Semester: 4 (US) 7.5 (ECTS)

Level: 4

Prerequisites: none

Suitability:

- This module runs entirely in the **spring semester**
- Study Abroad/International Exchange students for Study Options 1 or 3
- Not open to Erasmus students (as Level 4, unless home university agrees)

Content:

The module will explore the global environmental, economic, and social problems that society faces and encourage students to find and create sustainable innovative solutions.

The students will be introduced to the complex societal problems and current challenges associated with social justice, cultural inequalities, ethics, and climate change emergencies, this will enable them to reflect on the UN Guiding Principles on Business and Human Rights. The students will be immersed in a culture of education that provides knowledge, values, attitudes, and skills and encourages them to think about possible solutions seeking to balance economic, environmental, and social objectives set by the United Nations Sustainable Development Goals (UNSDGs), and the challenges in achieving those goals.

Students will be able to develop knowledge, values, attitudes, and skills associated with systems thinking and integrated problem-solving within the context of environmental systems and processes and the built environment. This will encourage students to critically address ways to mitigate and solve complex global societal problems addressed by the UNSDGs.

Working in teams, students will explore, and debate: to evaluate the interconnectivity between the United Nations Sustainable Development Goals (UNSDGs), collaborate and co-design practical and equitable strategic solutions to Net Zero carbon (positive), and evaluate sustainability-related global challenges (e.g., the climate emergency) while developing critical thinking and self-awareness.

Teaching: weekly two-hour workshops

Assessment:

- 1,500-word Sustainability Brief Report (100%)

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE4023

Module Title: Structural Analysis & Design 1

Credits:

- Full Year: 8 (US) 15 (ECTS)
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 4

Prerequisites: prior study of university-level physics is useful

Suitability:

- Study Abroad/International Exchange students for Study Options 1 or 2 or 3
- Not open to Erasmus students (as Level 4, unless home university agrees)

Content:

The module covers the fundamentals of structural analysis along with an introduction to stress analysis and design. The behaviour of statically determinate structures, their properties and the effect of different types of static loading will be studied. The theoretical principles will be verified by laboratory testing under the Mechanics of Materials module. An analysis of trusses and simple structural elements will be developed qualitatively and quantitatively using numerical skills that are necessary for a thorough understanding of the behaviour of structures and structural systems.

- **Overall Topics:**

- The principle of statics: forces, resolution of forces and equilibrium
- The use of free body diagrams in static analysis of simple structures
- The qualitative understanding of structural behaviour
- The analysis of simple trusses, beams and columns to draw axial force, shear force and bending moment diagrams
- The analysis of arches and cables
- Types of structural failure- ductile and brittle behaviour
- Stress analysis (axial, bending and shear, complex and combined)
- Principles of structural design (pure tension, bending and shear)
- Mathematical idealisation of structures
- Types of loads, load distribution and load paths in structures including examples

- **Autumn Semester: Structural Analysis**

- Forces and moments, types of loads
- Principles of equilibrium, types of supports and reactions
- Section properties
- Pin jointed structures- trusses
- AF diagrams
- BM & SF diagrams

- **Spring Semester: Engineering Bridge Design Group Project**

This part of the module tests the theory covered in the autumn semester. It will enable students to put into practice many important aspects of the design process. It is a group activity that will encourage teamwork and improve communication skills.

Teaching:

- weekly three-hour lecture (Autumn)
- weekly three-hour computing/practical sessions (Spring)

Assessment:

- Study Option **1:**
- In-class test (40%)
- Engineering Bridge Design Group Project: group work (40%) and individual work (10%)
- Lab report: Roof Trusses (10%)

- Study Option **2**:

- In-class test (100%)

- Study Option **3:**

- Engineering Bridge Design Group Project: group work (40%) and individual work (10%)

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE4024

Module Title: Mathematics & Engineering Analytics

Credits:
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 4

Prerequisites: prior study of university-level physics is useful

Suitability:
- This module runs entirely in the **spring semester**
- Study Abroad/International Exchange students for Study Options 1 or 3
- Not open to Erasmus students (as Level 4, unless home university agrees)

Content:
The aim of this module is to provide a thorough background in engineering mathematics and equip students with the mathematical skills essential for solving engineering problems. Topics covered comprises algebra, functions, logarithms, trigonometry, calculus, differential equations, and vectors among others. The context of the problems to be solved will include practical and real-life problems from a wide range of civil engineering

examples to demonstrate the relevance of the various mathematical tools taught in the whole year.

➢ **Topics:**

- Fundamentals of numerical and algebraic calculus
- Solution of linear and quadratic equations
- Systems of linear equations
- Basic concepts of functions and most common engineering functions
- Exponential and logarithmic equations
- Elements of Trigonometry
- Differentiation and integration
- Matrix algebra
- Vectors and their applications
- Binomial, Maclaurin and Taylor series
- Complex numbers
- First and second order differential equations
- Elements of statistics and probability

Teaching: weekly three-hour lectures

Assessment:

- Coursework (50%)
- In-class 2-hour test (50%)

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE4025

Module Title: Introduction To Mechanics & Materials

Credits:

- Single Semester: 4 (US) 7.5 (ECTS)

Level: 4

Prerequisites: prior study of university-level physics is useful

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Suitability:

- Study Abroad/International Exchange students for Study Options 1 or 3
- Not open to Erasmus students (as Level 4, unless home university agrees)

Content:

This module develops students' understanding of the fundamentals of structural characteristic and mechanics properties of a broad range of engineering materials including common civil engineering materials. This module introduces the fundamental concepts and engineering mechanics of the materials.

This module also enables the student to appreciate essential fundamental materials properties required to undertake practical approach to the solution of basic real-life engineering problems.

This module also promotes effective group working and leadership skills and develops skills in management of engineering design and creative problem solving which are key employability and graduate skills.

➢ **Topics:**

- The mechanisms and analysis of elastic and plastic deformation and materials hardening
- Understand and analyse brittle and ductile fracture, fatigue and creep failures, impact and toughness failures.
- Introduction to mechanical testing of solids and evaluation of material performance and analysis of failure mechanisms of engineering components
- Structural mechanics concept and behaviour such as bending, compression, tension, torsion and composite sections.
- Loading and resistance such as loads path, actions, calculated stress, design stress and partial factors of safety
- Principles of material selection procedures and their impact on the environment.
- Sustainability issues relating to engineering materials including their recyclability.
- Materials used in civil engineering applications including its key engineering properties, durability and affordability.
- Laboratory practical to test basic mechanics of materials and behaviour.
- The production of succinct laboratory reports: laboratory use, data collection and data analysis
- The engineering design and construction processes to specification using relevant design software
- Communication of engineering problems through design ideas, drawings, specifications, concept development and detailed design documentation
- Skills development through solving basic engineering problem through oral, poster and final model product presentations, presentation preparation and delivery, communication of design ideas through specifications, conceptual drawings, concept development and detailed design documentation and visual aids.

Teaching:

- weekly three-hour lectures or tutorials (or lab sessions for 2 weeks)

Assessment:

- Portfolio of reports (40%):

- Workstation 1: Deflection of a simple supported beam (15%)
- Workstation 2: Tensile Testing of Engineering Materials (15%)
- Online MCQ (10%)

- Group bridge project (60%):

- Part A: Group work (bridge model making) (50%)
- Part B: Individual work (reflective and self contribution) (10%)

Note: methods of assessment listed are indicative only and may be subject to change

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LEVEL 5 – INTERMEDIATE

Module Code: CE5020

Module Title: Digital Construction & Building Information Modelling (BIM)

Credits:
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 5

Prerequisites: prior study of engineering concepts is useful

Suitability:
- This module runs entirely in the **Autumn semester**
- Study Options **1** or **2**

Content:

This module will introduce the key principle of Digital Construction and Building Information Modelling (BIM) providing learners with an overview of standards, management processes legal implications collaborative working practices, and software packages. Students will learn how digital construction has revolutionized the construction industry and how BIM and its closely related digital technologies are used as tools for the realization of the construction industry 4.0. The module will address various aspects of digital design, construction, and operation and maintenance, including the knowledge and use of tools related to BIM, virtual reality, artificial intelligence, and geographic information systems. This module addresses several future skills

and graduate attributes. Amongst these are creative problem-solving, digital competency and citizenship, digital productivity, and collaboration. A sequence of lectures, seminars, and workshops is used for delivery.

➢ **Topics:**

- Principles of BIM: an overview of the standards, management processes, and legal implications
- Group work project design workshop and sustainable project design
- Introduction to Revit and its applications, and practicing modelling with Revit—hands-on learning
- BIM in the construction process, development of the project design—practice learning
- Digital technologies and BIM tools in creating and managing digital models
- Development and design of the case study project with BIM - practice learning.
- Application of BIM in the different construction phases—practice learning
- Use BIM tools in the construction process, including design, building, and operation; practice learning
- Simulation and analysis of the BIM-developed model—practice learning

Teaching:
- weekly three-hour lectures or computing sessions

Assessment:

- Group project report (equivalent 2,500 words) and presentation (50%)
- Individual report (1,500 words) (50%)

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE5021

Module Title: Hydraulics & Water Engineering

Credits:
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 5

Prerequisites: Prior study of fluid mechanics such as CE4011 or similar

Suitability:
- This module runs entirely in the **Autumn semester**

- Study Options **1** or **2**

Content:

This module builds upon the Level 4 learning carried out in CE4011 or similar, developing the analysis and engineering design in hydraulics. The module considers natural river courses and the conveyance of water through pipelines, culverts and canal. The programmed sessions such as laboratory demonstrations and practical classes, will allow students to experience key phenomena at first hand. There may also be the opportunity for field trip/s to further reinforce learning of topics such as the basics of catchment characterization and stream flow measurement. The module will introduce students to much of the work carried out by civil engineers employed in the water industry.

➢ **Topics:**

- Practical skills learnt in the laboratory
- Participate in Laboratory work to reinforce the lecture materials covered
- Calculating solutions to related engineering problems
- Gain a wide understanding of the principles of hydraulic engineering
- Dimensional analysis – the Buckingham Group method
- Hydraulic Engineering - hydraulic design and analysis
- Discharge and pressure in pipes
- Pipe friction loss equations, secondary losses, energy and hydraulic grade line
- Rotodynamic machines - pumps and turbines
- Pipeline design
- Steady uniform and steady rapidly varied open channel flow
- Specific energy, critical depth, Froude Number
- Momentum equation, stream force, hydraulic jumps
- Flow measurement and control in open channels - weirs, flumes, sluices

Teaching:

- weekly three-hour lectures and three three-hour practical sessions

Assessment:

- Two laboratory reports (1000 words equivalent) (35% each)
- In-class test (2 hours) (70%)

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE5022

Module Title: Engineering Geodesy and GIS

Credits:
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 5

Prerequisites: Prior study of civil engineering

Suitability:
- This module runs entirely in the **Spring semester**
- Study Options **1** or **3**

This module is about a fundamental skill, based on accuracy and precision, that underpins all engineering and construction projects. This module exposes students to the instrumentation and observation principles of modern engineering surveying and develops their theoretical understanding and relevant mathematical expertise as well as practical skills.

Students will be helped to understand how engineering surveying can contribute to the successful design and completion of engineering projects through practical hands on activities and in desktop calculation and software use. Basic operating principles of surveying equipment, focusing on the horizontal and vertical control using Theodolites, Levels and Total Stations are covered in the module and supported by practical exercises.

During the lectures, students will gain the required theoretical knowledge and concepts of surveying, as well as develop practical and mathematical surveying skills. Theoretical knowledge will then be enhanced by a range of fieldwork sessions using high precision surveying instrumentation such as levels, theodolites, total stations and other geodesy equipment. Students will be taken from data collection, through processing and analysis to interpretation of results using appropriate computer software.

➢ **Topics:**

- Principles of surveying, measurement, data recording and dimensional control
- Coordinate geometry and determination of Whole Circle Bearings
- Use of Theodolites and/or Total Stations to measure angles and distances
- Quality checks of fieldwork data
- Calculations and assessment of fieldwork data
- Development of theoretical knowledge of the fundamental principles of engineering geodesy
- Processing fieldwork data using appropriate software
- Health and safety in site work, including hazard and risk assessment

Teaching:
- weekly two/three-hour lectures and several three-hour practical or computing sessions

Assessment:

- 1,200-word technical report (70%)
- In-class test (30%)

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE5023

Module Title: Structural Analysis & Design 2

Credits:
- Year: 8 (US) 15 ECTS
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 5

Prerequisites prior study of structural analysis and design such as CE4023 or similar.

Suitability:
- Study Options **1** or **2**

Content:

The Structural Analysis part of this module follows level 4 (Structural Analysis and Design 1) with conventional methods of evaluating displacements and the study of statically indeterminate structures. Based on the Introduction to Design at level 4, the module continues with the more intermediate methods and techniques of structural design in steel, concrete, masonry and timber, and develops the student's ability to produce competent and professional structural calculations and detailed drawings. The module also includes the principles of Conceptual Design of structures and therefore laying the foundations for the advanced level 6 module CE6020.

The module also assists in developing employability future skills such as, team collaborative working, digital literacy, analytical and critical thinking.

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Overall Topics:

- Static and kinematic Indeterminacy (emphasis on statical indeterminacy) with application of virtual work including unit load method.
- Slope deflection and strain energy methods for calculating deformations.
- Flexibility and moment distribution methods applied to indeterminate beams and pin & rigid jointed frames.
- Stability of elements under compression.
- Design of simple elements in reinforced concrete to EC2, steel to EC3, timber to EC5 and masonry to EC6.
- Sustainability as part of design process.
- Laboratory experiments to study the behaviour of T-beams, struts and RC beam and production of succinct laboratory reports.
- Introduction to FE analysis of determinate and indeterminate structures
- Introduction to conceptual design

➢ **Autumn Semester content:**

- T beam and Strut (Strain and buckling) test
- Introduction To three pin frames
- Virtual work
- Flexibility method
- Structural Analysis-computing

Teaching:

- weekly three-hour lectures and several 3-hour practical sessions

Assessment:

➢ Study Option **1:**

- 2 laboratory reports (20%)
- Structural analysis coursework (10%)
- Steel Design coursework (10%)
- Reinforced concrete beam design (10%)
- In-class test (50%)

➢ Study Option **2:**

- 1 lab report & bespoke assessment

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE5023

Module Title: Structural Analysis & Design 2

Credits:

- Year: 8 (US) 15 ECTS
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 5

Prerequisites prior study of structural analysis and design such as CE4023 or similar.

Suitability:

- Study Options **1** or **2**

Content:

The Structural Analysis part of this module follows level 4 (Structural Analysis and Design 1) with conventional methods of evaluating displacements and the study of statically indeterminate structures. Based on the Introduction to Design at level 4, the module continues with the more intermediate methods and techniques of structural design in steel, concrete, masonry and timber, and develops the student's ability to produce competent and professional structural calculations and detailed drawings. The module also includes the principles of Conceptual Design of structures and therefore laying the foundations for the advanced level 6 module CE6020.

The module also assists in developing employability future skills such as: team collaborative working, digital literacy, analytical and critical thinking.

➢ **Overall Topics:**

- Static and kinematic Indeterminacy (emphasis on statical indeterminacy) with application of virtual work including unit load method.
- Slope deflection and strain energy methods for calculating deformations.
- Flexibility and moment distribution methods applied to indeterminate beams and pin & rigid jointed frames.
- Stability of elements under compression.
- Design of simple elements in reinforced concrete to EC2, steel to EC3, timber to EC5 and masonry to EC6.
- Sustainability as part of design process.
- Laboratory experiments to study the behaviour of T-beams, struts and RC beam and production of

succinct laboratory reports.
- Introduction to FE analysis of determinate and indeterminate structures
- Introduction to conceptual design

➢ **Autumn Semester content:**
- T beam and Strut (Strain and buckling) test
- Introduction To three pin frames
- Virtual work
- Flexibility method
- Structural Analysis-computing

Teaching:
- weekly three-hour lectures and several three-hour practical sessions

Assessment:

➢ Study Option **1:**

- 2 laboratory reports (20%)
- Structural analysis coursework (10%)
- Steel Design coursework (10%)
- Reinforced concrete beam design (10%)
- In-class test (50%)

➢ Study Option **2:**

- 1 lab. report & a bespoke assessment

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE5024

Module Title: Geotechnics & Materials

Credits:
- Year: 8 (US) 15 ECTS
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 5

Prerequisites prior study of soil mechanics such as CE4011 and engineering materials or similar

Suitability: Study Options **1** or **2** or **3**

Content:

This module builds upon the skills and competences in soil mechanics and engineering materials learnt in introductory level (Level 4) study. The geotechnics section of the module covers groundwater seepage; shear strength of soils, stresses in soils due to foundation loading, consolidation behaviour and settlement of soils.

The materials section of the module develops understanding of properties of various engineering materials, enabling apprentices to learn about material selection and application in construction, including sustainable practices used to reduce waste, promote recyclability, and assess impacts on the environment.

➢ **Autumn Semester: Materials**

- Behaviour and performance characteristics of key civil engineering materials and use of relevant British /European Standards.
- Varieties of common civil engineering materials including new materials.
- Concrete technology including concrete constituents, design of concrete mix, casting, testing, understanding its behaviour, performance, recommending good concrete practice and sustainability related issues.
- Sustainability and recyclability of materials. Carbon footprint, embodied energy, recycling and reuse of materials and green credentials of sustainable materials
- Civil engineering materials applications and case studies.
- Laboratory experiments: physical and mechanical properties of aggregates, fresh and hardened concrete, brickwork and mortar, timber, steel and bitumen, concrete mixing, and testing.
- Laboratory practical to test basic mechanics of materials and behaviour.
- Competency in writing of laboratory reports, use of various equipment, data interpretation and analysis.

➢ **Spring Semester: Geotechnics**

- Soil permeability, seepage flow nets and application to dams, sheet piles and buoyant structures.
- Stresses in soil due to finite and infinite loaded areas; effective stress principle; pore pressure parameters and applications in geotechnical design.
- Shear strength of soils: triaxial and shear box tests; shearing of fine- and coarse-grained soils; residual strength.
- One dimensional consolidation theory; oedometer testing and data analysis; rate of consolidation and application to foundation settlement calculation.
- Sustainability and case studies in ground engineering including environmental issues.

Teaching:

- weekly two-hour lectures and several 2/3 3-hour practical sessions

Assessment:

➢ Study Option **1:**

- Construction Materials Lab Report 1 (20%)
- Construction Materials Lab Report 2 (20%)
- Oral Presentation Case studies - New Innovation in Construction Materials (10%)
- Geotechnics Laboratory Write-up (10%)
- In-class test (40%)

➢ Study Option **2:**

- Construction Materials Lab Report 1 (45%)
- Construction Materials Lab Report 2 (45%)
- Oral Presentation Case studies - New Innovation in Construction Materials (10%)

➢ Study Option **3:**

- Geotechnics Laboratory Write-up
- In-class test

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE5022

Module Title: Engineering Geodesy and GIS

Credits:

- Single Semester: 4 (US) 7.5 (ECTS)

Level: 5

Prerequisites: Prior study of civil engineering

Suitability:

- This module runs entirely in the **Spring semester**
- Study Options **1** or **3**

This module is about a fundamental skill, based on accuracy and precision, that underpins all engineering and construction projects. This module exposes students to the instrumentation and observation principles of modern engineering surveying and develops their theoretical understanding and relevant mathematical expertise as well as practical skills.

Students will be helped to understand how engineering surveying can contribute to the successful design and completion of engineering projects through practical hands on activities and in desktop calculation and software use. Basic operating principles of surveying equipment, focusing on the horizontal and vertical control using Theodolites, Levels and Total Stations are covered in the module and supported by practical exercises.

During the lectures, students will gain the required theoretical knowledge and concepts of surveying, as well as develop practical and mathematical surveying skills. Theoretical knowledge will then be enhanced by a range of fieldwork sessions using high precision surveying instrumentation such as levels, theodolites, total stations and other geodesy equipment. Students will be taken from data collection, through processing and analysis to interpretation of results using appropriate computer software.

➢ **Topics:**

- Principles of surveying, measurement, data recording and dimensional control
- Coordinate geometry and determination of Whole Circle Bearings
- Use of Theodolites and/or Total Stations to measure angles and distances
- Quality checks of fieldwork data
- Calculations and assessment of fieldwork data
- Development of theoretical knowledge of the fundamental principles of engineering geodesy
- Processing fieldwork data using appropriate software
- Health and safety in site work, including hazard and risk assessment

Teaching:

- weekly two/three-hour lectures and several three-hour practical or computing sessions

Assessment:

- 1,200-word technical report (70%)
- In-class test (30%)

Note: methods of assessment listed are indicative only and may be subject to change

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LEVEL 6 – ADVANCED

Module Code: CE6027

Module Title: Integrated Group Design Project

Credits:

- Single Semester: 4 (US) 7.5 (ECTS)

Level: 6

Prerequisites: substantial prior study of civil engineering

Suitability:

- This module runs entirely in the **Spring semester**
- Study Options **1** or **3**

This core module builds upon knowledge gained at introductory and intermediated levels.

Students will be able to produce competent and professional designs that will be utilised in a group project. This will stimulate students to develop an interest and awareness of the scope and nature of civil engineering within the design process and to encourage creativity, engineering judgement and technical report writing. Development of team-working skills and independent study is an important part of the module. This module intends: to develop technical design skills, students' academic and communication skills, to increase awareness of the role of the civil engineer in planning, design and construction issues, to encourage students to utilise their membership of professional institutions, to appreciate effective team working and to enhance their employability.

Some of the graduate attributes developed in this module are: analytical/critical thinking, communication, collaboration, conflict management, digital productivity, networking and perseverance.

➢ **Topics:**

- Design process, organisation and planning.
- Case studies for civil engineering design with sustainability considerations to be taken into account
- during initial stages of the design process.
- Conceptual design of a major civil engineering project involving layout and function of each
- component.
- Apply standard computer software for analysis and design solutions.

- Project quantities, costs and finance.
- Role and responsibilities of the civil engineer and of other professionals in the construction industry,
- as well as professional negligence.
- Sustainability and Carbon footprint of projects.
- Risk assessment, environmental assessment, ethics, health and safety, legislation, education and
- training.
- Employment opportunities and employability skills, career development and benefits of membership
- of professional organisations.

Teaching:

- weekly three-hour seminars

Assessment:

- Individual reflection assignment – 1000 words max (20%)
- Group design project – 6000 words max (80%)

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE6020

Module Title: Advance Structural Modelling and Design

Credits:

- Year: 8 (US) 15 ECTS
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 6

Prerequisites: prior intermediate-level study of structural analysis and design such as CE5023 or similar

Suitability:

- Study Options **1** or **2**

Content:

Building upon the intermediate level module CE5023 Structural Analysis & Design 2 the module covers advanced methods and techniques for structural analysis and design of complex statically indeterminate

structures in steel, concrete and timber.

Upon the completion of this module students will be able to produce competent and professional structural designs including calculations and detailed drawings that will stimulate students' interest in structural engineering and encourage them to use their creativity and imagination to develop sustainable structural solutions. This module intends to develop students' structural design technical skills, to increase their awareness of the role of structural engineers in solving design and construction problems, to encourage students to utilise their membership of professional institutions and to enhance their employability.

The module develops analytical/critical thinking, digital literacy, innovation and being values-informed.

- **Overall topics:**

- Moment distribution: Sway frames with sloping members.
- Stiffness method: Sway frames with sloping members.
- Introduction to FE method and use of FE software.
- Reinforced concrete: Sub-frames, multiple load cases, bending moment redistribution and pre-stressed concrete to EC2
- Steel: Plastic analysis, frames, continuous beams, lateral-torsional buckling, combined axial force and bending to EC3.
- Timber: modern timber building construction to EC5
- Sustainable design including carbon footprint calculations.
- Career development and membership in Professional Engineering Institutions.

- **Autumn Semester content:**

- Introduction to moment distribution
- Moment distribution method: beams
- Moment distribution method: beams and frames
- Moment distribution method: frames
- RC design: flanged beams
- RC design: columns
- RC design: detailing
- Prestressed concrete
- Timber Design - beams
- Timber Design – columns
- Stiffness method

Teaching:

- weekly three-hour lectures

Assessment:

- Study Option **1:**

- Coursework 1: Reinforced Concrete Structures Design assignment (20%)
- Coursework 2: FE modelling assignment (10%)
- Coursework 3: Steel design (20%)
- 3-hour exam (50%)

- Study Option **2:**

- Part of Study Option 1 assessment

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE6021

Module Title: Geotechnical & Environmental Engineering

Credits:
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 6

Prerequisites: substantial prior study of civil engineering

Suitability:
- This module runs entirely in the **Spring semester**
- Study Options **1** or **3**

Content:

This module builds on knowledge gained at level 5 (CE5024 Geotechnics and Materials), and covers the analysis of stability of slopes, shallow and deep foundations, earth pressures and retaining walls, and ground improvement. The module incorporates design of various geotechnical structures according to current European Codes of Practice and relevant British Standards. Upon completion, students should be able to interpret geotechnical data from site investigation, use Eurocode 7 procedures to design earth slopes, spread footings, piled foundations, and retaining walls.

The module emphasis on some graduate attributes and future skills including, critical and analytical thinking,

perspective taking, curiosity and reflective thinking.

➢ **Topics:**

- Slope stability: Principles, analysis, and modelling of instability in natural and engineered slopes, design of engineered slopes
- Slope stability problems; stabilisation methods, risk analysis, case studies.
- Earth pressure: Rankine's and Coulomb's theories.
- Retaining walls: analysis and design to Eurocode 7.
- Bearing capacity theory: Eurocode 7 design of spread foundations.
- Piled foundations: various piling techniques; pile capacity and settlement.
- Eurocode 7 design of single piles, pile testing and interpretation of results.
- Pile groups: analysis and design to Eurocode 7: load testing
- Ground improvement, risk assessment, safety, and sustainability issues.
- Professional software for geotechnical analysis e.g., Wallapp, Plaxis, GeoSlope.

Teaching:

- weekly three-hour seminars

Assessment:

- Design report and calculation problems on slope stability and shallow foundations (25%)
- end of year 3-hour exam (75%)

Note: methods of assessment listed are indicative only and may be subject to change

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Module Code: CE6024

Module Title: Highway, Transport and Traffic Engineering

Credits:

- Single Semester: 4 (US) 7.5 (ECTS)

Level: 6

Prerequisites: substantial prior study of civil engineering

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Suitability:

- This module runs entirely in the **Autumn semester**
- Study Options **1** or **2**

This module has been designed to broaden the students' perspective on the infrastructure that underpins a developed society and the role of the civil engineer in its design, construction, maintenance and management. The requirement for sustainable solutions will be emphasised throughout the module, considering environmental, economic, social and political factors.

The module will promote the creative learning experience and will provide the opportunity of the development of professional skills such as collaboration, cross-cultural communications, perspective taking, reflective and critical thinking. Digital Literacy and citizenship are also among the future skills developed in this module.

The delivery of the module will be reinforced by a number of computer lab sessions on the subject of highway design and traffic management. The module will consider a broad range of infrastructure with a focus on transportation, traffic and highway design, with the view to opening up career path opportunities for graduates.

Teaching:

- weekly three-hour lecture and one two-hour practical session

Assessment:

- 2-hour in-class test (60%)
- Highway Materials Lab Report (Group) (10%)
- Junction Design & Modelling Report (Group) (20%)
- Individual Reflection & Essay (10%)

Note: methods of assessment listed are indicative only and may be subject to change

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