Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

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 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 May 2024/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

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

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 (May 2024), 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
SUITABILITY OF MODULE FOR STUDENTS VISITING KU ON STUDY OPTION ____
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)

MODULE CODE	TITLE	SUITABILITY

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

LEVEL 4 - INTRODUCTORY				
CE4011	Fluid and Soil Mechanics	1	2	3
EG4022	Sustainability for Professional Practice	1		3
CE4023	Structural Analysis & Design 1	1	2	
CE4024	Mathematics & Engineering Analytics	1	2	
CE4025	Introduction To Mechanics & Materials	1		3
LEVEL 5 - INTERMEDIATE				
CE5020	Digital Construction & Building Information Modelling (BIM)	1	2	
CE5021	Hydraulics & Water Engineering	1	2	
CE5022	Engineering Geodesy and GIS	1		3
CE5023	Structural Analysis & Design 2	1	2	
CE5024	Geotechnics & Materials	1	2	3
LEVEL 6 - ADVANCED				
CE6611	Structural Engineering 2 and Geotechnical Engineering 2	1	2	3
CE6012	Sustainable Infrastructure and Environment	1	2	3

LEVEL 4 – INTRODUCTORY

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

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

Module Code	**CE4011**
Module Title	**Fluid and Soil Mechanics**
Level	4
Prerequisites	Prior study of university-level physics is useful
Credits	• Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Suitability	• Study Abroad/International Exchange students for Study Options **1** or **2** or **3** • Not open to Erasmus students (as Level 4)
Content	The module introduces the fundamental properties of fluids and soils covering the basic conservation 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. A laboratory programme runs alongside the teaching, informing students on safe and effective working in an engineering laboratory, the analysis of test data, using appropriate software, and the production of succinct laboratory reports. Where possible, lectures will relate academic work to the 'real world' of civil engineering, through the introduction of case studies and research. **Overall content:** ➢ **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	interactive lectures/tutorials/workshops and laboratory sessions
Assessment	Study Option **1:** • Portfolio 1 (25%) - report based on work in the hydraulics laboratory (500 words) and a presentation within soil mechanics • Portfolio 2 (25%) - two reports (approx. 500 words each) relating to laboratories undertaken within hydraulics and geotechnics. • 2-hour exam (50%)
	Study Option **2:** • Fluid mechanics lab report • Geotechnics presentation
	Study Option **3:** • Geotechnics lab • Fluid mechanics lab report
Last updated	03/05/24 PJW

Return to Top

Module Code	**EG4022**
Module Title	**Sustainability for Professional Practice**

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

Level	4
Prerequisites	None
Credits	4 (US) 7.5 (ECTS)
Suitability	• This module runs in the **Spring semester** • Study Abroad/International Exchange students for Study Options **1** or **3** • Not open to Erasmus students (as Level 4)
Content	The module will explore the 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 time challenges associated with social justice, cultural inequalities, ethics, and climate change emergencies. The students will be immersed in a culture of education that provides knowledge, values, attitudes and skills and encourage 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 problematize and critically address ways to mitigate and solve complex societal problems addressed by the UNSDGs. The students will explore, debate, and work in teams: • To unleash the interconnectivity among the 17 United Nations Sustainable Development Goals (UNSDGs). • To collaborate and co-design practical and equitable strategic solutions to Net Zero carbon (positive) and sustainability-related global challenges wrapped up in the climate emergency while developing self-awareness.
Teaching	Lectures and practical sessions
Assessment	• Group-based poster presentation (50%) • 1,500-word Sustainability Brief Report (50%)
Last updated	03/05/24 PJW

Return to Top

Module Code	**CE4023**
Module Title	**Structural Analysis & Design 1**

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

Level	4
Prerequisites	Prior study of university-level physics is useful
Credits	• Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Suitability	• Study Abroad/International Exchange students for Study Options **1** or **2** • Not open to Erasmus students (as Level 4)
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:** • 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
Teaching	Lectures and practical sessions

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

Assessment	Study Option **1:** • Group project (2500-word equivalent) (40%) • 90 minutes in-class test (60%)
	Study Option **2:** • Group project (2500-word equivalent) (100%)
Last updated	03/05/24 PJW

Return to Top

Module Code	**CE4024**
Module Title	**Mathematics & Engineering Analytics**
Level	4
Prerequisites	Prior study of university-level physics is useful
Credits	Single Semester: 4 (US) 7.5 (ECTS)
Suitability	• This module runs entirely in the **autumn semester** • Open to Study Abroad/International Exchange students for Study Options **1** or **2** • 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 students with the mathematical skills essential for solving engineering problems. Topics covered comprises algebra, functions, logarithms, trigonometry, calculus, differential equations, and vectors amongst 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

	• Maclaurin and Taylor Series • Complex numbers • First and second order differential equations • Elements of statistics and probability
Teaching	Lectures and informal tutorials
Assessment	• Coursework (50%) • In-class test (50%)
Last updated	03/05/24 PJW

Return to Top

Module Code	**CE4025**
Module Title	**Introduction To Mechanics & Materials**
Level	4
Prerequisites	Prior study of university-level physics is useful
Credits	Single Semester: 4 (US) 7.5 (ECTS)
Suitability	• This module runs entirely in the **Spring semester** • Open to Study Abroad/International Exchange students for Study Options **1** or **3** • Not open to Erasmus students (as Level 4)
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	Lectures, workshops and lab. sessions
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%)
Last updated	03/05/24 PJW

Return to top

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

Module Code	**CE5020**
Module Title	**Digital Construction & Building Information Modelling (BIM)**
Level	5
Prerequisites	none
Credits	4 (US) 7.5 (ECTS)
Suitability	• This module runs entirely in the **Autumn semester** • Study Options **1** or **2**
Content	This module introduces the key principles of BIM providing learners with an overview of the standards, management processes, legal implications, ethical context, collaborative working practices and software packages. It will also provide an understanding of digital technologies and construction-related information modelling in the built environment context. 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 realisation 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 system. This module addresses a number of future skills and graduate attributes. Amongst these are Creative problem solving, digital competency and citizenship, digital productivity and collaboration. ➢ **Topics:** • Knowledge of the principles, procedures, and application of tools for BIM and Data Management and Types of BIM models and their applications. • The history and evolution of digital construction and industry 4.0. • Benefits of digital construction for the construction industry. • Overview of digital tools and technologies used in construction during design, construction, operation and maintenance. • The legal and ethical framework of projects for BIM in relation to design liability, risk, contracts, and insurance. • An introduction to a range of design modelling software. • Introduction to ISO 19650 and relevant standards. • Development of group and interpersonal skills to facilitate collaborative working practices. • Report writing and drawing management practices.
Teaching	Lectures, online resources and some small group computer sessions.
Assessment	• Group Project Report (equivalent 2,500 words) and presentation (50%) • Individual report (1,500 words) (50%)

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

Last updated	03/05/24 PJW

Return to top

Module Code	**CE5021**
Module Title	**Hydraulics & Water Engineering**
Level	5
Prerequisites	Prior study of fluid and soil mechanics such as CE4011 or similar
Credits	4 (US) 7.5 (ECTS)
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 Fluid & Soil Mechanics 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

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

Teaching	lectures, tutorials and an extensive laboratory practical programme and fieldwork
Assessment	• Portfolio of laboratory reports (1000 words equivalent) (30%) • Exam (2 hours) (70%)
Last updated	03/05/24 PJW

Return to top

Module Code	**CE5022**
Module Title	**Engineering Geodesy and GIS**
Level	5
Prerequisites	Prior study of civil engineering
Credits	• Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Suitability	• This module runs entirely in the **Spring semester** • Study Options **1** or **3**
Content	This module is 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	lectures and interactive problem-based workshops
Assessment	• 2,000-word technical report (70%) • In-class test (30%)
Last updated	03/05/24 PJW

Return to top

Module Code	**CE5023**
Module Title	**Structural Analysis & Design 2**
Level	5
Prerequisites	Prior study of structural analysis such as CE4023 Structural Analysis and Design 1 or similar
Credits	• Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Suitability	Study Options **1** or **2**
Content	The Structural Analysis part follows CE4023 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. ➢ **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
Teaching	lectures, tutorials, laboratory practical(s) and computer sessions.
Assessment	Study Option **1:** • Portfolio of Quizzes (30%) • Two of Laboratory reports (20%) • In-Class test (50%)
	Study Option **2:** • Portfolio of quizzes/lab reports (100%)
Last updated	03/05/24 PJW

Return to Top

Module Code	**CE5024**
Module Title	**Geotechnics & Materials**
Level	5
Prerequisites	Prior study of soil mechanics and engineering materials
Credits	• Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Suitability	• Study Options **1** or **2** or **3**
Content	This module builds upon the skills and competences in soil mechanics and engineering materials learned at introductory level. ➢ **Topics:** • Soil permeability, seepage flow nets and application to dams, sheet piles and buoyant structures.

	• Engineering behaviour of rocks; geomorphology and aquifers. • 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. • 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. ➢ **Autumn Semester: Materials** 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. ➢ **Spring Semester: Geotechnics** This section engineering geology, groundwater seepage; shear strength of soils, stresses in soils due to fondation 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.
Teaching	interactive lectures/workshops with additional practical(s) in the material and geotechnics laboratories

Assessment	Study Option **1:** • Portfolio of laboratory work (50%) • In class test (50%)
	Study Options **2/3** • Parts of Study Option 1 assessment
Last updated	03/05/24 PJW

Return to Top

LEVEL 6 – ADVANCED

Module Code	**CE6611**
Module Title	**Structural Engineering 2 and Geotechnical Engineering 2**
Level	6
Prerequisites	Prior study of structural & geotechnical engineering at intermediate level such as CE5023 and CE5024
Credits	• Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Suitability	Study Options **1** or **2** or **3**
Content	Building upon knowledge gained at level 5, the module covers methodologies and techniques of structural analysis and design of steel, concrete and timber structures, as well as a range of geotechnical elements, e.g. foundations, retaining walls, slopes and excavations.. Upon the completion of this module students will be able to utilise various Codes of Practice to produce competent and professional designs for superstructures and substructures and to analyse stability of natural and engineered slopes. This will stimulate students to develop an interest and awareness of the scope and nature of structural and geotechnical engineering within the design process and to instill creativity, engineering judgment and technical report writing capability. Development of team working skills and independent study is an important part of the module. This module intends: to develop engineering desing skills, to increase awareness of the roles of the structural and geotechnical engineers in the planning, design and construction of infrastructure and to

encourage students to utilise opportunities afforded by their membership of professional institutions to enhance their employability and professionalism.

Overall content:

- Moment distribution: Sway frames with sloping members. Symmetry.
- Matrix algebra.
- Stiffness method: Sway frames with sloping members. Symmetry.
- applying structural software for structural and geotechnical analysis and design.
- Reinforced concrete: Division of continuous structures into sub-frames. Multiple load cases, moment redistribution. Analysis of one- and two-way continuous slabs. Columns and bases. Design to Eurocode 2 and National Annex.
- Prestressed concrete: Design of simple beams for serviceability and ultimate loads. Cracking, ultimate moment, deflection.
- Steel design: Simple and continuous design. Design of beams for lateral-torsional buckling. Combined axial force and bending. Design to Eurocode 3 and corresponding National Annex.
- Timber design: Strength classes and modification factors. Design of timber floors, columns and roof structures. Design to Eurocode 5.
- Soil mechanics: Stress paths and critical state theory in soil mechanics.
- Slope stability: Principles, analysis and modelling of instability in natural and engineered slopes, design of engineered slopes and slope stabilisation options, quantitative risk analysis, case studies of landslide problems;
- 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 to Eurocode 7; Piled foundations: various piling techniques; pile capacity and settlement calculation; Eurocode 7 design pile testing and interpretation of results.
- Pile groups: analysis and design to Eurocode 7: load testing Sustainability, risk assessment, environmental assessment, health and safety issues.
- Employment opportunities and employability skills, career development and benefits of membership of professional organisations.

➢ **Autumn Semester:**

Note that this semester includes a fieldtrip during enrichment week.

Structural Design

- Steel Design

Structural Analysis 2

- Stiffness method
- Moment Distribution

Geotechnical Design

- foundation types, bearing capacity theory, failure mechanisms
- Effect of water table, eccentric loading on shallow foundation bearing capacity
- Eurocode 7 bearing capacity (strip+pad foundations), ground characterization
- Eurocode 7 design of pad foundations; shallow foundations

Slope Stability & Landslides

- Principles of Slope Stability
- Stability Analysis & Modelling
- Water in Slopes
- Landslides and Infrastructure
- Landslide Hazards and Monitoring
- Landslide Mitigation
- Eurocode 7 and any other topics

➢ **Spring Semester:**

Structural Analysis 2

- Moment Distribution
- Multiplication of matrices

Structural Design

- Reinforced concrete (RC) beams design
- RC column design
- RC analysis of structures
- Reinforced Concrete slab design
- Prestressed concrete
- Timber design
- Composite Design

Geotechnical Design

- Piling systems, load-transfer, pile testing
- Pile load capacity calculation procedures
- EC7 design of piles, negative skin friction, pile settlement calculation
- Pile groups; capacity calculation, efficiency
- Pile group settlement calculation, piling
- Rankine earth pressure theory; active+passive; pressure distribution
- Surcharges, water pressure, ground slope, tension crack depth.
- Coulomb's earth pressure theory; Culman line diagram method
- Retaining wall types; limit states onsidered in design
- Eurocode 7 design of gravity retaining walls.

Kingston University London

Civil Engineering and Infrastructure Modules for Visiting Students 2024/5

Teaching	Seminars, workshops and tutorials, along with computer simulation sessions
Assessment	Study Option **1:** • Coursework 1: Structural Design Coursework of steel structures and reinforced concrete structures (20%, 1600 words) • Coursework 2: Geotechnical Analysis and Design Portfolio (30% total) consisting of three equally weighed elements of 800 words each: Eurocode 7 design of shallow foundations, Eurocode 7 design of deep foundations and and a Geotechnical analysis of slope stability conditions. • Two-hour exam (50%)
	Study Option **2:** • Structural design coursework of steel structures • Slope Stability report -1200 words
	Study Option **3:** • Structural design coursework of reinforced concrete structures • Foundation design coursework
Last updated	03/05/24 PJW

Return to Top

Module Code	**CE6012**
Module Title	**Sustainable Infrastructure and Environment**
Level	6
Prerequisites	Substantial prior study of civil engineering
Credits	• Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Suitability	Open to suitably qualified Visiting Students for Study Options **1** or **2** or **3**
Content	The module has been formulated 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 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.

Overall content:

- Global issues on sustainability, climate change and infrastructure, including environmental impact such as social, economic, political and health factors.
- Regulatory framework: Government transportation policy, Environmental Impact Assessment (EIA), waste management, waste water collection and treatment, carbon footprint and renewable energy
- Waste water management and treatment: water quality, water supply, Sewage and Sustainable Urban Drainage System (SUDs), waste water collection and treatment, disposal of wastewater and sewage sludge.
- Engineering hydrology including groundwater and surface water, flood hydrographs including rainfall and unit hydrograph method, rive and canal engineering
- Hydraulic structure design: the use of physical hydraulics models, waterhammer in pressurised systems including surge suppression
- Gradually Varied Flow (GFV) including solution of differential equations, computer and mathematical modelling
- Energy infrastructure: electrical power network and generation, natural gas storage, transfer and distribution, petroleum, coal, renewable energy
- Transportation infrastructure: railways, highways, traffic management, safety and appraisal, signalling, highway and junction design, computer modelling, flexible and rigid pavements, highway drainage, design manual, construction and maintenance.
- Sustainable integrated transport systems: pollution-free modes of transport, planning and execution of highway schemes, contracts and documentation
- Evaluation of road schemes in technical, environmental, economic and social terms; monitoring and control of air and noise pollution
- Evaluation of road schemes in technical, environmental, economic and social terms; monitoring and control of air and noise pollution

➢ **Autumn Semester: Highways and Transportation**

- Highway design
- Transport policy and traffic growth
- Traffic assessment, Development issues and Public Transport Accessibility
  Traffic surveys
- Materials and introduction to laboratory activities
- Highway capacity, design speed and sight distances, Pavement Design, Geometrical Design, Horizontal Alignment
- Highway layout and geometry – Longitudinal Section and Vertical Alignment

	• Highway layout and geometry – Cross Sections Calculations of cross section areas • Signalled junctions: signal hardware and software; signal parameters; staging & phasing • Signal design: saturation flow; opposed/unopposed flows; inter-green period; optimum timing Tutorial on traffic signals: calculating flow capacities and green period & optimum signal cycle time • Superelevation Diagram ➢ **Spring Semester: Water and Sanitation Infrastructure** • Intro to water and environment section • The UK Water Industry; Thames Super Sewer • Virtual Water • Low flow hydrology • Water supply • Reservoir Design • Cumulative mass curve • Water Quality • Water treatment • Sewage treatment • Sewerage design; The rational method • Air Pollution • Solid waste
Teaching	Seminars, workshop and tutorials, guest lectures by practitioners/researchers, site visits, a local traffic survey and a laboratory programme
Assessment	Study Option **1:** • Coursework 1 (50%): design report related to highway infrastructure, including: o Highway design (30%) o Local traffic survey & junction design report 3,000 words (15%) o Highway materials lab reports (5%) • Coursework 2 (50%): an engineering hydrology design report relating to hydrology, water and wastewater infrastructure. This includes: o Spillway and Stilling Basin (30%) o Coastal Engineering – 1000 words (10%) o Water Quality Lab (10%)

	Study Option **2:** • Coursework (100%): design report related to highway infrastructure, including: ○ Highway design (60%) ○ Local traffic survey & junction design report 3,000 words (30%) ○ Highway materials lab reports (10%)
	Study Option **3:** • Coursework (100%): an engineering hydrology design report relating to hydrology, water and wastewater infrastructure. This includes: ○ Spillway and Stilling Basin (60%) ○ Coastal Engineering (20%) ○ Water Quality Lab (20%)
Last updated	03/05/24 PJW

Return to Top