

# **CIVIL ENGINEERING**

## **SYLLABUS**

The syllabus applies to students admitted in the academic year 2015-16 and thereafter under the four-year curriculum.

### Definition and Terminology

Each course offered by the Department of Civil Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Civil Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Civil Engineering that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (78 credits), comprising 24 credits of introductory core courses and 54 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 36 credits of advanced discipline elective courses offered by the Department of Civil Engineering.

#### Elective Courses

Students are required to complete 18 credits of elective course(s) offered by either the Department of Civil Engineering, or other departments within or outside of the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9540 Technical English for Civil Engineering”;
- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for Engineering Students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from the same Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### Capstone Experience

Students are required to complete the 12-credit “CIVL4102 Project” to fulfill the capstone experience requirement for the degree of BEng in Civil Engineering.

Internship

Students are required to complete the 6-credit internship “CIVL2109 Internship”, which normally takes place after their third year of study.

**Degree Classification**

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

**The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Civil Engineering) comprises 240 credits of courses with the following structure:

**UG 5 Requirements (54 credits)**

Course Code	Course	No. of credits
CAES1000	Core University English	6
CAES9540	Technical English for Civil Engineering	6
CENG9001	Practical Chinese for Engineering Students	6
CC##XXXX	University Common Core Course (6 courses)*	36
<b>Total for UG5 Requirements</b>		<b>54</b>

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one and no more than two courses from each Area of Inquiry during the whole period of study.

**General Engineering Courses (36 credits)**

Course Code	Course	No. of credits
MATH1851	Calculus and ordinary differential equations	6
MATH1853	Linear algebra, probability & statistics	6
ENGG1111/ ENGG1112	Computer programming and applications/ Computer programming and applications I	6
PHYS1050	Physics for engineering students	6
ENGG1201	Engineering for sustainable development	6
ENGG120X	Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering*	6
<b>Total for General Engineering Courses</b>		<b>36</b>

\* Choose one General Engineering Course from the following list:

- ENGG1202 Introduction to computer science
- ENGG1203 Introduction to electrical and electronic engineering
- ENGG1204 Industrial management and logistics
- ENGG1205 Introduction to mechanical engineering
- ENGG1206 Introduction to biomedical engineering
- ENGG1207 Foundation of biochemistry for medical engineering

**Discipline Core Courses (78 credits)****Introductory Courses (24 credits)**

Course Code	Course	No. of credits
CIVL1105	Environmental engineering	6
CIVL1113	Engineering mechanics & materials	6
CIVL1114	Surveying & drawing	6
MECH2407	Multivariable calculus & partial differential equations	6
<b>Total for Introductory Discipline Core Courses</b>		<b>24</b>

**Advanced Courses (54 credits)**

Course Code	Course	No. of credits
CIVL2102	Engineering geology and rock mechanics	6
CIVL2103	Fluid mechanics	6
CIVL2104	Hydraulics and hydrology	6
CIVL2105	Theory and design of structures I	6
CIVL2106	Soil mechanics	6
CIVL2107	Theory and design of structures II	6
CIVL2108	Principles of civil engineering management	6
CIVL2111	Transportation engineering	6
CIVL4101	Capstone design project	6
<b>Total for Advanced Discipline Core Courses</b>		<b>54</b>

**Capstone Experience and Internship (18 credits)**

Course Code	Course	No. of credits
CIVL2109	Internship*	6
CIVL4102	Project <sup>+</sup>	12
<b>Total for Capstone Experience and Internship Courses</b>		<b>18</b>

+Capstone Experience

\*Internship

**Discipline Elective Courses (36 credits)**

Course Code	Course	No. of credits
CIVL2110	Experiential learning	6
CIVL3101	Advanced engineering mechanics	6
CIVL3103	Construction project management	6
CIVL3106	Engineering hydraulics	6
CIVL3107	Environmental impact assessment of civil engineering projects	6
CIVL3108	Foundation engineering	6
CIVL3111	Wastewater treatment	6
CIVL3112	Prestressed concrete structures	6
CIVL3114	Slope engineering	6
CIVL3115	Solid and hazardous waste management	6
CIVL3116	Steel structures	6

CIVL3118	Theory and design of structures III	6
CIVL3119	Traffic engineering	6
CIVL3120	Transportation infrastructure engineering	6
CIVL3121	Water resources engineering	6
CIVL3122	Wind engineering	6
CIVL3125	Law for civil engineers	6
CIVL3126	Engineering practice in Mainland China	6
CIVL3127	Professional practice in the built environment	6
CIVL3128	Structural dynamics and earthquake engineering	6
CIVL3129	Numerical analysis in geotechnical engineering	6
CIVL3130	Structural fire engineering	6
CIVL3131	Earth retaining system	6
CIVL3132	Geotechnical testing instrumentation and monitoring	6
CIVL3133	Ground improvement	6
CIVL3134	Environmental geotechnology	6
<b>Complete six discipline elective courses for a total of 36 credits</b>		<b>36</b>

### **Elective Courses (18 credits)**

At least 18 credits of courses offered by either the Department of Civil Engineering, or other departments within or outside of the Faculty of Engineering.

### **Summary of curriculum structure of BEng (Civil Engineering)**

<b>Course Categories</b>	<b>No. of credits</b>
UG5 Requirements	54
General Engineering Courses	36
Discipline Core Courses (Introductory)	24
Discipline Core Courses (Advanced)	54
Capstone Experience and Internship	18
Discipline Elective Courses	36
Elective Courses	18
<b>Total</b>	<b>240</b>

A suggested study plan is given as follows:

### **FIRST YEAR**

#### **General Engineering Courses (36 credits)**

MATH1851	Calculus and ordinary differential equations
MATH1853	Linear algebra, probability & statistics
ENGG1111/	Computer programming and applications/
ENGG1112	Computer programming and applications I
PHYS1050	Physics for engineering students
ENGG1201	Engineering for sustainable development
ENGG120X	Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering

**University Requirements (UG5) (24 credits)**

CAES1000            Core University English  
CC##XXXX           Three Common Core Courses

**SECOND AND THIRD YEARS****Introductory Discipline Core Courses (24 credits)**

CIVL1105            Environmental engineering  
CIVL1113            Engineering mechanics & materials  
CIVL1114            Surveying & drawing  
MECH2407           Multivariable calculus & partial differential equations

**Advanced Discipline Core Courses (48 credits)**

CIVL2102            Engineering geology and rock mechanics  
CIVL2103            Fluid mechanics  
CIVL2104            Hydraulics and hydrology (pre-requisite: CIVL2103)  
CIVL2105            Theory and design of structures I (pre-requisite: CIVL1113)  
CIVL2106            Soil mechanics  
CIVL2107            Theory and design of structures II (pre-requisite: CIVL2105)  
CIVL2108            Principles of civil engineering management  
CIVL2111            Transportation engineering

**Discipline Elective Courses (18 Credits)**

(Note that pre-requisite is required for some courses. Please refer to the course description for individual courses)

**University Requirements (UG5) (24 credits)**

CC##XXXX            Three Common Core Courses  
CENG9001            Practical Chinese for Engineering Students (This course should be enrolled in the third year)

**Internship (6 credits)**

CIVL2109            Internship (This course must be enrolled in the Summer semester of the third year)

**FOURTH YEAR****Advanced Discipline Core Courses (6 credits)**

CIVL4101            Capstone design project (This course must be enrolled in the fourth year)

**Discipline Elective Courses (18 credits)**

(Note that pre-requisite is required for some courses. Please refer to the course descriptions for individual courses)

**Capstone Experience (12 credits)**

CIVL4102            Project (This course must be enrolled in the fourth year)

**University Requirements (UG5) (6 credits)**

CAES9540            Technical English for Civil Engineering (This course should be enrolled in the fourth year)

**Elective Courses (18 credits)**

(Note that pre-requisite is required for some courses. Please refer to the course descriptions for individual courses)

**COURSE DESCRIPTIONS**

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

### **General Engineering Courses**

ENGG1111	Computer programming (6 credits)
ENGG1112	Computer programming I (6 credits)
MATH1851	Calculus and ordinary differential equations (6 credits)
MATH1853	Linear algebra, probability & statistics (6 credits)
MECH2407	Multivariable calculus & partial differential equations (6 credits)
PHYS1050	Physics for engineering students (6 credits)
ENGG1201	Engineering for sustainable development (6 credits)
ENGG1202	Introduction of computer science (6 credits)
ENGG1203	Introduction to electrical and electronic engineering (6 credits)
ENGG1204	Industrial management and logistics (6 credits)
ENGG1205	Introduction to mechanical engineering (6 credits)
ENGG1206	Introduction to biomedical engineering (6 credits)
ENGG1207	Foundations of biochemistry for medical engineering (6 credits)

Please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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### **University Requirements on Language Enhancement Courses**

- CAES1000. Core University English (6 credits)**  
**CENG9001. Practical Chinese for engineering students (6 credits)**

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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### **CAES9540. Technical English for Civil Engineering (6 credits)**

This one semester 6-credit English course will be offered to final year Civil Engineering and BEng(EngSc) Environmental Engineering students. It will run alongside Civil Engineering core project course. The main course objective is to provide students with training on report writing and oral presentation skills. Students will learn to write a technical report in a professional and effective manner through drafting and revision of their work. They will also be trained to give a technical presentation that focuses on explaining technical information to the general audience, handling over in a group presentation and designing appropriate visual aids to both professional and non-expert audiences. Assessment is by coursework and a final test.

Co-requisite: CIVL4102 Project  
CIVL4101 Capstone design project (for BEng(EngSc) Environmental Engineering students only)

Assessment: 100% continuous assessment.

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## **University Common Core Curriculum**

36 credits of courses in the University Common Core Curriculum, in which students can select not more than one course from the same Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study:

- Scientific and Technology Literacy
  - Humanities
  - Global Issues
  - China: Culture, State and Society
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## **Introductory Discipline Core Courses**

### **CIVL1105. Environmental engineering (6 credits)**

This is an introductory course on environmental engineering. Students are taught in 31 hours of lecture plus 8 hours of interactive problem-based tutorial (IPBT). The IPBT is designed to train students in small groups for using the knowledge and engineering principles learned from the course to solve practical environmental engineering related problems.

Assessment: 20% continuous assessment, 80% examination

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### **CIVL1113. Engineering mechanics and materials (6 credits)**

The Engineering Mechanics part of this course aims to provide students with a firm foundation of engineering mechanics, which is needed for their later studies in structural engineering and geotechnical engineering. This part covers equilibrium of forces; bending moment, shear and axial forces; beam theory for bending and shear; torsion of circular sections; shear centre; analysis of stress and strain; and column buckling.

The Materials part of this course aims to provide students with a general knowledge of common construction materials and some background knowledge of material science. This part covers major applications and required properties of construction materials; structural steel; concrete; masonry; timber; bituminous materials; crystalline structure; elastic and plastic deformation; phase diagram; alloying; material forming and heat treatment; and corrosion.

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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### **CIVL1114. Surveying and drawing (6 credits)**

The Surveying part of this course aims to provide students with an overview on the surveying principles in determination of the differences in levelling between stations and of the coordinates of stations. Students will be introduced to basic surveying instruments and techniques through lectures and field work. The aim of the Drawing part of this course is to familiarize the students with the techniques for reading and production of both hand drawings and computer aided drafting (CAD) drawings. Students are expected to understand and appreciate the importance of surveying and drawing in the construction industry in order to prepare them for an engineering career.

Assessment: 35% practical work, 65% continuous assessment

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### **Advanced Discipline Core Courses**

#### **CIVL2102. Engineering geology and rock mechanics (6 credits)**

This course provides an introduction to engineering geology, acquainting the students with the fundamental aspects of rock mechanics, and developing the students' capability of applying the concepts and knowledge to solve practical problems in rock engineering.

Assessment: 20% practical work, 10% continuous assessment, 70% examination

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#### **CIVL2103. Fluid mechanics (6 credits)**

The course introduces the fundamental concepts of fluid flow, and examples of engineering fluid mechanics.

The course helps students to develop a sound understanding of control volume analysis, and its use with mass, momentum, and energy conservation principles. The course prepares students for dimensional analysis for the use of scale models in wind tunnel and hydraulic model testing.

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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#### **CIVL2104. Hydraulics and hydrology (6 credits)**

This course is to consolidate the principles of fluid mechanics learnt in CIVL2103, to apply them to civil engineering hydraulic problems, and to provide an understanding of the basic concepts of the hydrological cycle including its relevance and application to civil engineering field.

Pre-requisite: CIVL2103 Fluid mechanics

Assessment: 15% practical work, 15% continuous assessment; 70% examination

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#### **CIVL2105. Theory and design of structures I (6 credits)**

This is the first of three consecutive courses on Theory and Design of Structures. This course provides students with the basic knowledge in structural theory and design. Apart from introducing students to statically determinate structures, it also provides the background for future study of statically indeterminate structures.

Pre-requisite: CIVL1113 Engineering mechanics and materials

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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#### **CIVL2106. Soil mechanics (6 credits)**



Soil mechanics is a branch of engineering mechanics that describes the behaviour of soils. It differs from fluid mechanics and solid mechanics in the sense that soils consist of a heterogeneous mixture of fluids (usually air and water) and particles (usually clay, silt, sand and gravel) but soil may also contain organic solids, liquids, and gasses and other matter. Along with rock mechanics, soil mechanics provides the theoretical basis for analysis in geotechnical engineering. Soil mechanics is used to analyze the deformations of and flow of fluids within natural and man-made structures that are supported on or made of soil, or structures that are buried in soils. Examples applications are building and bridge foundations, retaining walls, dams, and buried pipeline systems.

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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### **CIVL2107. Theory and design of structures II (6 credits)**

This course is the second of three consecutive courses on Theory and Design of Structures. This course aims to provide students with knowledge and understanding in behaviour, analysis and design of statically indeterminate structures.

Prerequisite: CIVL2105 Theory and design of structures I

Assessment: 30% continuous assessment, 70% examination

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### **CIVL2108. Principles of civil engineering management (6 credits)\***

Civil engineering projects are characterised by their uniqueness, complexity and uncertainty, and these have posed immense challenges to our industry. To satisfy the client and project requirements, a good management skill and knowledge is of paramount importance. While engineers play a key role in relevant government departments, client organisations, design offices and contracting firms, they have the responsibilities of improving the efficiency, safety and quality of civil engineering projects and maximising the chance of project success and discharging their duties ethically. Therefore, the aims of this course are to introduce the basic concepts of various aspects of management and to explain how to apply these management principles to plan, organise and control a civil engineering project.

Assessment: 30% continuous assessment, 70% examination

\* For the double-degree in BEng/BBA, students who have completed the business course of 'Principles of management' are exempted from taking this core course under the BEng curriculum.

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### **CIVL2111. Transportation engineering (6 credits)**

This course is an introductory course of Transportation Engineering, and covers the causes and motivations of the movements of people and goods, the basic characteristics of different transportation modes, land use and transportation planning, equilibrium analysis, cost-benefit analysis, travel demand modeling and forecasting, highway alignment and geometric design, transportation surveys, and traffic impact assessment. Hong Kong examples will be used if possible.

Assessment: 20% continuous assessment, 80% examination

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### **CIVL4101. Capstone Design Project (6 credits)**

All modern engineering projects required substantial design and communication skills from engineers. With the demand for quality infrastructural projects, many professional engineers are required to participate in interdisciplinary teams throughout various project stages. Therefore, this course aims to train future civil engineers to handle civil engineering projects through synergetic teamwork within a multi-disciplinary working environment. The course will start by introducing the importance of engineering design and communication skills, and then will equip students with the general knowledge of project designing across different disciplines by a series of guest lectures. Student will be divided into small project groups. Each group will be allocated a real-life project and supervised by one of the departmental teaching staff (staff tutor) and an industrial tutor. The students will work closely with their staff tutor and industrial tutor throughout the project period, together with the specific technical advisors, to carry out feasibility study, preliminary design and detail design of their project. The project will be assessed by a series of oral presentations and written reports from the project team.

Assessment: 100% continuous assessment

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### **Capstone Experience and Internship**

#### **CIVL2109. Internship (6 credits)**

The course is to provide industrial training to engineering students. The students will have an opportunity to gain practical experience in civil engineering and related professions.

The course requires students to complete a period of full time approved internship in industry, of not less than 4 weeks normally after the end of the second semester of the student's third academic year of study. The students are required to complete the internship to the satisfaction of an engineering professional, who will act as the students' supervisors during the internship.

During the course of their internship, sometimes students will be asked to visit construction sites. To comply with the legal requirements and for safety reasons, all students must complete the Mandatory Basic Safety Training Course (MBST). Through the MBST course, students will gain an understanding on the relevant safety legislation; potential hazards and preventive strategies; use of the protective equipment and the accident reporting mechanism.

Assessment: 100% continuous assessment

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#### **CIVL4102. Project (12 credits)**

The primary aim of the project is to give each individual student an opportunity to handle a practical engineering problem and to present the findings in a precise and concise report. An important part of the project lies in the way in which the students plan and carry out the task, and apply their engineering knowledge sensibly and diligently to solve the problem. The way in which the students present their findings is equally important.

Assessment: 100% continuous assessment

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## **Discipline Elective Courses**

### **CIVL2110    Experiential learning (6 credits)**

To complete a period of training in industry, workshop training, study tour, or leadership programme, approved by the Head of Department, not less than a total of four weeks during the summer semester, subject to satisfactory performance in these activities and the submission of a satisfactory completion report.

Assessment: 100% continuous assessment

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### **CIVL3101.    Advanced engineering mechanics (6 credits)**

CIVL3101 Advanced Engineering Mechanics aims to introduce to the fundamentals of engineering mechanics and how this is linked to engineering solutions by advanced computation techniques based on the finite element method. Equilibrium in elasticity problems and continuity equation for steady-state field problems are discussed, and by means of the virtual work principle, finite element formulation will be systematically established. Using simple 3-node triangular element as an example, engineering problems in structural mechanics and fluid flow are analysed. A computer demonstration will be presented to show students how complex practical engineering problems are tackled, and allow them to develop the ability to analyse realistic engineering problems by themselves and appreciate the capability and limitations of modern computational tools for engineering solutions.

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3103.    Construction project management (6 credits)**

This course conveys knowledge of the fundamentals of construction project management, including core principles and their basic applications, which can be further built upon during career development. Topics span both the management of civil engineering designs and the management of construction projects. The course imparts important basics of the planning and control of time and money, and links these to achieving better value for stakeholders, including quality and life cycle considerations.

The course is designed to enable civil engineering undergraduates to appreciate and assimilate key principles and good practices for the effective, efficient and ethical management of construction projects. It also aims to equip young civil engineers with the basic knowledge that will enable them to perform well and contribute meaningfully in multi-disciplinary project teams that may include financial and legal professionals, apart from those from other core construction industry disciplines

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3106.    Engineering hydraulics (6 credits)**

The course Engineering Hydraulics covers three major parts: Open Channel Flow, Storm Drainage Design and Environmental Hydraulics.

In Open Channel Flow, emphasis will be placed on the ‘gradually varied’ open channel flow (GVF), which deals with the classification of GVF profiles and different methods of computation of flow profiles. Some examples of ‘rapidly varied’ flow, such as energy dissipators and vertical drop structures, will also be given.

In Storm Drainage Design, the classification of drainage and sewerage systems will be introduced. Students will learn the design of urban stormwater drainage system.

In Environmental Hydraulics, students will appreciate the assimilative capacity (self purification) of the natural environment, through the study of basic concepts of turbulent mixing and dispersion of pollutants in water. Examples will be given to demonstrate the use of advective diffusion equation to solve actual environmental problems.

Pre-requisite: CIVL2104 Hydraulics and hydrology

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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### **CIVL3107. Environmental impact assessment of civil engineering projects (6 credits)**

This course will introduce concepts on environmental protection legislation, environmental impact assessment process, environmental impacts during construction and operation of projects, mitigation measures, modelling, environmental monitoring and audit, and case studies.

Pre-requisite: CIVL1105 Environmental engineering and CIVL2103 Fluid mechanics

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3108. Foundation engineering (6 credits)**

Foundation engineering deals with the investigation, design and construction of the foundations of engineering structures, which is of prime importance. This course addresses the site investigation of a geotechnical project, follows by the design and construction of shallow and deep foundations in accordance with both ultimate and serviceability criteria. In particular the design and construction practices in Hong Kong will be addressed. A site visit will be arranged to offer students an opportunity to observe the construction practice in Hong Kong.

Pre-requisite: CIVL2102 Engineering geology and rock mechanics and CIVL2106 Soil mechanics

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3111. Wastewater treatment (6 credits)**

This course focuses on the theory, design and operation of wastewater treatment. Emphasis will be placed upon a fundamental understanding of commonly used treatment technologies. Major sections of the course cover the generation and characteristics of municipal wastewater, sewerage systems, preliminary treatment, primary sedimentation, secondary biological treatment, nutrient removal, disinfection, sludge treatment and disposal, unit process selection and treatment plant design, characteristics of industrial wastewater, and physical, chemical and biological processes used in industrial wastewater treatment.

The course aims to introduce to students the basic concept of wastewater treatment engineering and the knowledge of unit treatment operations and processes. At the end of this course, students who fulfill the requirement of the course will be able to present the principles and theories behind the common wastewater treatment technologies and to conduct preliminary design of sewerage systems and typical physical, chemical and biological units used in conventional wastewater treatment.

Pre-requisite: CIVL1105 Environmental engineering and CIVL2103 Fluid mechanics

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **CIVL3112. Prestressed concrete structures (6 credits)**

This is an elective course to provide students with the basic knowledge for the design of Prestressed Concrete Structures. Apart from introducing students to the fundamental principles of prestressing and application to design of long-span concrete structures, it also provides the background for future study of bridge engineering. Each student is required to submit a comprehensive design of prestressed concrete structure. Students must have taken the pre-requisite CIVL2107 Theory and Design of Structures II before taking this course.

Pre-requisite: CIVL2107 Theory and design of structures II

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3114. Slope engineering (6 credits)**

This course is to provide our students with basic knowledge of slope stability analysis and design. It covers slope stability analyses, cases of landslide hazards, landslide investigation, uncertainties in slope stability analysis, landslip preventive measures and design, many case studies and actual examples, a Slope/w software workshop and one field technical trip.

Pre-requisite: CIVL2102 Engineering geology and rock mechanics and CIVL2106 Soil mechanics

Assessment: 20% continuous assessment, 80% examination

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### **CIVL3115. Solid and hazardous waste management (6 credits)**

Human activities generate solid waste materials that are often discarded because they are considered useless. However, the disposal of these unwanted waste materials has created a heavy burden to our environment and sometimes even threatened the human health due to its hazardous properties. Waste management has become one of the most significant problems of our time because the current ways of life in Hong Kong and in many areas of the world produce enormous amounts of waste, and most people want to preserve their lifestyle, while also protecting the environment and public health. Furthermore, if managed properly, many of these waste materials can be reused or recovered for becoming a resource for industrial production or energy generation. This course is an introduction to the key managing concepts and processing technologies of solid waste. It aims to train future engineers capable of conducting solid waste project planning for industries, businesses, communities and governmental sectors. The discussion of context will stem from solid waste materials generated from municipal sources, and then include selected examples from industrial sources and/or of hazardous properties with local relevance. After the training provided by this course, students are expected to be capable of using different planning tools to

manage the reduction of solid waste generation, the reuse and recovery of waste materials, or the safe and economical disposal strategies.

Assessment: 30% continuous assessment, 70% examination

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**CIVL3116. Steel structures (6 credits)**

This course aims to provide students with knowledge and understanding in behaviour and design of steel structures. Students will be exposed to plastic analysis, residual stress, slender sections, plate girders, steel frames, connections and composite structures. Students must have fulfilled the pre-requisite CIVL2107 Theory and Design of Structures II requirement before taking this course.

Pre-requisite: CIVL2107 Theory and design of structures II  
Assessment: 20% continuous assessment, 80% examination

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**CIVL3118. Theory and design of structures III (6 credits)**

The theory part of the course introduces the theory and applications of the matrix method for static and stability analyses of two-dimensional structures together with the elastic and plastic torsional analyses of thin-walled sections. The design part of the course introduces the concept and principles of inelastic design of reinforced concrete structures with emphasis on plastic hinge formation and moment redistribution. On practical design aspects, ultimate limit state design as per Hong Kong Concrete Code of special structural members such as two-way slabs, flat slabs, torsion members and slender columns will be discussed and explained. The course also includes a section of serviceability limit state design of large civil water-retaining reinforced concrete structures, such as underground box culverts, open channels, manholes, inspection chambers and water/sewage treatment tanks.

Pre-requisite: CIVL2107 Theory and design of structures II  
Assessment: 30% continuous assessment, 70% examination

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**CIVL3119. Traffic engineering (6 credits)**

This course is an introduction to the broad disciplines of traffic engineering and its applications to the management and control of traffic flows in highways and the planning and design of highway junctions and interchanges. This course covers the characteristics of traffic flow, mathematical models of traffic flow, traffic management schemes, traffic surveys, traffic design for safety, and the planning and design of different types of road junctions, including priority junctions, roundabouts, traffic signal controlled junctions and grade-separated junctions and interchanges. Hong Kong examples will be used if possible.

Assessment: 30% continuous assessment, 70% examination

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**CIVL3120. Transportation infrastructure engineering (6 credits)**

This course is an introduction to the theory and practice of transportation infrastructure planning, design implementation and maintenance. Emphasis is placed on demand estimation, capacity assessment, facility operational requirements, facility location and arrangements, design codes, properties of construction

materials and their underlying theories. The different stages of project development are discussed and illustrated by case studies to cover demand forecast, system planning, feasibility studies, project appraisal, public consultation, preliminary and detailed design, procurement methods and construction.

Pre-requisite: CIVL2111 Transportation engineering  
Assessment: 60% continuous assessment, 40% examination

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### **CIVL3121. Water resources engineering (6 credits)**

CIVL3121 is a course that focuses on the concept, theory, design and operation of urban water supply systems. Emphasis will be placed upon a fundamental understanding of commonly used water collection and treatment technologies. Major sections of the course cover water cycle, water consumption and demand, water collection, storage and transportation, drinking water quality, conventional surface water treatment unit operations and processes, advanced water treatment technologies, water stabilisation and corrosion control, urban water distribution and transmission, water reclamation and total water management.

The course aims to introduce to students the basic concept of water resources engineering and the knowledge of urban water supply. At the end of this course, students who fulfill the requirement of the course will be able to present the principles and theories behind the common water collection and treatment technologies and to conduct conceptual design of freshwater collection systems, common surface water treatment processes and urban water distribution systems.

Pre-requisite: CIVL1105 Environmental engineering and CIVL2103 Fluid mechanics  
Assessment: 20% practical work, 80% examination

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### **CIVL3122. Wind engineering (6 credits)**

The course introduces the effects of wind on buildings, structures and the environment, with emphasis on wind loading of buildings and structures.

The course provides students with the basic scientific knowledge of the engineering description of wind and the engineering phenomena of wind flow around bluff bodies, buildings, bridges and civil engineering structures. The basics of flow-structure interaction and wind-induced vibration of structures are also presented. The course then continues to describe the format and features of a wind loading code and how the code should be interpreted with the knowledge of wind engineering. The course also introduces the effects of wind on pedestrian comfort and pollutant dispersion.

Pre-requisite: CIVL2103 Fluid mechanics  
Assessment: 15% practical work, 15% continuous assessment, 70% examination

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### **CIVL3125. Law for civil engineers (6 credits)**

With the changing demands and expectations of civil engineers, law has become an essential part of the body of knowledge important to the discharge of daily tasks of civil engineers. Whether working for sub-contractors, contractors, consultants, governments or private developers, a core competence for the

planning, design, construction and maintenance of projects is the ability to apply principles of laws to their works. These enable the proper management of projects and the areas of disputes arising thereunder.

This course aims at introducing the basic principles of laws with particular emphasis on those, which are relevant to the construction industry.

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3126. Engineering practice in Mainland China (6 credits)**

To enable students to gain basic understanding of engineering design and construction practice in Mainland China. By introducing some commonly used codes of practice, work procedures, quality control system, engineering requirements, practical design case study, design principles and procedure of foundation, building structures with and without seismic design requirement and bridges/highway structures, students will be better equipped to engage in Mainland engineering projects. At the end of this course, students should be able to understand the work procedure in Mainland China. In design, students should be capable of carrying out correct design of foundations and buildings as per various GB Codes and understand the principle of respective design clauses stipulated in the Codes.

Pre-requisite: CIVL2107 Theory and design of structures II  
Assessment: 30% continuous assessment, 70% examination

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### **CIVL3127. Professional practice in the built environment (6 credits)**

Building construction is one of the major sectors of the construction industry in Hong Kong. Many high-rise buildings were built in the last three decades, calling for sophisticated designs in building layout, structure and foundation. At the same time it demands high technique in construction skill and management. There are government departments ensuring compliance with statutory standards of safety, health and environment of buildings and building works. Civil engineers would join relevant government departments, client organizations, consultant and contracting firms playing a key role in planning, design and construction of buildings. Therefore, the aims of this course are to introduce the basic knowledge and idea of statutory control on building planning, construction and site supervision.

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3128. Structural dynamics and earthquake engineering (6 credits)**

Earthquake disaster is increasingly of global concern as it threatens the world's population, economy, and sustainable development. It is the responsibility of civil engineers to design and build earthquake-resistant structures, in order to minimize the earthquake risk. By reducing losses of lives and properties, socio-economical sustainability can be achieved.

In this course, students will be introduced to the basic science of earthquakes and its effects on the natural and built environment.

Pre-requisite: CIVL2107 Theory and design of structures II  
Assessment: 30% continuous assessment, 70% examination



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**CIVL3129. Numerical analysis in geotechnical engineering (6 credits)**

Advances in computer technology greatly enhance the application of numerical methods in geotechnical engineering. The importance of numerical modelling in geotechnical practice has been increased tremendously over the past decade. In this course, the students will be introduced a proper understanding of the subject, covering from fundamentals of the numerical techniques to geotechnical practical considerations. This course first provides students a basic knowledge of numerical techniques including the finite difference and finite element method. The second part of the course focuses on practical considerations required for applying these techniques to geotechnical problems. It will be concluded by a number of geotechnical applications and case histories.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 35% continuous assessment, 65% examination

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**CIVL3130. Structural fire engineering (6 credits)**

The major aims of this course are to introduce to the students the concept of fire safety engineering and design of fire resistant structures. Students will be given opportunities to learn Eurocode for the design of steel and concrete structures under elevated temperature. At the end of this course, students will be able to understand the fire development and predict gas temperature of fire compartment and temperature of structural members in fire condition. With respect to structural design, students will appreciate the special structural actions that occur under elevated temperature and capable of carrying out fire resistance design of simple steel and reinforced concrete members.

Pre-requisite: CIVL2107 Theory and design of structures II

Assessment: 30% continuous assessment, 70% examination

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**CIVL3131. Earth retaining system (6 credits)**

Development in urban areas is often limited by the space available, and efficient use of that space requires building underground or near slopes. Earth retaining systems are the engineering solution to this problem. This course introduces civil engineering students to different types of earth retaining systems, and gives them the means of designing earth retaining walls from first principles. An introduction to unsaturated soils is also given. At the end of the course, the students will have a good understanding of the forces exerted by the ground on retaining structures, for different cases (e.g. inclined ground, inclined wall, embedded wall, wall friction/adhesion), the different stabilizing methods that can be used (e.g. anchors, nails), and be able to use these calculations to design safe retaining walls.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 30% continuous assessment, 70% examination

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**CIVL3132. Geotechnical testing, instrumentation and monitoring (6 credits)**

Geotechnical testing aims at understanding the behaviour of geomaterials that engineers are dealing with. A proper instrumentation and monitoring scheme provides crucial information for engineers to judge the

effectiveness and safety of the engineering design and construction. This course first provides students advanced knowledge on geotechnical testing from both experimental and theoretical perspectives. Students are required to have hands-on experience on a common geotechnical test – multi-stage triaxial test. Then both practical and theoretical aspects of geotechnical instrumentation and monitoring are addressed.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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### **CIVL3133. Ground improvement (6 credits)**

Construction is sometimes needed in ground that has poor strength and stiffness qualities. Improving the ground by reinforcing it or by modifying it can prevent excessive deformations or even failure. This course introduces civil engineering students to ground improvement by modification or reinforcement. At the end of the course, the students will have a good understanding of the different techniques used for ground improvement, and be able to use some of the theory for design.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3134. Environmental Geotechnology (6 credits)**

Environmental geotechnology can be defined as an interdisciplinary science which covers soil and rock and their interactions with various environmental cycles, including the atmosphere, biosphere, hydrosphere, and lithosphere, as well as the geo-microbiosphere, and human activities, which includes characteristics of tree and vegetation roots and bacterial activities in the subsurface and subsequent response to the engineering behavior of the soil-water system.

The objective of the course is to provide the students with exposure to the geotechnical nature of environmental problems through discussions of contaminant transport in porous media and relationship with remediation technologies for hazardous waste sites and discussions of soil properties relative to waste containment systems, soil stability, and permeability. At the end of the course, the students who fulfill the requirements of this course should be able to understand the importance of Geotechnical Engineering related to environmental issues, to perform preliminary designs of different components of a municipal landfill, and to select appropriate remediation technologies for a contaminated site of a given contaminated site.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 30% continuous assessment, 70% examination

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### **Minor in Environmental Engineering**

Candidates are required to complete a total of 48 credits of courses comprising:

- (a) Introductory Courses (18 credits)

<b>Course Code</b>	<b>Course</b>	<b>No. of credits</b>
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ENGG1201	Engineering for sustainable development*	6
CIVL1105	Environmental engineering	6
CIVL2103	Fluid mechanics <b>OR</b>	6
CIME2101	Water and air quality: concepts and measurement	6
Total for Introductory Discipline Core Courses		18

\* Students opting for the Minor cannot use the course ENGG1201 Engineering for sustainable development as satisfying the requirements of the General Engineering Course.

(b) Discipline Elective Courses (30 credits)

Students must complete 30 credits of discipline elective courses to be chosen from the following list:

Course Code	Course	No. of credits
CIME2101	Water and air quality: concepts and measurement	6
CIVL2111	Transportation engineering	6
CIVL2104	Hydraulics and hydrology	6
CIVL3106	Engineering hydraulics	6
CIVL3107	Environmental impact assessment of civil engineering projects	6
CIVL3111	Wastewater treatment	6
CIVL3115	Solid and hazardous waste management	6
CIVL3121	Water resources engineering	6
CIVL3122	Wind engineering	6
CIVL3134	Environmental Geotechnology	6
MECH3420	Air pollution control	6
Total for Discipline Elective Courses		30

## COURSE DESCRIPTIONS

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

### Minor in Geotechnical Engineering

Candidates are required to complete a total of 48 credits of courses comprising:

(a) Introductory courses (18 credits)

Course Code	Course	No. of credits
MATH1851	Calculus and ordinary differential equations	6
MATH1853	Linear algebra, probability & statistics	6
CIVL2106	Soil mechanics	6
Total for Introductory Discipline Core Courses		18

(b) Discipline Elective Courses (30 credits)

Students must complete 30 credits of discipline elective courses to be chosen from the following list:

<b>Course Code</b>	<b>Course</b>	<b>No. of credits</b>
CIVL2102	Engineering geology and rock mechanics	6
CIVL3108	Foundation engineering	6
CIVL3114	Slope engineering	6
CIVL3129	Numerical analysis in geotechnical engineering	6
CIVL3131	Earth retaining system	6
CIVL3132	Geotechnical testing, instrumentation and monitoring	6
CIVL3133	Ground improvement	6
CIVL3134	Environmental geotechnology	6
Total for Discipline Elective Courses		30

### **COURSE DESCRIPTIONS**

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.