

MSC(ENG) IN CIVIL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2022-23 and thereafter)

Terminology

Discipline course – a list of courses in the discipline within the curriculum which a candidate must pass at least a certain number of credits as specified in the regulations.

Stream specific course – course within a subject group which corresponds to the specialisation of the stream of study.

Elective course – any taught postgraduate level course offered by the Departments of the Faculty of Engineering.

Curriculum Structure

Candidates are required to complete 72 credits of courses as set out below, normally over one academic year of full-time study or two academic years of part-time study:

| Course Category | General Stream | Environmental Engineering Stream Geotechnical Engineering Stream Structural Engineering Stream |
|---------------------|--|--|
| | No of credits | |
| Discipline Courses | Not less than 36 (from Groups A to D) | Not less than 36 [Include at least 24 credits in Stream Specific Courses in the corresponding stream of study from Groups B to D] |
| Elective Courses | Not more than 12 | Not more than 12 |
| Capstone Experience | | 24 |
| Total | | 72 |

Course selection

Candidates should select courses in accordance with the regulations of the degree. Candidates must complete 8 courses plus a dissertation (Capstone Experience).

For the General Stream, candidate can choose any discipline courses listed below in subject groups A to D, and undertake a dissertation in any area in civil engineering.

For the General Stream, students are not allowed to take more than four construction management related courses from Group A.

To qualify as a graduate of Environmental Engineering, Geotechnical Engineering or Structural Engineering Stream, candidates must pass at least 4 stream specific courses (at least 24 credits in total) in the corresponding subject group, and successfully complete a dissertation in the area of the corresponding stream.

Subject Groups

A. General

| | |
|----------|--|
| CIVL6007 | Behavioural travel demand modelling |
| CIVL6014 | Construction dispute resolution [#] |
| CIVL6015 | Construction financial management [#] |
| CIVL6037 | Project management – human and organisational factors [#] |
| CIVL6046 | Theory of traffic flow |
| CIVL6047 | Traffic management and control |
| CIVL6049 | Urban development management by engineering approach [#] |
| CIVL6054 | Engineering for transport systems |
| CIVL6058 | Management of infrastructure megaprojects [#] |
| CIVL7005 | Sustainable construction technology: principles and practices [#] |
| CIVL7006 | Optimization techniques for transportation applications |
| CIVL7007 | Building information modelling (BIM): Theories, development and application [#] |

Students should not take more than four construction management courses (as shown in pound #).

Any courses from Group B to Group D

B. Environmental Engineering

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|----------|---|
| CIVL6005 | Data analysis in hydrology |
| CIVL6006 | Advanced water and wastewater treatment |
| CIVL6023 | Environmental chemistry |
| CIVL6025 | Environmental impact assessment of engineering projects |
| CIVL6029 | Groundwater hydrology |
| CIVL6034 | Municipal wastewater treatment |
| CIVL6040 | Solid and hazardous waste management engineering |
| CIVL6050 | Urban hydrology and hydraulics |
| CIVL6053 | Wind engineering |
| CIVL6061 | Special topic in environmental engineering A |
| CIVL6062 | Special topic in environmental engineering B |
| CIVL6081 | Recent advances in water and environmental engineering |
| MEBS6004 | Built environment |
| MEBS6010 | Indoor air quality |
| MECH6017 | Noise and vibration |
| MECH6019 | Sources and control of air pollution |

C. Geotechnical Engineering

| | |
|----------|---|
| CIVL6004 | Advanced soil mechanics |
| CIVL6025 | Environmental impact assessment of engineering projects |
| CIVL6026 | Finite element method |
| CIVL6027 | Foundation engineering |
| CIVL6028 | Ground improvement |
| CIVL6035 | Highway pavement engineering |
| CIVL6043 | Special topic in geotechnical engineering A |
| CIVL6044 | Special topic in geotechnical engineering B |
| CIVL6077 | Ground investigation and soil testing |
| CIVL6078 | Rock mechanics and rock engineering |
| CIVL6079 | Slope engineering |
| CIVL6083 | Practical design and construction of tunnels in Hong Kong |
| CIVL7002 | Geotechnical analysis and case histories |
| CIVL7010 | Advanced engineering geology |

D. Structural Engineering

| | |
|----------|---|
| CIVL6003 | Advanced reinforced concrete structure design |
| CIVL6008 | Bridge engineering |
| CIVL6013 | Concrete technology |
| CIVL6025 | Environmental impact assessment of engineering projects |
| CIVL6026 | Finite element method |
| CIVL6027 | Foundation engineering |
| CIVL6045 | Tall building structures |
| CIVL6053 | Wind engineering |
| CIVL6063 | Special topic in structural engineering A |
| CIVL6064 | Special topic in structural engineering B |
| CIVL6080 | Fire engineering design of structures |
| CIVL7003 | Space structures |
| CIVL7008 | Seismic analysis for building structures |

Candidates may select no more than 2 courses (at most 12 credits in total) offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Programme Director and Course Coordinators concerned.

The following is a list of the discipline courses offered by the Department of Civil Engineering for the MSc(Eng) in Civil Engineering curriculum. The list below is not final and some courses may not be offered every year.

All courses are assessed through examination and/or coursework assessment, the weightings of which are subject to approval by the Board of Examiners. The coursework:examination ratio for courses ranged from 15:85 to 50:50.

CIVL7009 Dissertation (24 credits)

On admission to the curriculum, students will undertake a supervised dissertation which will be assessed. The dissertation must relate to the subject matter and be agreed by the

Department of Civil Engineering. The progress of the dissertation work will be assessed according to a timeframe set by the Department of Civil Engineering for submission of the following:

- (a) a tentative title, an outline and an inception report on the dissertation,
- (b) a written report on the preliminary findings of the dissertation, and
- (c) a draft dissertation and the final version of dissertation.

Failure to satisfy the examiners in the dissertation milestones specified by the Department of Civil Engineering shall be considered as unsatisfactory performance or progress.

Students also have to attend some supporting courses, such as visits, seminars and workshops (on report writing, professional ethics and safety...etc). Assessment will be based on completion of quizzes of the workshops; attendance and summary reports for the visits and/or seminars.

The final assessment of the dissertation shall be by an oral presentation AND a dissertation. Students are REQUIRED to give an oral presentation on the findings of their dissertation in the form of a seminar at a time agreed by the Department of Civil Engineering prior to the submission of the dissertation. Failure in the oral presentation may lead to a failure in the dissertation as a whole.

CIVL6003 Advanced reinforced concrete structure design (6 credits)

Flexural, shear and torsional behaviours of reinforced concrete members; yield line theory; strut and tie theory; ductile design of reinforced concrete beams and columns; design of high-strength concrete members.

CIVL6004 Advanced soil mechanics (6 credits)

Soil behaviour; stresses and strains in soil masses; stress path; soil deformation and consolidation theory; soil strength and failure criteria of soils; soil modelling techniques; laboratory testing applications.

CIVL6005 Data analysis in hydrology (6 credits)

Time series analysis; hydrological forecasting; artificial neural networks in hydrology; chaos in hydrological time series.

CIVL6006 Advanced water and wastewater treatment (6 credits)

Water/wastewater characteristics and standards; coagulation/flocculation; sedimentation and filtration; membrane separation; adsorption; chemical oxidation; disinfection; biological removal of organic pollutants and nutrient.

CIVL6007 Behavioural travel demand modelling * (6 credits)

Demand theory; statistical models; survey methods in transport; land use transportation models; disaggregate choice models; behavioural concepts in choice modeling.

CIVL6008 Bridge engineering (6 credits)

Choice of structural systems; construction materials; construction methods; loading on bridges; structural analysis of bridges; bridge substructures; bridge parapets, bearings and movement joints.

CIVL6013 Concrete technology (6 credits)

Concrete mixes; quality control; in-situ strength assessment; non-destructive testing; cracks and other defects; maintenance and repair.

CIVL6014 Construction dispute resolution (6 credits)

Introduction to disputes, claims and methods of dispute avoidance and resolution in construction; mediation; arbitration: fundamental principles, arbitration agreement, arbitration rules, appointment of arbitrators, power and duties of arbitrators, pre-hearing proceedings, hearing, award, role of the court; other ADR (alternative dispute resolution) methods; litigation.

CIVL6015 Construction financial management * (6 credits)

Estimating and costing; tendering strategy; productivity analysis; financial accounting; financial management; management accounting; taxation effects.

CIVL6023 Environmental chemistry (6 credits)

Water chemistry; microbial biochemistry; water pollution and treatment; soil chemistry; hazardous wastes; environmental chemical analyses.

CIVL6025 Environmental impact assessment of engineering projects (6 credits)

Environmental impact assessment process; methodologies to assess environmental impacts on water, air, and land; environmental management; case studies, e.g. on transportation projects, environmental control facilities and reclamation works.

CIVL6026 Finite element method (6 credits)

Elasticity; calculus of variation; energy methods; shape functions; two and three-dimensional problems; linear elasticity problems; field problems.

CIVL6027 Foundation engineering (6 credits)

Introduction to foundation engineering; shallow foundations; bearing capacity; stress distribution and settlements; deep foundations; pile installation and construction control; pile load tests; inspection of deep foundations; foundation on slopes.

CIVL6028 Ground improvement (6 credits)

Some principal ground improvement techniques for both granular and soft deposits, viz. surcharging with and without vertical drains, deep mixing methods, dynamic compaction and vibration, stone columns, grouting, geosynthetics and reinforced soil techniques, soil nailing and other novel schemes; principles and design considerations through worked examples and case studies; techniques of obtaining relevant soil parameters for design and the verification methods.

CIVL6029 Groundwater hydrology (6 credits)

Principle of groundwater flow, flow equations and modeling. Flow to wells, groundwater monitoring, contamination and remediation. Special topics such as surface water groundwater interactions and sea water intrusion.

CIVL6034 Municipal wastewater treatment (6 credits)

Municipal wastewater flows and characteristics; sewerage systems; preliminary, primary and secondary treatment processes; wastewater disinfection; advanced treatment for nutrient removal; sludge processing and disposal.

CIVL6035 Highway pavement engineering (6 credits)

Traffic loading; subgrade properties; soil stabilization; bituminous materials; flexible pavement design; rigid pavement design; pavement maintenance and upgrading; pavement

management systems.

CIVL6037 Project management - human and organisational factors * (6 credits)

Management theories; organisations structures and cultures; project management and project teams; leadership; ethics; communication; negotiations; recruitment; engineers in the society.

CIVL6040 Solid and hazardous waste management engineering (6 credits)

Resource use in modern society; sources, characteristics, and quantities of waste; environmental impact; waste prevention, reduction, and recycling; collection, transfer and transport; mechanical, biological, chemical and thermal processing; final disposal; case studies.

CIVL6043 Special topic in geotechnical engineering A (6 credits)

This course provides an opportunity for students to study in-depth an area of geotechnical engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6044 Special topic in geotechnical engineering B (6 credits)

This course provides an opportunity for students to study in-depth an area of geotechnical engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6045 Tall building structures (6 credits)

Coupled shear/core walls; coupling effects of beams and slabs; finite element analysis of building structures; wall-frame interaction; framed-tube structures; tube-in-tube structures; outrigger braced structures; shear lag effects in core walls.

CIVL6046 Theory of traffic flow * (6 credits)

Measurements and statistical distributions of traffic characteristics; traffic stream models; car-following theories; hydrodynamic theory of traffic flow; traffic queues and delays.

CIVL6047 Traffic management and control * (6 credits)

Transportation networks; network equilibrium concepts; estimation of origin-destination matrix; traffic management measures; traffic control techniques.

CIVL6049 Urban development management by engineering approach (6 credits)

Urban development process, introductory town planning; transport modelling; integration of infrastructure and service planning; optimisation and risk management; integration of planning and implementation of engineering works; urban development; project management; principles of building control; integration of theory and practice; case studies.

CIVL6050 Urban hydrology and hydraulics (6 credits)

Rainfall-runoff; hydrograph prediction; unsteady flow, flood routing; culvert hydraulics; flood control structures; stormwater management; storage concepts; river restoration; case studies.

CIVL6053 Wind engineering (6 credits)

Statistical description of wind, parent and extreme wind data, wind profiles, wind effects on buildings and structures, wind pressures, quasi-steady approach, wind-induced vibration, dampers, codification of dynamic effects, wind effects on building ventilation, pedestrian-level wind environment, wind effects on pollutant dispersion, wind tunnel techniques.

CIVL6054 Engineering for transport systems * (6 credits)

Engineering appreciation of the transport systems; transport infrastructure development; choice of transportation systems; fixed track systems; application of technology in transport.

CIVL6058 Management of infrastructure megaprojects (6 credits)

Public Works financing; Public-Private-Partnerships (PPPs) including BOT-type developments; selecting appropriate procurement frameworks; multi-party contractual links; co-ordinating large work packages; interface management; JVs and cross-cultural issues; risk management; decision analysis; value management.

CIVL6061 Special topic in environmental engineering A (6 credits)

This course provides an opportunity for students to study in-depth an area of environmental engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6062 Special topic in environmental engineering B (6 credits)

This course provides an opportunity for students to study in-depth an area of environmental engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6063 Special topic in structural engineering A (6 credits)

This course provides an opportunity for students to study in-depth an area of structural engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6064 Special topic in structural engineering B (6 credits)

This course provides an opportunity for students to study in-depth an area of structural engineering of interest to students and staff alike. The topic will be announced in the beginning of the semester when the course is offered.

CIVL6077 Ground investigation and soil testing (6 credits)

Need for ground investigation; planning and procedures of ground investigation; drilling and sampling methods; *in-situ* tests; geophysics; soil and rock classification systems; geological modelling; ground investigation contract; supervision and statutory control of ground investigation works; groundwater measurement and hydrogeology; field instrumentation techniques; observational method in civil engineering; laboratory soil tests; stress-path and its applications.

CIVL6078 Rock mechanics and rock engineering (6 credits)

Rock mass classification; rock mass strength and deformability as a function of structural defects such as joints; faults and bedding planes; in-situ rock stresses and their measurement; ground water percolation in rock; underground excavations and rock support system design; rock slope stability analysis; rock foundations; case histories in rock engineering; numerical methods; rock joint strength parameters; rockfall control.

CIVL6079 Slope engineering (6 credits)

Slope engineering in Hong Kong; geological models for slopes; slope stability analysis methods; landslide investigation; soil nailing; slope stabilization measures; surface drainage and protection; slope construction and monitoring; slope safety management and

maintenance; natural terrain study.

CIVL6080 Fire engineering design of structures (6 credits)

Fire behaviour, fire safety, design principles for structures in fire, prescriptive and performance-based approach, fire load and standard fire test, temperature prediction of compartment, temperature prediction of steel and reinforced concrete members, behaviour of concrete material under elevated temperature, design of steel, reinforced concrete and composite structures in fire, practical structural fire design.

CIVL6081 Recent advances in water and environmental engineering (6 credits)

Environmental hydraulics, fluid mechanics, hydrology, environmental microbiology, water chemistry, water and wastewater treatment technologies.

CIVL6083 Practical design and construction of tunnels in Hong Kong (6 credits)

Introduction to tunneling; shallow tunnels; deep tunnels; stress distribution and settlements around underground opening; site investigation requirements; analysis and design of underground opening; ground convergence support reaction curves, soil structure interaction; construction methods; control of groundwater; construction monitoring; risk management and construction contract.

CIVL7002 Geotechnical analysis and case histories (6 credits)

Reviewing basics of finite difference and finite element techniques; common soil constitutive models; numerical modelling in geotechnical construction; potentials and limitations of modelling; analytical solutions in geotechnics; lesson learnt from case histories.

CIVL7003 Space structures (6 credits)

Design considerations for planar frames; double layer grids; barrel vaults, braced domes; geodesic domes; cable structures; membrane structures; expandable and foldable systems; joint systems; construction methods, optimisation techniques and stability checks.

CIVL7005 Sustainable construction technology: principles and practices (6 credits)

This course provides in-depth knowledge of technology in the context of sustainable construction, with the syllabus covering concepts of sustainable construction; systems theories;

technological innovation theories; types of technology and their applications; technology selection and management strategy.

CIVL7006 Optimization techniques for transportation applications (6 credits)

Linear programming, nonlinear programming, network optimization, and integer optimization methods for solving transportation problems.

CIVL7007 Building information modelling (BIM): Theories, development and application (6 credits)

This course is designed to equip students with the basic concept of BIM, its history in Hong Kong, the value to project management, the best practice and the way to apply BIM in infrastructure and construction projects.

CIVL7008 Seismic analysis for building structures (6 credits)

Structural dynamics; vibration of single-degree-of-freedom systems; vibration of multiple-degree-of-freedom systems; base-shear method; response spectrum analysis; coefficient-based method; Seismic drift demand and capacity.

CIVL7010 Advanced engineering geology (6 credits)

Hard rock geology and geological structures; the sedimentary system; geological controls of engineering works; engineering geology of Hong Kong rocks and soils; earth surface processes; weathering and ground profiles; unsaturated soils; problematic soils; aquifers and source protection zones; desk studies and applied geophysics; ground models.

MEBS6004 Built environment (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Building Services Engineering curriculum.

MEBS6010 Indoor air quality (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Building Services Engineering curriculum.

MECH6017 Noise and vibration (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Mechanical Engineering curriculum.

MECH6019 Sources and control of air pollution (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Mechanical Engineering curriculum.

* Approved for reimbursement from the Continuing Education Fund (CEF).
