

# **CIVIL ENGINEERING**

## **SYLLABUS**

This syllabus applies to students admitted in the academic year 2012-13.

### Curriculum

The curriculum comprises 180 credits of courses as follows:

(a) General Engineering Courses

Students are required to successfully complete at least 24 credits of General Engineering courses.

(b) Core Engineering Courses

Students are required to successfully complete ALL core engineering courses (84 credits), comprising of 18 credits of introductory core courses and 66 credits of advanced core courses.

(c) Advanced Elective Courses in Civil Engineering

Students are required to take 36 credits of advanced elective courses in civil engineering offered by the Department of Civil Engineering.

(d) Elective Course(s)

Students are required to take 9 credits of advanced elective course(s) offered by either the Department of Civil Engineering or other department(s) within or outside of the Faculty of Engineering.

(e) University Requirements

(i) Students are required to successfully complete two English language courses to accumulate up to a maximum of 6 credits.

(ii) Students are required to successfully complete one Chinese language course (3 credits)<sup>1</sup>.

(iii) Students are required to successfully complete 12 credits of courses in the Common Core Curriculum, selecting no more than one course from each Area of Inquiry.

(f) Internship

Students are required to successfully complete an Internship (6 credits). The training

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<sup>1</sup> Putonghua-speaking students should take CUND0002 or CUND0003. Students who have not studied Chinese language during their secondary education / who have not attained the requisite level of competence in the Chinese language to take CENG1001 can apply (i) to take credit-bearing Cantonese or Putonghua language courses offered by the School of Chinese especially for international and exchange students; OR (ii) to be exempted from the Chinese language requirement and take an elective course in lieu.

normally takes place after the second year of study.

To complete the curriculum, a candidate is required to gain not fewer than 180 credits from the above listed courses.

### 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.

An example of the programme structure is as follows:

#### (a) First Year

##### General Engineering Courses

Computer programming and applications or Computer programming and applications I	6
Engineering for sustainable development	6
One General Engineering Course from another Department within the Faculty of Engineering	6

Mathematics I or <i>both</i> Mathematics IA and Mathematics IB	6
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##### University Requirements

Practical Chinese language course for engineering students	3
Professional and technical oral communication for engineers	3
Professional and technical written communication for engineers	3
Course in the Common Core Curriculum	6

##### Introductory / Advanced Core Engineering Courses

Engineering mechanics and materials	6
Any two courses from:	
Transportation engineering OR	6
Environmental engineering and fluid mechanics OR	6
Surveying and drawing	6

Total credits	57
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#### (b) Second Year

Course in the Common Core Curriculum	6
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##### Introductory / Advanced Core Engineering Courses

Engineering design and communication	6
Engineering geology and rock mechanics	6
Engineering mathematics II	6
Hydraulics and hydrology	6
Principles of civil engineering management	6
Soil mechanics	6
Theory and design of structures I	6
Theory and design of structures II	6
Any one course from:	
Transportation engineering OR	6

Environmental engineering and fluid mechanics OR	6
Surveying and drawing	6
Total credits	60
Summer Semester	
Internship	6
Total credits	6
(c) Third Year	
<u>Advanced courses</u>	
Civil engineering advanced elective courses	36
Elective course(s)	9
Project	12
Total credits	57

## **COURSE DESCRIPTIONS**

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

### **Level One**

#### **General Engineering Courses**

<b>ENGG1002.</b>	<b>Computer programming and applications (6 credits)</b>
<b>ENGG1003.</b>	<b>Mathematics I (6 credits)</b>
<b>ENGG1004.</b>	<b>Mathematics IA (3 credits)</b>
<b>ENGG1005.</b>	<b>Mathematics IB (3 credit- units)</b>
<b>ENGG1006.</b>	<b>Engineering for sustainable development (6 credits)</b>
<b>ENGG1007</b>	<b>Foundation of computer science (6 credits)</b>
<b>ENGG1009</b>	<b>Industrial management and logistics (6 credits)</b>
<b>ENGG1011</b>	<b>Introduction to biomedical engineering (6 credits)</b>
<b>ENGG1015</b>	<b>Introduction to electrical and electronic engineering (6 credits)</b>
<b>ENGG1018</b>	<b>Introduction to Mechanical Engineering (6 credits)</b>
<b>ENGG1016.</b>	<b>Computer programming and applications I (6 credits)</b>

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

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

**CAES1505. Professional and technical written communication for engineers (3 credits)**

The focus of this course is the function and importance of professional and technical communication in English and specifically understanding and using written English. Topics include accessing, abstracting, analysing, organizing and summarizing information; making

effective grammatical and lexical choices; technical report writing; small-scale project design and implementation.

Assessment: 100% Continuous assessment

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**CAES1515. Professional and technical oral communication for engineers (3 credits)**

**CENG1001. Practical Chinese language course for engineering students (3 credits)**

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

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### **University Common Core Curriculum**

12 credits of courses in the University Common Core Curriculum, selecting no more than one course from each Area of Inquiry:

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

**CIVL1012. Environmental engineering and fluid mechanics (6 credits)**

Man and the environment; water quality, resources and treatment; wastewater characteristics and treatment; solid waste, air and noise pollution control; environmental impact assessment; flow measurements; dimensional analysis and scale models; flow of an ideal fluid; flow in pipes.

Assessment: 20% practical work, 80% examination

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**CIVL1013. Engineering mechanics and materials (6 credits)**

Engineering Mechanics: Bending moment, shear and axial force diagrams; Beam theory for bending and shear; shear centre; deflections of beams; analysis of stress and strain; energy methods.

Materials: Major applications and required properties of construction materials; structural steel; concrete pulverized fuel ash; fibre-reinforced cementitious materials; brickwork and masonry; timber; bituminous materials. Crystalline structure; elastic and plastic deformations; phase diagrams; alloying; material forming and heat treatment; corrosion.

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

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**CIVL1014. Surveying and drawing (6 credits)**

Engineering drawing; fundamental geometrical projections; general civil engineering drawings; detailing for reinforced concrete and steel structures.

Basic principles of plane surveying; differential and trigonometrical levelling; distance and angle measurements; tachometry; horizontal control; traverse; triangulation and trilateration; theory of errors; network adjustment.

Assessment: 100% Continuous assessment

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### **Advanced Core Engineering Courses**

#### **CIVL1010. Theory and design of structures I (6 credits)**

Statically determinate structures; beams and frames; trusses; elementary arch and cable analysis; masonry structures; influence lines; deflection of simple structures.

Structural forms and concepts; philosophy of design; loading; codes of practice; design of simple sections and members.

Prerequisite: CIVL1013 Engineering mechanics and materials

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

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#### **CIVL1011. Transportation engineering (6 credits)**

Transportation and its context; basic characteristics of different transportation modes; urban transportation planning and land use/transportation studies; highway alignment and geometric design; transportation surveys.

Assessment: 20% Continuous assessment, 80% examination

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### **Level Two**

### **Advanced Core Engineering Courses**

#### **CIVL2001. Engineering design and communication (6 credits)**

Planning and design of civil engineering projects; open-ended schematic design of multi-disciplinary projects; project appraisal and feasibility study; environmental impact assessment; project implementation.

Communication and presentation of information related to project work.

Assessment: 100% Continuous assessment

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#### **CIVL2002. Engineering geology and rock mechanics (6 credits)**

Minerals and rocks; introduction to stratigraphy; structural geology; earthquakes; surface processes; groundwater; geological maps; geology of Hong Kong; stereonet; rock slopes; behaviour and properties of rocks as an engineering material; rock discontinuities; rock stresses; failure of rock and strength theory; tunnels and underground excavations in rocks; rock foundation; rock testing techniques; applications of rock mechanics in engineering practice; fieldwork and case studies.

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

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**CIVL2003. Engineering mathematics II (6 credits)**

Complex variables; Fourier analysis & partial differential equations; introduction to probability & statistics.

Prerequisite: ENGG1003 Mathematics I or both ENGG1004 Mathematics IA and ENGG1005 Mathematics IB

Assessment: 20% Continuous assessment, 80% examination

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**CIVL2004. Hydraulics and hydrology (6 credits)**

Governing equations of motion; laminar and turbulent flow; boundary layer theory; flow in open channels; hydraulic machinery; basic concepts of the hydrological cycle; precipitation; evaporation and evapo-transpiration; infiltration; methods of estimating runoff; probability concepts in hydrology.

Pre-requisite: CIVL1012 Environmental engineering and fluid mechanics

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

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**CIVL2006. Soil mechanics (6 credits)**

Basic characteristics of soils; soil classification; seepage; effective stress; soil compaction; soil testing techniques; consolidation theory and settlement analysis; shear strength and failure criteria; applications of soil mechanics in engineering practice: lateral pressures and retaining structures, bearing capacity of foundations, slopes and embankments.

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

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**CIVL2007. Theory and design of structures II (6 credits)**

Method of consistent deformation, slope-deflection method, and moment distribution method for indeterminate structures.

RC short columns, bending moment and shear force envelopes, RC continuous one-way slabs, concept of T-beams, and reinforcement curtailment. Steel flexural members (lateral torsional buckling), tension members and compression members.

Prerequisite: CIVL1010 Theory and design of structures I

Assessment: 30% Continuous assessment, 70% examination

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**CIVL2008. Principles of civil engineering management (6 credits)\***

Engineers in society; organization of firm and site; engineering economics; site planning; estimating; human resources management; project management; basic legal systems and contracts; dispute resolution techniques; quality management; safety management; general planning and control systems.

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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### **Internship**

#### **CIVL2009. Internship (6 credits)**

To complete a period of training in industry not less than a total of four weeks during the summer semester, subject to satisfactory performance in training and the submission of a satisfactory training report.

Assessment: 100% Continuous assessment

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### **Advanced Elective Course**

#### **CIVL2010 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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### **Level Three**

#### **Advanced Core Engineering Course**

#### **CIVL3013. Project (12 credits)**

A dissertation or report on a topic consisting of design, experimental or analytical investigation.

Assessment: 100% Continuous assessment

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### **Advanced Elective Courses in Civil Engineering**

#### **CIVL3001. Advanced engineering mechanics (6 credits)**

Three-dimensional analysis of stress and strain; examples in two- and three-dimensional problems; equilibrium and principle of virtual work; linear system and matrix methods; finite element procedure and formulation; plane stress/strain triangular elements; triangular element for heat conduction and steady state field problems.

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3003. Construction project management (6 credits)**

Construction planning and programming methods; critical paths and resource scheduling; work study and productivity; financial planning and control; cash flow management; civil engineering contracts and contract administration; managing design and other consultancy services; value management; ethics and professionalism.

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3006. Engineering hydraulics (6 credits)**

Non-uniform open channel flow; gradually & rapidly varied flow, applications to hydraulic structures & storm water drainage design; hydraulics of alluvial channels; turbulent mixing and transport.

Prerequisite: CIVL2004 Hydraulics and hydrology

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

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**CIVL3007. Environmental impact assessment of civil engineering projects (6 credits)**

Environmental protection legislation; environmental impact assessment process; environmental impact prediction and evaluation during construction and operation of projects; mitigation measures; modelling; environmental monitoring and auditing; environmental management issues; case studies.

Prerequisite: CIVL1012 Environmental engineering and fluid mechanics

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3008. Foundation engineering (6 credits)**

Ground investigation; bearing capacity, shallow and deep foundations, foundation settlements; foundation failure and remediation; case studies.

Prerequisite: CIVL2006 Soil mechanics

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3010. Management and communication skills for engineers (3 credits)**

Leadership; team building; problem solving and decision making; verbal communication; business development skills; interviews and business writing.

Assessment: 100% Continuous assessment

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**CIVL3011. Municipal and industrial wastewater treatment (6 credits)**

Municipal wastewater flows and characteristics; sewerage systems; municipal wastewater treatment; industrial wastewater characteristics; physical, chemical and biological treatment of industrial wastewater.

Prerequisite: CIVL1012 Environmental engineering and fluid mechanics  
Assessment: 20% practical work, 80% examination

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**CIVL3012. Prestressed concrete structures (6 credits)**

Fundamental principles of prestressing; materials and systems for prestressed concrete; loss of prestress; design of simple and composite beams; secondary moment; concordant cable; linear transformation; design and construction of concrete bridges.

Prerequisite: CIVL2007 Theory and design of structures II  
Assessment: 30% Continuous assessment, 70% examination

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**CIVL3014. Slope engineering (6 credits)**

Landslide hazards, slope stability analyses; landslide investigation; uncertainties in slope stability analysis; landslip preventive measures; case studies.

Prerequisite: CIVL2002 Engineering geology and rock mechanics and CIVL2006 Soil mechanics  
Assessment: 20% Continuous assessment, 80% examination

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**CIVL3015. Solid and hazardous waste management (6 credits)**

Sources, control, characteristics, collection, transport, recovery, treatment and disposal of solid and hazardous wastes.

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3016. Steel structures (6 credits)**

Plastic analysis, design of steel structures, design of composite structures.

Prerequisite: CIVL2007 Theory and design of structures II  
Assessment: 20% Continuous assessment, 80% examination

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**CIVL3018. Theory and design of structures III (6 credits)**

Matrix method; differential settlements; temperature; shrinkage and other effects; torsion structures; stability.

Design of reinforced concrete structures: building frames, shearwalls and water retaining structures.

Prerequisite: CIVL2007 Theory and design of structures II  
Assessment: 30% Continuous assessment, 70% examination

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**CIVL3019. Traffic engineering (6 credits)**

Highway traffic system; characteristics of traffic; theories of traffic flow; traffic surveys; traffic management; intersections and interchanges; design of signal systems.

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3020. Transportation infrastructure engineering (6 credits)**

This course will serve as an introduction to the theory and practice of transportation infrastructure planning and design. Topics may vary from year to year but will usually include highway engineering, railway engineering and airport engineering.

Prerequisite: CIVL1011 Transportation engineering

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3021. Water resources engineering (6 credits)**

Sources of water; collection and treatment; transmission and distribution; wastewater collection, treatment and disposal; water related disasters; hydropower; irrigation; case studies.

Prerequisite: CIVL1012 Environmental engineering and fluid mechanics

Assessment: 20% practical work, 80% examination

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**CIVL3022. Wind engineering (6 credits)**

Wind characteristics; topographical effects on wind patterns; wind flow around buildings and structures; wind loading.

Assessment: 20% Continuous assessment, 80% examination

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**CIVL3025. Law for civil engineers (6 credits)**

Introduction to legal system; local & PRC legislation and regulations; contractual rights; obligations and remedies; law of tort; company law; land law; litigation; dispute resolution approaches; evidence; insurance law.

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3026. Engineering practice in Mainland China (6 credits)**

Engineering code of practice and work procedure; site investigation; foundation design and construction; loading and structural design practice; introduction to seismic design; design of bridges and highway structures; acceptance criteria; site supervision system.

Prerequisite: CENG1001 Practical Chinese language course for engineering students or CENG1004 Practical Chinese language course for civil engineering (law) students or CUND0002 Practical Chinese language and Hong Kong society and CIVL2007 Theory and

design of structures II

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3027. Professional practice in the built environment (6 credits)**

Statutory control of building safety, health and environment in Hong Kong; buildings ordinance and regulations; general and structural planning of buildings; professional communication skills, conduct, responsibility, liability, risk and indemnity.

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3028. Structural dynamics and earthquake engineering (6 credits)**

Earthquake hazard and ground shaking, site (soil) effects, seismic design spectra, earthquake loadings, dynamic earthquake response, design codes, performance-based design, vibration control.

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3029. Numerical analysis in geotechnical engineering (6 credits)**

Introduction to finite difference and finite element methods; general numerical considerations for geotechnical problems; elementary constitutive models for soils; application to one-dimensional consolidation, seepage and excavation problems.

Prerequisite: CIVL2006 Soil mechanics

Assessment: 35% Continuous assessment, 65% examination

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**CIVL3030. Structural fire engineering (6 credits)**

Fire behaviour, fire curve, fire development, fire safety, fire type, design principles for structures in fire, prescriptive and performance-based approaches, materials behaviour in fire condition, temperature prediction of fire compartment, temperature prediction of steel, concrete and composites members, design of steel and reinforced concrete structures in fire, practical design case study.

Prerequisite: CIVL2007 Theory and design of structures II

Assessment: 30% Continuous assessment, 70% examination

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**CIVL3031. Earth retaining system (6 credits)**

Lateral earth pressure; retaining walls, braced-cut; anchors, soil nails and rock bolts; reinforced earth structure; basement.

Assessment: 30% Continuous assessment, 70% examination

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### **CIVL3032. Geotechnical testing, instrumentation and monitoring (6 credits)**

Single and multistage triaxial tests; principles of common laboratory transducers; basic instrument response; sampling and digitization; observational method; field instrumentation and construction monitoring; case histories.

Prerequisite: CIVL2006 Soil mechanics

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

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### **CIVL3033. Ground improvement (6 credits)**

Ground modification techniques; deep compaction and vibro-compaction; vertical drains and electro-osmosis; grouting; soil and rock anchors; soil reinforcement; embankments; control of ground water.

Prerequisite: CIVL2006 Soil mechanics

Assessment: 20% Continuous assessment, 80% examination

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### **CIVL3034. Environmental Geotechnology (6 credits)**

Introduction to environmental geotechnology; municipal waste management; environmental site assessment; contaminant transport in the subsurface; interactions between chemicals and geomaterials; hazardous waste remediation technologies.

Prerequisite: CIVL2006 Soil mechanics

Assessment: 30% Continuous assessment, 70% examination

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For the double degree in BEng/BBA, students may take business elective courses in Finance, HRM or Marketing major offered by the Faculty of Business and Economics to satisfy up to a maximum of 12 credits of Civil Engineering elective courses.

### **Advanced Elective Course**

#### **Elective Course (9 credits)**

Students are expected to select 9 credits of Advanced courses offered by either the Department of Civil Engineering or other department(s) within or outside of the Faculty of Engineering.

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### **Minor Programmes (not applicable to candidates from the Department of Civil Engineering)**

In the 2011-12 academic year, candidates from other departments in the Faculty of Engineering or from other faculties may pursue a Minor in Environmental Engineering or Minor in Geotechnical Engineering.

#### **Minor in Environmental Engineering**

Candidates are required to complete a total of 36 credits of courses comprising:

(a) Introductory courses (12 credits)

Students are required to complete ENGG1006 Engineering for sustainable development\* (6 credits) AND CIVL1012 Environmental engineering and fluid mechanics (6 credits).

\* Students opting for the Minor cannot use the course ENGG1006 Engineering for sustainable development as satisfying the requirements of the General Engineering Course.

(b) Advanced Elective courses (24 credits)

Students must complete 24 credits of advanced elective courses to be chosen from the following list:

CIVL2004 Hydraulics and hydrology (6 credits)  
CIVL3006 Engineering hydraulics (6 credits)  
CIVL3007 Environmental impact assessment of civil engineering projects (6 credits)  
CIVL3011 Municipal and industrial wastewater treatment (6 credits)  
CIVL3015 Solid and hazardous waste management (6 credits)  
CIVL3021 Water resources engineering (6 credits)  
CIVL3022 Wind engineering (6 credits)

### **Minor in Geotechnical Engineering**

Candidates are required to complete a total of 36 credits of courses comprising:

(a) Introductory courses (12 credits)

Students are required to complete ENGG1003 Mathematics I (6 credits) AND CIVL2006 Soil Mechanics (6 credits).

(b) Advanced Elective courses (24 credits)

Students must complete 24 credits of advanced elective courses to be chosen from the following list:

CIVL2002 Engineering geology and rock mechanics (6 credits)  
CIVL3008 Foundation engineering (6 credits)  
CIVL3014 Slope engineering (6 credits)  
CIVL3029 Numerical analysis in geotechnical engineering (6 credits)  
CIVL3031 Earth retaining system (6 credits)  
CIVL3032 Geotechnical testing, instrumentation and monitoring (6 credits)  
CIVL3033 Ground improvement (6 credits)  
CIVL3034 Environmental Geotechnology (6 credits)

### **Double-Degrees in BEng/BBA Option**

Candidates pursuing studies for the double-degrees in BEng/BBA are required to satisfy all the requirements of the above BEng curriculum and pass 54 credits of courses as listed below:

<b>Course Code</b>	<b>Course</b>	<b>Credits</b>
BUSI1002	Introduction to accounting	6
BUSI1003	Introduction to management information system	6
BUSI1004	Marketing	6

BUSI1007	Principles of management	6
ECON1001	Introduction to economics I	6
FINA1003	Corporate finance	6
BUSI0027	Management accounting I	6
	Business Electives (Any 2 courses in Finance, HRM or Marketing major)	12
	<b>Total</b>	<b>54</b>

Candidates pursuing the double-degrees in BEng/BBA are granted exemptions from the following courses:

<b>Courses in the BEng curriculum to be exempted</b>	<b>Business courses to be completed</b>
CAES1505 Professional and technical written communication for engineers (3 credits)	CAES1907 Business communication (3 credits)
CIVL2008 Principles of civil engineering management (6 credits)	BUSI1007 Principles of management
One Advanced Elective Course in Civil Engineering (6 credits)	BUSI1003 Introduction to management information system or other equivalent Business course as approved by the Department of Civil Engineering and the Faculty
One Advanced Elective Course (6 credits)	One 6-credit Business Elective course