Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

The range of modules available cover theoretical, practical, academic, management and industrial-based skills.

Level 4 modules develop skills in engineering science, mathematics, computing, engineering drawing (including AutoCAD), fluid mechanics, soil mechanics, structures, materials and sustainable construction and design. There is an emphasis on practical work, including surveying, model-making and computer-aided design packages.

At level 5, practical-focused studies cover specific civil engineering subjects such as hydraulics, geotechnics, structures, construction materials and site surveying. Students will also gain a thorough grounding in project and business management. There are two residential field courses, in engineering surveying and geotechnical engineering.

At level 6, specialized modules expand upon core civil engineering disciplines (structures, hydraulics and geotechnics) with building and environmental engineering, and includes a field trip devoted to coastal engineering. Students study the development, design and construction of sustainable infrastructure, focusing on water engineering, transport, highway and the energy sector.

Updated March 2019/PJW

<table>
<thead>
<tr>
<th>Entry requirements</th>
<th>GPA of 2.75 or above (out of 4.0) or equivalent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-requisites</td>
<td></td>
</tr>
<tr>
<td>• Level 4:</td>
<td>prior introductory university-level study of mathematics is very useful.</td>
</tr>
<tr>
<td>• Level 5:</td>
<td>prior study of civil engineering is required (at level 4 or equivalent).</td>
</tr>
<tr>
<td>• Level 6:</td>
<td>substantial prior study of civil engineering is required.</td>
</tr>
<tr>
<td>• For levels 5 and 6,</td>
<td>any specific pre-requisites for individual modules will be detailed in each module description.</td>
</tr>
</tbody>
</table>

| Taught at          | Penrhyn Road campus. |

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

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Civil Engineering and Infrastructure Modules for Visiting
Students 2019/20

Notes:

1. All modules are at undergraduate level only.

2. Students enrolled on Study Option 1 are required to study the entire module over both semesters.

3. Whilst the University makes every effort to ensure that this information is correct at the time of updating (January 2019), 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 continuous improvement 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.

KEY TO MODULE DESCRIPTORS

<table>
<thead>
<tr>
<th>SUITABILITY OF MODULE FOR STUDENTS VISITING KU ON STUDY OPTION</th>
<th>DESCRIPTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indicates module is suitable for students visiting KU on Study Option 1 (Whole Year)</td>
</tr>
<tr>
<td>2</td>
<td>Indicates module is suitable for students visiting KU on Study Option 2 (Autumn)</td>
</tr>
<tr>
<td>3</td>
<td>Indicates module is suitable for students visiting KU on Study Option 3 (Spring)</td>
</tr>
</tbody>
</table>

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

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Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

<table>
<thead>
<tr>
<th>MODULE CODE</th>
<th>TITLE</th>
<th>SUITABILITY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL 4 - INTRODUCTORY</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>EG4010</td>
<td>Engineering Design and Professional Practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EG4011</td>
<td>Engineering Mechanics, Structures and Materials</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EG4012</td>
<td>Engineering Mathematics and Computing</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>EG4013</td>
<td>Fluid Mechanics and Engineering Science</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>LEVEL 5 - INTERMEDIATE</td>
<td>ME5011</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CE5011</td>
<td>Hydraulic and Geotechnical Engineering 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE5012</td>
<td>Engineering Surveying</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CE5013</td>
<td>Structural Engineering 1 and Construction Material</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>EG5014</td>
<td>Engineering Project Management</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>LEVEL 6 - ADVANCED</td>
<td>ME5011</td>
<td>ME5012</td>
<td>ME5013</td>
</tr>
<tr>
<td>CE6011</td>
<td>Hydraulic and Geotechnical Engineering 2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CE6012</td>
<td>Sustainable Infrastructure and Environment</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>

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

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LEVEL 4 – INTRODUCTORY

<table>
<thead>
<tr>
<th>Module Code</th>
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<tbody>
<tr>
<td>Module Title</td>
<td>Engineering Design and Professional Practice</td>
</tr>
<tr>
<td>Level</td>
<td>4</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>None</td>
</tr>
<tr>
<td>Credits</td>
<td>Full Year: 8 (US) 15 (ECTS) / Single Semester: 4 (US) 7.5 (ECTS)</td>
</tr>
</tbody>
</table>

### Content

The principal aim of this module is to provide a flavour of what is involved in engineering design and to develop the good academic and professional practice needed to attain professional status. The module introduces the key aspects involved in: planning a project from start to finish, design processes incorporating a sustainability agenda, building an awareness of the interactions across various disciplines, regulatory frameworks and Health and Safety procedures. The module develops good academic and professional practice by developing skills in self-reflection and recording professional development. The basic principles of measurement and manufacturing processes in a workshop and testing environment are also addressed in the module.

#### Curriculum content

- The regulatory framework, local/government policies, codes of practice, strategies, requirements and other initiatives, cost and environmental impact
- Health and Safety and risk assessment procedures
- The engineering design and construction processes to specification using relevant design software
- Communication of design ideas through specifications, concept development and detailed design documentation
- Employability and professional roles and the routes to Professional Status
- Good academic practice, feedback, group and individual development
- Introduction to research methods
- Report writing and presentation skills
- Showcasing design through oral presentations and posters
- Principles of project management and planning
- Team based 'design and build' project

There will be some discipline specific content within this module. Typical discipline specific content could include:

Aerospace Engineering

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

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### Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

- Measurement of engineering components using a variety of techniques and assessing the mechanical properties of materials through testing and heat treatment
- Machining including drilling, milling and turning, fitting, sheet metal cutting and forming, fabrication by riveting, soldering, spot welding as well as modern manufacturing techniques.
- Aerospace Industry regulatory framework
- Astronautics: space engineering, the space environment and some example space missions.

#### Civil Engineering/Construction Management

- Sustainable construction principles and the sustainability agenda: global warming and its effects, carbon footprint, embodied energy, alternative energy sources, recycling and reuse, green credential of sustainable materials
- Sustainable design: renewable energy sources, new technologies, sustainable design techniques
- Lean construction, management and principles including construction technology, methods and management
- Building Information Modelling (BIM) - managing information on a construction project across the project lifecycle, building optimisation, BIM standard documents, the role of the professional in BIM, relevant BIM software packages that integrates drawings with 3D models and specifications
- Basic principles of land surveying including practical use of surveying instruments: levels and total station

#### Mechanical Engineering

- Measurement of engineering components using a variety of techniques and assessing mechanical properties of materials through testing and heat treatment
- Machining including drilling, milling and turning, fitting, sheet metal cutting and forming, fabrication by riveting, soldering, spot welding as well as modern manufacturing techniques.
- Communication of engineering design ideas through integrating engineering drawing and 3D solid modelling
- The mechanical engineering design processes and analysis

<table>
<thead>
<tr>
<th>Teaching</th>
<th>Lectures and practical sessions</th>
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</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>Study Option 1:</td>
</tr>
<tr>
<td></td>
<td>- Portfolio of 3 short pieces 500 words each (30%)</td>
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<tr>
<td></td>
<td>- Group Design and Make Project (50%)</td>
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<td></td>
<td>- Workshop based project (20%)</td>
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<td></td>
<td>Study Option 2:</td>
</tr>
</tbody>
</table>

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### Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

<table>
<thead>
<tr>
<th>Study Option 1 = Whole Year</th>
<th>Study Option 2 = Autumn</th>
<th>Study Option 3 = Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio 1 and 2 (short pieces of written work)</td>
<td>Group Project (design/research aspect)</td>
<td>CAD drawings Portfolio</td>
</tr>
<tr>
<td>Study Option 3:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portfolio 3 (short piece of written work)</td>
<td>Group Project (model design/making aspect)</td>
<td></td>
</tr>
</tbody>
</table>

**Last updated** 26/03/19 PJW

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<table>
<thead>
<tr>
<th>Module Code</th>
<th>EG4011</th>
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</thead>
<tbody>
<tr>
<td>Module Title</td>
<td>Engineering Mechanics, Structures and Materials</td>
</tr>
<tr>
<td>Level</td>
<td>4</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>None</td>
</tr>
<tr>
<td>Credits</td>
<td>Full Year: 8 (US) 15 (ECTS) / Single Semester: 4 (US) 7.5 (ECTS)</td>
</tr>
</tbody>
</table>

#### Suitability
- Open to suitably qualified Study Abroad/International Exchange students enrolled at KU for Study Option 1 only
- Not open to Erasmus students (as Level 4)

#### Content

The module introduces the fundamentals of structural analysis (statics and dynamics) and the mechanical behaviour of a broad range of engineering materials. The mechanics part provides an understanding of the behaviour of particles and rigid bodies whilst stationary and in motion. Bodies such as trusses in equilibrium are studied and the external and internal parameters such as force, moment, stress, strain, etc. are defined and calculated. The analysis of structural components will be developed with theoretical and numerical skills that are necessary in the design of real world structures. This section also introduces the dynamics of particles and rigid bodies with their engineering applications. Material test methods will be used to determine the deformations and failures of the various engineering materials. A selection of materials for engineering applications, such as metals, ceramics, polymers and composites, will be studied including their carbon footprint and their impact on the environment. The module is primarily delivered through lectures supported by tutorial sessions and laboratories.

#### Curriculum content

- Mathematical modelling of general engineering problems
- Use of free body diagrams in Statics and Dynamics for analysis of simple structures and machines
- Qualitative understanding of structural behaviour

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Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

- Principle of Statics: forces, resolution of forces and conditions of equilibrium
- Properties of simple structural members: stress and strain, elastic constants, centroids and second moments of area
- Analysis of simple truss and structural components: forces, shear force and bending moment
- Understand and apply the theory of bending in structural engineering and become familiar with axial, shear and bending moment diagrams
- Kinematics of particles with constant and variable accelerations, kinematics of rigid bodies, simple mechanisms
- Kinetics of particles and rigid bodies, Newton's method, energy and impulse
- Classification and properties of engineering materials: characteristics, analysis, application and evaluation of metals, polymers and ceramics
- Analysis of elastic and plastic deformation and materials hardening
- Introduction to mechanical testing of solids and evaluation of material performance and analysis of failure mechanisms of engineering components
- Principles of material selection procedures and their impact on the environment
- Sustainability issues relating to engineering materials including their carbon footprint, global warming and its effects.
- Understand and analyse brittle and ductile fracture, fatigue and creep failures
- Laboratory practice including health and safety guidelines.
- Laboratory experiments including tensile testing of metals, polymers and ceramics, behaviours of trusses and beams
- The production of succinct laboratory reports: laboratory use, data collection and data analysis using computing methods
- Employability through development of soft skills in written communication

<table>
<thead>
<tr>
<th>Teaching</th>
<th>Lectures, seminars and online material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>Study Option 1:</td>
</tr>
<tr>
<td></td>
<td>- Exam (50%)</td>
</tr>
<tr>
<td></td>
<td>- Portfolio of 3 in-class MCQ assessment (10% each)</td>
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<tr>
<td></td>
<td>- Portfolio of 2 lab reports (2 x 10%)</td>
</tr>
</tbody>
</table>

Last updated 26/03/19 PJW

Module Code | EG4012
---|---
Module Title | Engineering Mathematics and Computing
Level | 4
Prerequisites | None
Credits | Full Year: 8 (US) 15 (ECTS) / Single Semester: 4 (US) 7.5 (ECTS)
Suitability | Open to suitably qualified Study Abroad/International Exchange students enrolled at KU for Study Options 1 or 2 or 3

Return to TOP

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

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Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

- Not open to Erasmus students (as Level 4)

**Content**

The aim of this module is to provide a thorough background in engineering mathematics and equip you with the mathematical skills essential for solving engineering problems. The module also introduces the use of computing methods in engineering. The mathematics part comprises algebra, functions, logarithms, trigonometry, calculus, differential equations and vectors. The computing part covers the use of software for problem solving, visualisation and data representation. The emphasis is on using mathematical and computational tools to solve engineering problems.

**Curriculum content**

- Differential calculus, integral calculus with standard integrals
- Numerical differentiation and integration; partial differentiation
- Simultaneous equations, solution of non-linear equations
- First and second order differential equations
- Matrix algebra
- Linear systems
- Geometry and trigonometry in design
- Complex numbers
- Random variables, probability density and distribution functions, Binomial, Poisson and Normal distributions, Laws of probability
- Curve fitting
- Appropriate mathematical and statistical software

**Autumn Semester (Maths):**

- Mathematical foundations for engineers
- Engineering functions
- Probability and the Binomial Distribution
- Normal and Poisson Distributions
- Rates of Change and Differentiation 1
- Differentiation 2 (Engineering Applications)
- Differentiation 3 (Further applications, numerical solutions)
- Integration

**Autumn Semester (Computing):**

- Excel and Maple

**Spring Semester (Maths):**

- Matrices
- Vectors and their Applications
- Binomial. Maclaurin and Taylor Series
- Complex Numbers and their applications
- First Order Ordinary Differential Equations and their Applications
- Second Order Ordinary Differential Equations and their Applications
- Partial Differentiation and its Applications

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Spring Semester (Computing):
Matlab

Teaching
Lectures, tutorials and computer laboratory sessions

Assessment
Study Option 1:
- Exam (50%)
- Computing Report 1 – 500 words (25%)
- Computing Report 2 – 500 words (25%)

Study Option 2:
- Computing Coursework 1 (TBC)

Study Option 3:
- Computing Coursework 2 (TBC)

Last updated 26/03/19 PJW

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<table>
<thead>
<tr>
<th>Module Code</th>
<th>EG4013</th>
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</thead>
<tbody>
<tr>
<td>Module Title</td>
<td>Fluid Mechanics and Engineering Science</td>
</tr>
<tr>
<td>Level</td>
<td>4</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Prior study of university-level physics is useful</td>
</tr>
<tr>
<td>Credits</td>
<td>Full Year: 8 (US) 15 (ECTS) / Single Semester: 4 (US) 7.5 (ECTS)</td>
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</tbody>
</table>
| Suitability | • Open to suitably qualified Study Abroad/International Exchange/Erasmus students enrolled at KU for Study Option 1 only
• Not open to Erasmus students (as Level 4) |
Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

| Content | This module introduces the fundamentals of fluid mechanics and engineering science. Taught to mechanical, aerospace and civil engineering students, it will use this broad audience to enhance a collaborative learning environment. The fluid mechanics section will cover the fundamental properties of fluids and the main basic conservation equations used and their engineering applications. It also introduces the concept of dimensions and the SI units of measurement. The engineering science section will consider subject areas relevant to each discipline.

For mechanical and aerospace engineering students it will introduce thermodynamics and electrical engineering and for civil engineering students it will consider soil mechanics. The thermodynamics topic covers the key concepts of system, work, heat and the main thermodynamics laws with special reference to their engineering applications. The electrical engineering section covers the basic concepts and electrical quantities such as charge, current, resistance, voltage, power and energy before looking at fundamental electrical components and how they can be incorporated into both AC and DC circuits. The soil mechanics topic will introduce the fundamental properties of soils and their essential aspects.

Curriculum content

Common (Autumn Semester)

- Fluid mechanics: properties of fluids - density, viscosity, bulk modulus
- Hydrostatics, laminar and turbulent flows
- Pressure and temperature measurement
- Conservation of mass, momentum and energy equations
- Dimensions and dimensional analysis

Mechanical and Aerospace (Spring Semester):

- Units and dimensions, open and closed systems, work, heat, fluid properties in thermodynamics
- Zeroth, first and second laws of thermodynamics
- Basic electrical theory: AC and DC, electronic components, power supplies
- Analysis of simple linear circuits: parameters, parallel and series, ohms law, energy and power.

Civil (Spring Semester)

- Soil mechanics: origin and nature of soils, weathering and deposition
- Description and classification of soils, plasticity and sieve analysis, phase relationships and soil compaction

Teaching | Lectures, labs and tutorials
LEVEL 5 – INTERMEDIATE

<table>
<thead>
<tr>
<th>Module Code</th>
<th>CE5011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module Title</td>
<td>Hydraulic and Geotechnical Engineering 1</td>
</tr>
<tr>
<td>Level</td>
<td>5</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Prior study of fluid mechanics and engineering science such as EG4013 or equivalent.</td>
</tr>
</tbody>
</table>
| Credits | Full Year: 8 (US) 15 (ECTS)  
Single Semester: 4 (US) 7.5 (ECTS) |
| Suitability | Open to suitably qualified Study Abroad/International Exchange/Erasmus students enrolled at KU for Study Options 1 or 2 or 3 |
| Content | This module builds upon an introductory level module in fluid mechanics and engineering science such as EG4013 or equivalent, developing the analysis and engineering design in hydraulics and geotechnics.  
The hydraulics section considers natural river courses and the conveyance of water through pipelines, culverts and canals. The geotechnics section concentrates on engineering geology, emphasising the influence of subsurface conditions on civil engineering design and construction; also covered are principles of effective stress and shear strength as well as their use in design. The analysis of groundwater seepage and the dewatering of below-ground works are linked to other aspects of civil engineering hydraulics. The module is primarily delivered through a programme of interactive sessions supported by an extensive laboratory programme and a week-long residential field trip. |

Curriculum content

- Dimensional analysis - the Buckingham Group method
- Hydraulic Engineering - hydraulic design and analysis
- Discharge and pressure in pipes

Assessment

Study Option 1:
- Full Laboratory report 1 (25%)
- Full laboratory report 2 (30%)
- Exam (50%)

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### Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

- 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
- Work in the hydraulics laboratory; pump characteristics, pipe friction, sluice gate, broad-crested weirs
- Soil permeability and the seepage of water through soils
- Flow nets; application to dam design, sheet piles and buoyant structures
- Field course; regional geology, glaciations, engineering geology, geological construction materials, dam engineering, reservoirs and water transfer schemes
- Geology - Structure of the earth and geological time; plate tectonics and geological processes, with an engineering/construction context
- Weathering, engineering behaviour of rocks; geomorphology and aquifers
- Effective stress theory; effect of total stress changes; pore pressure parameters; influence of seepage on effective stress
- Seepage theory and soil permeability, construction of flow nets and their application, for example, to the design of earth dams and sheet piles
- Shear strength of soil: triaxial and shear box tests; shear behaviour of fine and coarse grained soils; residual shear strength
- Stresses in soil mass due to applied loads; stress-strain properties of soils; models of soil elasticity and plasticity and introduction to the mechanics of unsaturated soils
- Consolidation theory; laboratory determination of consolidation parameters; application to settlement design
- Ground improvement techniques including sustainability issues
- Civil Engineering case studies including environmental impact and safety

### Teaching
Lectures/tutorials, laboratory test programme (and a week-long residential fieldtrip in spring semester)

### Assessment

**Study Option 1:**
- Exam (60%)
- Practical report 1: first hydraulics lab write-up Geotechnic lab report (10% each)
- Practical report 2: second hydraulics lab report and fieldwork report (10% each)

**Study Option 2:**
- Lab reports

**Study Option 3:**
- TBC

**Last updated:** 26/03/19 PJW
Civil Engineering and Infrastructure Modules for Visiting
Students 2019/20

Module Code  | CE5012
---|---
Module Title | Engineering Surveying
Level | 5
Prerequisites | Successful completion of introductory university level study in surveying.
Credits | Full Year: 8 (US) 15 (ECTS)
| Single Semester: 4 (US) 7.5 (ECTS)
Suitability | Open to suitably qualified Study Abroad/International Exchange/Erasmus students enrolled at KU for Study Options 1 or 2.

Content
Surveying is a fundamental skill expected of any civil engineer and this module builds on the surveying introduced at Level 4 in EG4010 or equivalent. 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 their practical skills. The operating principles of surveying equipment (including GNSS/GPS), are all covered in the programme and supported by practical exercises including a residential field course. Further sessions explore a range of mathematically more advanced themes such as error analysis and geometric designs (eg, road curves, earthworks).

Curriculum content
- Principles of surveying
- Principles of measurement and data recording
- Coordinate systems: global, national, local
- Cartesian and polar coordinates and transformations between them, including determination of Whole Circle Bearings
- Ordnance Survey mapping systems and data
- Geodesy
- Global Positioning Systems: principles, processes, applications, limitations
- Measurement of distance, including principles of Electronic Distance Measurement
- Measurement of angles: theodolites, instrument checks, measurement procedures, data recording and calculations
- Mathematical analysis of errors in surveying data
- Principles of dimensional control and control surveys
- Traverse surveys: principles, procedures, calculations, accuracy assessment
- Detailing (EDM tacheometry): principles, procedures, data recording and presentation
- Setting out: principles, procedures, quality control
- Measurement of elevations: principles and procedures of levelling
- Surveying elevation profiles or cross-sections, production of contour plans
- Curve geometry for road design: circular, transition and vertical curves
- Estimation and calculation of earthworks volumes

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## Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

### Teaching

- Health and safety in site work, including hazard and risk assessment

### Assessment

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<tr>
<th>Study Option 1:</th>
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<table>
<thead>
<tr>
<th>Study Option 2:</th>
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### Module Code

CE5013

### Module Title

Structural Engineering 1 and Construction Materials

### Level

5

### Prerequisites

Completion of EG4011 or equivalent

### Credits

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

### Suitability

Open to suitably qualified Study Abroad/International Exchange/Erasmus students enrolled at KU for Study Options 1 or 2 or 3

### Content

The module expands on the methodologies and techniques given in EG4011 for structural design at a fundamental level in steel, concrete, masonry and timber, and develops the student’s ability to produce competent and professional structural designs. The consideration of a variety of construction materials, including sustainability issues, will help you to develop your knowledge and understanding of material behaviour, an essential component of civil engineering projects. The module will include the design of civil engineering structures from a conceptual viewpoint.

**Curriculum content:**

- Static and Kinematic Indeterminacy (emphasis on statical indeterminacy) with application of Virtual Work Principle including Unit Load Method.
- Flexibility Method and Moment Distribution Method applied to determinate and indeterminate beams, pin jointed and rigid jointed frames.

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Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring
Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

- Design of Concrete and Steel beams and columns to Eurocodes 2 and 3 with consideration of the National Annexes.
- Conceptual design elements and the role of better understanding of different types of structures for improved employability of the graduates.
- Design of Timber and Masonry elements to corresponding European Codes of practice.
- Case studies for structural design and sustainability considerations to be taken into account during initial stages of the design process.
- Behaviour of civil engineering materials including concrete, steel, masonry, timber, aggregates, glass, FRP and bituminous mixtures.
- Concrete technology including design concrete mix, casting, testing, understanding its behaviour, performance, recommending good concrete practice and sustainability issues.
- Understanding and assessing sustainability and environmental issues relating to civil engineering materials.
- Identifying and recommending the use of appropriate BS/EN standards.
- Carbon footprint, embodied energy, recycling and reuse, green credential of sustainable materials.
- Laboratory practice including health and safety guidelines.

**Autumn Semester:**
- Construction Materials
- Steel Design
- Timber
- Virtual Work and Unit Load
- Flexibility Method
- Sustainable materials
- 3-pinned frames
- Moment distribution

**Spring Semester:**
- Flexibility Method
- Reinforced Concreate Design
- SuperSTRERS
- Masonry design
- Moment distribution
- Flexibility Method
- Concrete Constituents
- Concrete Mix Design
- Concrete Durability
- Concrete Repairs

<table>
<thead>
<tr>
<th>Teaching</th>
<th>Lectures, lab sessions and tutorials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment</strong></td>
<td>Study Option 1:</td>
</tr>
<tr>
<td></td>
<td>Exam (50%)</td>
</tr>
<tr>
<td></td>
<td>Coursework 1: Design coursework in steel and concrete (5% each)</td>
</tr>
</tbody>
</table>
### Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

<table>
<thead>
<tr>
<th>Study Option 2:</th>
<th>Coursework 2: Practical in-class and lab reports in materials (40%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Option 3:</td>
<td>Lab reports&lt;br&gt;Coursework in steel Design&lt;br&gt;Lab reports&lt;br&gt;Coursework: reinforced concrete design</td>
</tr>
</tbody>
</table>

**Module Code**  EG5014  
**Module Title**  Engineering Project Management  
**Level**  5  
**Prerequisites**  None  
**Credits**  
- Full Year: 8 (US) 15 (ECTS)  
- Single Semester: 4 (US) 7.5 (ECTS)  
**Suitability**  Open to suitably qualified Study Abroad/International Exchange/Erasmus students enrolled at KU for Study Options 1 or 2.  
**Content**  
This module considers the principles and practices for the management of engineering projects. The nature of engineering project management is discussed in the context of constraints on quality, time, risk and sustainability. The module broadens students’ knowledge of how organizations undertake and monitor projects. It continues to develop effective team working skills to prepare students for larger group projects in subsequent years of study and employment. The group project at the end of the module enables students to demonstrate their ability to apply their subject specific knowledge in a realistic context.  
**Curriculum content**  
- Knowledge of the principles, procedures and application of tools for project and risk management.  
- The legal and ethical framework of projects in relation to the law of contract, to tort and to health and safety legislation.  
- Project planning, scheduling and resource levelling, including use of proprietary software  
- Utilisation of financial tools to undertake economic assessment and analysis of projects
Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

- Quality management requirements of engineering projects, including aspects of ISO9000.
- Basic statistical tools and techniques.
- Development of group and interpersonal skills in project management.

**Teaching**
Lectures, seminars, group work, essay workshops and revision classes

**Assessment**
Study Option 1:
- Project Planning and Risk – group work (30%)
- Exam (60%)
- Employability portfolio (10%)

Study Option 2:
- Group course project
- CV assignment

**Last updated**
18/10/18 PJW

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**LEVEL 6 – ADVANCED**

**Module Code**  CE6011

**Module Title**  Hydraulic and Geotechnical Engineering 2

**Level**  6

**Prerequisites**  Successful completion of CE5011 or equivalent

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

**Suitability**  Open to suitably qualified Study Abroad/International Exchange/Erasmus students enrolled at KU for Study Options 1 or 2
**Civil Engineering and Infrastructure Modules for Visiting Students 2019/20**

<table>
<thead>
<tr>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>This module builds on the level 5 Module CE5011 progressing the analysis and engineering design in hydraulics and geotechnics. The hydraulics section focuses on the hydraulic design and analysis of civil and environmental works related to water supply, drainage, and hydroelectricity. The geotechnical engineering section concentrates on analysis and design of foundations, retaining walls and slopes, including the application of Eurocode 7, in addition to further industry-standard computing software. The two sections are linked through topics of engineering hydrology, dam engineering and particularly the problem of coastal protection, for which there is a three day residential trip.</td>
</tr>
</tbody>
</table>

**Curriculum content (indicative)**

- Engineering hydrology; groundwater and surface water
- Flood hydrographs; rainfall and Unit Hydrograph Method
- Flood risk management; Flood Estimation Handbook, Water and Flood Management Act
- Coastal engineering; waves, tides and storm surges
- Global sea level change
- Coastal landslides, ‘hard’ and ‘soft’ sustainable coastal defence solutions
- River and canal engineering
- Sediment transport; erosion and deposition
- Gradually Varied Flow (GVF); solution of differential equations, computer software and mathematical modelling
- Hydraulic structure design; the use of physical hydraulic models
- Marine renewable energy; wave power, tidal power, tidal stream power
- Waterhammer in pressurised systems including surge suppression
- Work in the hydraulic laboratory; GVF, spillway design and model testing, use of the wave generator, wave theory, breakwater design
- Field work; coastal geology, landslides and coastal protection
- Dam engineering: types of dam, design, analysis, safety,
- Soil Mechanics: Stress paths and critical state theory in soil mechanics
- Earth pressures; stability analysis of slopes, excavations, gravity retaining structures and embankment dams; limit analysis and Coulomb’s theory
- Design of embedded walls, diaphragm walls and ground anchors
- Quantitative risk analysis, design of slope stabilisation works; case studies
- Bearing capacity theory: undrained and drained analyses; limit state design of spread foundations to Eurocode 7; serviceability concepts for total and differential settlement; application of numerical methods and professional software
- Piled foundations: various piling techniques; installation effects; calculation of pile capacity and settlement; negative skin friction; pile testing
- Pile groups: efficiency factors and group capacity calculation; settlement considerations; simple cases of piled rafts
- Civil Engineering case studies including sustainability, environmental impact and safety

**Autumn Semester:**

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# Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

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<tr>
<th>Teaching</th>
<th>Lectures/tutorials and laboratory test programme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment</strong></td>
<td>Study Option 1:</td>
</tr>
<tr>
<td></td>
<td>• Exam (60%)</td>
</tr>
<tr>
<td></td>
<td>• Practical Reports 1:</td>
</tr>
<tr>
<td></td>
<td>➢ Hydraulic Engineering Lab Write Up (Spillway Design) (10%)</td>
</tr>
<tr>
<td></td>
<td>➢ Foundation Design (10%)</td>
</tr>
<tr>
<td></td>
<td>• Practical Reports 2:</td>
</tr>
<tr>
<td></td>
<td>➢ Hydraulic Engineering Lab Write Up (Coastal) (10%)</td>
</tr>
<tr>
<td></td>
<td>➢ Foundation design (10%)</td>
</tr>
<tr>
<td>Study Option 2:</td>
<td>• Practical Reports 1: Spillway Design (10%) and Foundation Design (10%)</td>
</tr>
<tr>
<td><strong>Last updated</strong></td>
<td>26/03/19 PJW</td>
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<table>
<thead>
<tr>
<th>Module Code</th>
<th>CE6012</th>
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</thead>
<tbody>
<tr>
<td>Module Title</td>
<td>Sustainable Infrastructure and Environment</td>
</tr>
<tr>
<td>Level</td>
<td>6</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Successful completion of introductory university–level modules</td>
</tr>
</tbody>
</table>
| Credits | Full Year: 8 (US) 15 (ECTS)  
Single Semester: 4 (US) 7.5 (ECTS) |
| Suitability | Open to suitably qualified Visiting Students enrolled at KU for Study Options 1 or 2 or 3 |
Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

Content

The module has been formulated to broaden 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 the influencing environmental, economic, social and political factors. A global perspective will be introduced by considering case studies throughout the world and discussing the different factors that influence the infrastructure. Graduate employment opportunities will be outlined in the various sectors, reinforced by guest lectures from expert practitioners/researchers and relevant site visits.

The module will consider the broad range of infrastructure with a focus on transportation and water, opening up career path opportunities for graduates.

Curriculum content

- Sustainability and environmental impact; social, economic, political and health factors
- Global issues in sustainability and infrastructure
- Environmental Impact Assessment (EIA)
- Employment opportunities; design, construction and maintenance of infrastructure
- The UK water industry; water supply, water quality and water treatment
- Population growth, climate change and water security
- Sewerage and sustainable urban drainage systems (SUDs)
- Collection, treatment and disposal of wastewater and sewage sludge
- The hierarchy of waste; waste sources, treatment, disposal and energy recovery
- Energy infrastructure; electrical power network and generation
- Natural gas storage, transfer and distribution, petroleum, coal, renewable energy
- Energy mix, government policy, carbon capture and storage
- Transportation infrastructure; railways, highways, pollution-free modes of transport eg. cycling and pedestrianism
- Government transportation policy, sustainable integrated transport systems; planning and execution of highway schemes, contracts and documentation
- Characteristics of road traffic flow, growth, traffic management, safety and appraisal
- Traffic surveys; computer modelling and design of highway junctions
- Layout and alignment design of highways; use of the highway capacity manual, design manual for roads and bridges and the manual of contract documents for highway works
- Design of flexible and rigid pavements to current UK standards; highway drainage; construction and maintenance
- Signalled junctions: calculations of flow capacity and signal control parameters
- Evaluation of road schemes in technical, environmental, economic and social terms; monitoring and control of air and noise pollution

Autumn Semester (indicative):

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

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## Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

<table>
<thead>
<tr>
<th>Study Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Option 1 = Whole Year</td>
<td>Lectures and practical sessions</td>
</tr>
<tr>
<td>Study Option 2 = Autumn</td>
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<tr>
<td>Study Option 3 = Spring</td>
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</tbody>
</table>

### Intro to Highways; road classification; economic evaluation of road schemes
- Traffic surveys
- Traffic assessment
- Traffic management
- Highway capacity, design speed and sight distances
- Highway layout and geometry – cross-section features; alignment, super-elevation
- Highway intersections: various types of on-grade and separated grade junctions
- Highway structures, bridges and tunnels
- Signalled junctions: signal hardware and software; signal parameters; staging & phasing
- Signal design: saturation flow; opposed/unopposed flows; inter-green period; optimum timing
- Traffic planning, statistical analysis of traffic data: speeds/volumes
- Transport policy and traffic growth
- Development issues and Public Transport Accessibility
- Traffic calming systems
- Earthworks
- Pavement Design
- Highway drainage design features - standard specifications
- **Tutorial** on traffic signals: calculating flow capacities and green period & optimum signal cycle time
- Pavement construction and maintenance

### Spring Semester (indicative):
- The UK Water Industry; Thames Super Sewer
- Low flow hydrology
- Reservoir Design; Cumulative mass curve
- Water Quality
- Water treatment
- Sewage treatment
- Air Pollution 1
- Solid Waste
- Virtual Water
- Water Supply
- Sewerage design; The rational method

### Teaching
- Lectures and practical sessions
## Civil Engineering and Infrastructure Modules for Visiting Students 2019/20

### Assessment

<table>
<thead>
<tr>
<th>Study Option 1:</th>
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<tbody>
<tr>
<td>Exam (60%)</td>
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<tr>
<td>Coursework 1 (20%)</td>
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<tr>
<td>Coursework 2 (20%)</td>
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</table>

<table>
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<tr>
<th>Study Options 2/3:</th>
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<tbody>
<tr>
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### Last updated

26/03/19 PJW

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