REGULATIONS FOR THE DEGREES OF
MASTER OF SCIENCE IN ENGINEERING (MSc[Eng])
MASTER OF SCIENCE IN COMPUTER SCIENCE (MSc[CompSc]), AND
MASTER OF SCIENCE IN ELECTRONIC COMMERCE AND INTERNET COMPUTING
(MSc[ECom&IComp])

(Applicable to students admitted in the academic year 2018-19 and thereafter)

(See also General Regulations and Regulations for Taught Postgraduate Curricula)

The degrees of MSc(Eng), MSc(CompSc) and MSc(ECom&IComp) are each a postgraduate degree awarded for the satisfactory completion of a prescribed curriculum in the Faculty of Engineering.

For the MSc(Eng) degree, the major part of the curriculum must include courses offered in one of the following fields: building services engineering, electrical and electronic engineering, energy engineering, environmental engineering, geotechnical engineering, industrial engineering and logistics management, infrastructure project management, mechanical engineering, structural engineering, and transportation engineering.

The MSc(Eng), MSc(CompSc) and MSc(ECom&IComp) curricula are offered in part-time and full-time modes.

MSc1 Admission requirements

To be eligible for admission to the curriculum leading to the degree of MSc(Eng) / MSc(CompSc) / MSc(ECom&IComp), a candidate shall:

(a) comply with the General Regulations;
(b) comply with the Regulations for Taught Postgraduate Curricula;
(c) hold (i) a Bachelor's degree of this University in a relevant field; or
(ii) a relevant qualification of equivalent standard from this University or from another university or comparable institution accepted for this purpose; and
(d) satisfy the examiners in a qualifying examination if required.

MSc2 Qualifying Examination

(a) A qualifying examination may be set to test the candidate's academic ability or his/her ability to follow the curriculum prescribed. It shall consist of one or more written papers or their equivalent and may include a dissertation.
(b) A candidate who is required to satisfy the examiners in a qualifying examination shall not be permitted to register until he/she has satisfied the examiners in the examination.

MSc3 Period of Study

The curriculum of the degree of MSc(Eng)/MSc(CompSc)/MSc(ECom&IComp) shall normally extend over one academic year of full-time study or two academic years of part-time study. Candidates shall not be permitted to extend their studies beyond the maximum period of registration of two academic years of full-time study or three academic years of part-time study, unless otherwise permitted or required by the Board of Faculty. For both full-time and part-time modes, the period of study shall include any assessment to be held during and/or at the end of each semester.

MSc4 Curriculum Requirements

To complete the curriculum, a candidate shall, within the prescribed maximum period of registration stipulated in Regulation MSc3 above:

(a) satisfy the requirements prescribed in TPG6 of the Regulations for Taught Postgraduate Curricula;

(b) take not fewer than 72 credits of courses, in the manner specified in these regulations and syllabuses and pass all courses as specified in the syllabuses;

(c) follow courses of instruction and complete satisfactorily all prescribed practical / laboratory work; and

(d) satisfy the examiners in all forms of assessment as may be required in either

(i) 72 credits of courses which must include a dissertation of 24 credits or a project of 12 credits as capstone experience; or

(ii) at least 60 credits of courses successfully completed at this University (which must include a dissertation of 24 credits or a project of 12 credits) and not more than 12 credits of courses successfully completed at this or another university before admission to the MSc(Eng) / MSc(CompSc) / MSc(ECom&IComp) and approved by the Board of the Faculty.

MSc5 Dissertation or project report

(a) A candidate who is permitted to select a dissertation or a project is required to submit the dissertation or the project report by a date specified by the Board of Examiners.

(b) All candidates shall submit a statement that the dissertation or the project report represents his/her own work undertaken after the registration as a candidate for the degree.

MSc6 Selection of Courses

(a) A candidate shall select courses according to the guidelines stipulated in the syllabuses for the degree of MSc(Eng)/MSc(CompSc)/MSc(ECom&IComp).

(b) Selection of study patterns, as stipulated in the respective syllabus, shall be subject to the approval of the Head of the Department concerned.

(c) Candidates shall select their courses in accordance with these regulations and the guidelines specified in the syllabuses before the beginning of each academic year.

(d) Changes to the selection of courses may be made only during the add/drop period of the semester in which the course begins, and such changes shall not be reflected in the transcript of the candidate.

(e) Subject to the approval of the Committee on Taught Postgraduate Curricula on the recommendation of the Head of the Department concerned, a candidate may in exceptional circumstances be permitted to select additional course(s).

(f) Requests for changes after the designated add/drop period of the semester shall be subject to the approval of the Committee on Taught Postgraduate Curricula. Withdrawal from courses beyond the designated add/drop period will be subject to the approval of the Committee on Taught Postgraduate Curricula.

MSc7 Assessment

(a) The written examination for each course shall be held after the completion of the prescribed course of study for that course, and not later than January, May or August immediately following the completion of the course of study for that course unless otherwise specified in the syllabuses.

(b) A candidate, who is unable to complete the requirements within the prescribed maximum period of registration specified in Regulation MSc3 because of illness or circumstances beyond his/her control, may apply for permission to extend his/her period of studies.

(c) A candidate who has failed to satisfy the examiners in any course(s) is required to make up for failed course(s) in the following manners:
   (i) undergoing re-assessment/re-examination in the failed course(s); or
   (ii) repeating the failed course(s) by undergoing instruction and satisfying the assessments; or
   (iii) taking another course in lieu and satisfying the assessment requirements.

(d) A candidate who has failed to satisfy the examiners in his/her dissertation or project report may be required to submit or resubmit a dissertation or a project report on the same subject within a period specified by the Board of Examiners.

(e) In accordance with G9(h) of the General Regulation and TPG8(d) of the Regulations for Taught Postgraduate Curricula, there shall be no appeal against the results of examinations and all other forms of assessment.

MSc8 Grading system

Individual courses shall be graded according to the following grading system as determined by the Board of Examiners:

Standard	Grade	Grade Point
Excellent	A+	4.3
	A	4.0
	A-	3.7
Good	B+	3.3
	B	3.0
	B-	2.7
Satisfactory	C+	2.3
	C	2.0
	C-	1.7
Pass	D+	1.3
	D	1.0
Fail	F	0

MSc9 Discontinuation of Studies

Unless otherwise permitted by the Board of the Faculty, a candidate will be recommended for discontinuation of their studies in accordance with General Regulation G12 if he/she has:

(a) failed to pass 12 credits in an academic year; or

(b) failed to satisfy the examiners at a second attempt in his/her dissertation or project report within the specified period; or

(c) failed to achieve a cumulative grade point average* (CGPA) of 1.0 or higher for two consecutive semesters with course enrolment; or

(d) exceeded the maximum period of registration specified in Regulation MSc3.

** At the end of each semester, a cumulative grade point average (CGPA) for all courses, except cross-listed undergraduate courses and outside curriculum requirement optional courses as specified in the syllabuses, taken by a student (including failed courses) at the time of calculation is computed.*

MSc10 Advanced Standing

Advanced standing may be granted to candidates in recognition of studies completed successfully before admission to the curriculum in accordance with TPG3 of the Regulations for Taught Postgraduate Curricula. Candidates who are awarded Advanced Standing will not be granted any further credit transfer for those studies for which Advanced Standing has been granted. The amount of credits to be granted for Advanced Standing shall be determined by the Board of the Faculty, in accordance with the following principles:

(a) a candidate may be granted a total of not more than 20% of the total credits normally required under a curriculum for Advanced Stranding unless otherwise approved by the Senate; and

(b) credits granted for advanced standing shall not be included in the calculation of the GPA but will be recorded on the transcript of the candidate.

MSc11 Award of Degree

To be eligible for the award of the degree of MSc(Eng) / MSc(CompSc) / MSc(ECom&IComp), a candidate shall:

(a) comply with the General Regulations and the Regulations for Taught Postgraduate Curricula;

(b) complete the curriculum and satisfy the examiners in accordance with the regulations set out; and

(c) achieve a cumulative grade point average (CGPA) of 1.0 or higher

---

MSc12 Assessment results

On successful completion of the curriculum, candidates who have shown exceptional merit of achieving a cumulative grade point average (CGPA) of 3.6 or higher may be awarded a mark of distinction, and this mark shall be recorded on the candidates' degree diploma.

SYLLABUS FOR THE DEGREE OF
MASTER OF SCIENCE IN ENGINEERING
(MSc[Eng])

MSC(ENG) IN BUILDING SERVICES ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2017-18 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Building Services Engineering that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	No. of Credits
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience	24
Total	72

The curriculum provides advanced postgraduate education in the fields of design, management and operation of modern building services engineering systems to practising engineers or related professionals who wish to acquire new knowledge and keep abreast of technical developments in the building services industry.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete i) 8 courses, including at least 3 courses from List A, and ii) a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Course Coordinators.

The following is a list of discipline courses offered by the Department of Mechanical Engineering. 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.

List A discipline courses

MEBS6000 Utility services (6 credits)

Cold and hot water supply: water distribution systems, patterns of usage, estimation of requirements, simultaneous demand, storage capacity, pumping arrangements, calorifiers and water heaters; steam systems: low and high pressure systems, boilers and heat exchangers, steam supply piping and condensate return, insulation, steam trapping; drainage systems and sewage disposal: stormwater and sanitary drainage systems, rainfall intensity, simultaneous sanitary discharge, sizing of drains and sewers, methods of sewage disposal, primary and secondary treatments; security system planning and design; security devices.

MEBS6001 Electrical installations (6 credits)

This course covers the following topics: Supply rules, standards and codes of practice; types of electrical systems; distribution in buildings; factory built assemblies; protective devices and safety interlocks; overcurrent and fault protection; installation design principles; protective earthing and equipotential bonding arrangements; standby generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; lightning protection.

MEBS6002 Lighting engineering (6 credits)

Lighting physics; vision and light measurements; human perception; photometry and spectrophotometry; colorimetry; calculations of photometric data; glare control; guidelines for lighting design. Light production; artificial light sources and luminaires; daylighting; daylight factor; split flux formula; optical control; interior lighting; maintained illuminance; uniformity; colour rendering; utilization factors; polar curves; vector/scalar ratio; lighting for safety; lighting for workplaces; floodlighting; illuminance as vector; illuminance in complex situations.

MEBS6003 Project management (6 credits)

Tendering procedure, contract documents and contract strategy, insurance; project planning, scheduling and control. Management and organization theory and practice; human resources development: motivation; leadership, organization structures, quality management; safety management; environmental issues; communication; disputes; delay analysis.

MEBS7012 Air conditioning and refrigeration (6 credits)

Advanced pyschrometry, thermal comfort, load estimation and energy calculation, air conditioning cycles, air conditioning systems: all-air systems, air-water systems, all-water systems; refrigeration: vapour compression cycle, absorption cycle, heat pump cycle; heat rejection: air-cooling, evaporative cooling, cooling tower; ventilation: fresh air requirement, air contamination, fume and dust removal.

Students who have taken and passed MEBS6006 will not be allowed to take MEBS7012.

MEBS7013 Fire service installations (6 credits)

Fire detection and alarm systems; water-based fire extinguishing systems: automatic sprinkler systems, fire hydrant and hose reel systems, drencher systems; gas-based fire extinguishing systems: CO2 and clean agent systems; special fire extinguishing systems; portable fire extinguishers; means of fire escape; fire resisting construction; statutory regulations governing fire services installations: BS Standards, LPC rules, NFPA codes and local codes of practice; installation, acceptance testing and commissioning.

Students who have taken and passed MEBS6009 or MEBS6021 will not be allowed to take MEBS7013.

List B discipline courses

MEBS6004 Built environment (6 credits)

External environment: human factors, climatology; internal design criteria; thermal environment (heat): insulation for energy conservation, heat transmission, e.g. solar contribution; visual environment (light): eye and vision, light production, levels of illumination; aural environment (sound or noise): noise criteria for buildings, sources of noise and vibration, noise and vibration control; functional requirement of buildings.

MEBS6005 Building automation systems (6 credits)

Principles of building automation systems: objectives and functions; system configurations; central processor and outstations; transducers, sensors and actuators; distributed processing and intelligence; network architecture; hardware and software. Control fundamentals: Laplace and Z transforms, direct digital PID control; control valve performance Microprocessor and electronics fundamentals: architecture of microprocessor systems; digital-to-analog and analog-to-digital conversions; data sampling. Open systems and interoperability: LonWorks; BACnet; IIOT. Implementation and future development: commissioning; maintenance; integration; building emulator; future development trends.

MEBS6010 Indoor air quality (6 credits)

Concept of indoor air quality, health requirements, sick building syndrome, building related illnesses, indoor air quality indicators, types, sources, characterization and heath effects of pollutants, concentration, individual and population exposure, dose-response relationships, measurement and monitoring methods, ventilation, filtration, indoor air quality assessment and control, operation and maintenance, legislation and public policy issues, energy and cost implications.

MEBS6011 Maintenance and management of building facilities (6 credits)

Areas of facilities management; security of facilities; strategies and philosophies of maintenance; optimum control and operation; fault detection and analysis; building pathology; energy management; safety and environmental maintenance. Operational techniques in maintenance: decision making techniques; spares inventory control; resource management; computerized maintenance; measures of maintenance effectiveness. Plant availability, maintainability and reliability.

MEBS6013 Testing and commissioning (6 credits)

The commissioning process: design provisions, specification, documentation, planning and management, contractual responsibilities; setting to work; measurement methods: fundamentals, instrumentation, calibration, methodology, sources of error; commissioning tests on electrical and mechanical plants; balancing of fluid networks; performance testing; post construction evaluation.

MEBS6014 Computer modelling and simulation (6 credits)

Mathematical modelling: modelling of systems; subsystems and components, deterministic and stochastic modelling, steady-state and dynamic modelling, model format, accuracy and validation, applications to thermofluid systems for design, performance evaluation and economic analysis.

Computer simulation: computer implementation of simulation models, simulation methods by successive substitution and Newton-Raphson approach for univariate and multivariate problems, steady-state simulations for system analysis at off-design conditions, dynamic simulations for transient analysis, techniques for simulation of large systems and use of modular computer simulation packages.

MEBS6015 Natural and hybrid ventilation of buildings (6 credits)

Concepts of natural ventilation and hybrid ventilation, mixed-mode air conditioning, purposes of natural ventilation, driving forces, natural ventilation strategies for simple and complex buildings, design methods and guidelines, wind tunnel and small-scale testing, design processes and life-cycle analyses.

MEBS6016 Energy performance of buildings (6 credits)

Energy terms and concepts; energy use in buildings; energy efficient building design and operation; energy efficient technologies; building energy standards and codes; building energy analysis techniques; energy auditing of buildings; economic and financial analyses.

MEBS6017 Building intelligence (6 credits)

Fundamental concepts of intelligent building systems; whole building intelligence; evaluation of building intelligence; needs of occupants, cost effectiveness, economic benefits; engineering intelligence into buildings; information technology; building energy management and control systems; intelligent building design; intelligent controls; expert systems, artificial neural networks, genetic algorithms, fuzzy logic; potential and direction of future developments.

MEBS6018 Clean electrical energy and smart-grids for buildings (6 credits)

Smart-grid and micro-grid models for communities; clean energy sources for smart-grids, disturbance, noise and pollution in smart-grids; power quality regeneration: power conditioning and uninterruptible power supply; interconnection of smart-grids; smart meter management; power factor correction and tariff consideration; building energy codes; lightning protection.

Students who have taken and passed ELEC6095 will not be allowed to take MEBS6018.

MEBS6019 Extra-low-voltage electrical systems in buildings (6 credits)

This course focuses on extra-low-voltage electrical systems: roles, transmission medium and network, modeling, fixed and movable systems; types. Applications in building services: electrical safety; public address system, communication, cable and satellite television, conference and interpretive system, audio and visual system; service integration and automation; system monitoring. Applications in property management: fire and life-saving management equipment, electronic patrol, car park management, efficiency management, CCTV, security system, access and security control, electronic receptionist. Disturbance; electromagnetic interference and protective measures.

MEBS6020 Sustainable building design (6 credits)

Sustainable building concepts; energy and environmental design; green building assessment methods; sustainable masterplanning; analysis methods for sustainable building projects; practical examples.

MEBS7010 Vertical transportation and drive (6 credits)

Types of vertical transportation systems: lifts, escalators and passenger conveyors; their construction and features of lifts and lift-wells. Mechanical drives of systems: traction, hydraulic, and single/double-wrap. Electrical drives of systems: alternating current versus direct current. Illumination, power and ventilation requirement. Potential hazards and safety management. Prevention of overload and overspeed. Special systems: fireman lift, service lift, stairlift, fireman lift, observation lift, inclined lift, multi-deck lift, public-service escalator, parabolic escalator, and gondola. Traffic calculation and simulation model. Remote monitoring and protocols. Control and adaptive algorithm. Layout of multiple-lift and multiple-escalator. Energy management. Examination, certification and notification.

MEBS7011 Communication technology in building services (6 credits)

Analogue and digital signal encoding; signal transmission systems in buildings; baseband vs broadband; topologies, LAN/MAN/WAN; OSI model, TCP/IP model; wireline and wireless networks; PSTN; key lines, PABX, VoIP; ISDN, DSL, cable modems, FTTH; ISP, voice/data/video convergence; structured cablings; coordination with architects and structural engineers.

MEBS7014 Advanced HVAC applications (6 credits)

Fans and pumps: types and characteristics, parallel and series operation, system effects; complex fluid network analysis: graphical and iterative methods of solution, application to air and water systems and analysis of building air infiltration; room air diffusion: design strategies, application of computational fluid dynamics; sea water cooling systems: design and operation, water treatment; thermal storage systems: applications, system design and economic analysis; acoustic treatment and vibration isolation: basic principles, need for control, types and methods of control.

Students who have taken and passed MEBS6008 will not be allowed to take MEBS7014.

MEBS7015 Fire science and smoke control (6 credits)

Characteristics and behavior of fire; compartment fire: heat release rate, pre-flashover, flashover, post-flashover phases; fire hazards of materials and buildings; means of fire escape; smoke control: active

and passive smoke extraction, staircase pressurization, smoke venting, atrium smoke control; statutory regulations governing smoke control installations: BS Standards, NFPA codes and local codes of practice; installation, acceptance testing and commissioning.

Students who have taken and passed MEBS6009 or MEBS6022 will not be allowed to take MEBS7015.

MECH7012 Principles of engineering management (6 credits)

The focus of this course is on the basic principles, methods, and functions of engineering management. An overview of systems engineering is provided, with coverage on the design and management of an enterprise as an integrated system. The course objectives are: (1) acquire the essential principles of engineering management and understand how to apply these principles in daily practice in industry; and (2) understand and apply methods for managing the operations of engineering companies in the global business environment.

Topics include: systems engineering; core concepts and tools for the management of operations: operations planning and control functions, ERP systems; contemporary topics and approaches in engineering management: supply chain, green management, ethics, corporate social responsibility and compliance, risk and crisis management.

Capstone Experience course

MEBS6023 Dissertation (24 credits)

It involves undertaking a practical design or research project which integrates the students' knowledge acquired during the course of studies in the MSc curriculum. The project is closely industrial related to the design or analysis of building services systems and it allows students to conduct in-depth review and appreciation of the system performances through technical and economic analysis, analytical investigation, and evaluation for optimal design solutions. The project is group based but with substantial individual student contribution.

The objectives are to: (1) simulate a realistic working environment for students so that they can integrate what they have learnt into a real life work problem; (2) allow students to apply engineering principles, design skills, engineering economics and project management in the delivery of practical and optimized solutions for realistic project works; (3) train students to work in groups while contributing their abilities independently; (4) demonstrate an ability to have in-depth analytical investigation or evaluation for industrial related or research type problems.

Pre-requisite: Students must have taken and passed TWO of following courses before taking this course: MESB6000, MEBS6001, MEBS6002, MEBS6019, MEBS7012, MEBS7013. A co-requisite arrangement may be allowed for full-time students who enroll in this course in their Year 1 of studies.

MSC(ENG) IN BUILDING SERVICES ENGINEERING
(Applicable to students admitted to the curriculum in the academic year 2016-17)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Building Services Engineering that are not classified as discipline courses.

Capstone Experience# – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	No. of Credits
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience#	24
Total	72

The curriculum provides advanced postgraduate education in the fields of design, management and operation of modern building services engineering systems to practising engineers or related professionals who wish to acquire new knowledge and keep abreast of technical developments in the building services industry.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses, including at least 3 courses from List A, and a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Course Coordinators.

The following is a list of discipline courses offered by the Department of Building Services Engineering. 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.

 # Special approval has been given by the Senate for candidates admitted to the part-time mode of the curriculum in the academic year 2016-17 to take additional discipline courses of the same credit value in lieu of the capstone experience to satisfy the curriculum requirements.

List A discipline courses

MEBS6000 Utility services (6 credits)

Cold and hot water supply: water distribution systems, patterns of usage, estimation of requirements, simultaneous demand, storage capacity, pumping arrangements, calorifiers and water heaters; steam systems: low and high pressure systems, boilers and heat exchangers, steam supply piping and condensate return, insulation, steam trapping; drainage systems and sewage disposal: stormwater and sanitary drainage systems, rainfall intensity, simultaneous sanitary discharge, sizing of drains and sewers, methods of sewage disposal, primary and secondary treatments; security system planning and design; security devices.

MEBS6001 Electrical installations (6 credits)

This course covers the following topics: Supply rules, standards and codes of practice; types of electrical systems; distribution in buildings; factory built assemblies; protective devices and safety interlocks; overcurrent and fault protection; installation design principles; protective earthing and equipotential bonding arrangements; standby generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; lightning protection.

MEBS6003 Project management (6 credits)

Tendering procedure, contract documents and contract strategy, insurance; project planning, scheduling and control. Management and organization theory and practice; human resources development: motivation; leadership, organization structures, quality management; safety management; environmental issues; communication; disputes; delay analysis.

MEBS6006 Environmental services I (6 credits)

Different forms of energy supply to buildings: electricity, fuel oil, solar; heating and cooling systems: pyschrometry, thermal comfort, heating and cooling load estimation, boilers, furnaces and other heating devices, associated equipment including piping, ducting work; refrigeration; air conditioning and ventilation: fresh air requirement, air contamination, fume and dust removal, air conditioning system design, control devices.

MEBS6008 Environmental services II (6 credits)

Fans and pumps: types and characteristics, parallel and series operation, system effects; complex fluid network analysis: graphical and iterative methods of solution, application to air and water systems and analysis of building air infiltration; room air diffusion: design strategies, application of computational fluid dynamics; sea water cooling systems: design and operation, water treatment; thermal storage systems: applications, system design and economic analysis; acoustic treatment and vibration isolation: basic principles, need for control, types and methods of control.

MEBS6021 Fire services design I (6 credits)

Fire detection and alarm systems; water-based fire extinguishing systems: automatic sprinkler systems, fire hydrant and hose reel systems, drencher systems; gas-based fire extinguishing

systems: CO2 and clean agent systems; special fire extinguishing systems; portable fire extinguishers; means of fire escape; statutory regulations governing fire services installations: LPC rules, NFPA codes and local Codes of Practice; installation and commissioning; maintenance requirements.

Students who have taken and passed MEBS6009 will not be allowed to take MEBS6021.

MEBS6022 Fire services design II (6 credits)

Characteristics and behavior of fire; fire hazards of materials and buildings; fire hazards of building services and processes; means of fire escape; smoke control; staircase pressurization; smoke vents; statutory regulations governing fire services installations: LPC rules, NFPA codes and local Codes of Practice; installation and commissioning; maintenance requirements.

Students who have taken and passed MEBS6009 will not be allowed to take MEBS6022.

MEBS7012 Air conditioning and refrigeration (6 credits)

Advanced pyschrometry, thermal comfort, load estimation and energy calculation, air conditioning cycles, air conditioning systems: all-air systems, air-water systems, all-water systems; refrigeration: vapour compression cycle, absorption cycle, heat pump cycle; heat rejection: air-cooling, evaporative cooling, cooling tower; ventilation: fresh air requirement, air contamination, fume and dust removal.

Students who have taken and passed MEBS6006 will not be allowed to take MEBS7012.

MEBS7013 Fire service installations (6 credits)

Fire detection and alarm systems; water-based fire extinguishing systems: automatic sprinkler systems, fire hydrant and hose reel systems, drencher systems; gas-based fire extinguishing systems: CO2 and clean agent systems; special fire extinguishing systems; portable fire extinguishers; means of fire escape; fire resisting construction; statutory regulations governing fire services installations: BS Standards, LPC rules, NFPA codes and local codes of practice; installation, acceptance testing and commissioning.

Students who have taken and passed MEBS6009 or MEBS6021 will not be allowed to take MEBS7013.

List B discipline courses

MEBS6002 Lighting engineering (6 credits)

Lighting physics; vision and light measurements; human perception; photometry and spectrophotometry; colorimetry; calculations of photometric data; glare control; guidelines for lighting design. Light production; artificial light sources and luminaires; daylighting; daylight factor; split flux formula; optical control; interior lighting; maintained illuminance; uniformity; colour rendering; utilization factors; polar curves; vector/scalar ratio; lighting for safety; lighting for workplaces; floodlighting; illuminance as vector; illuminance in complex situations.

MEBS6002 is listed under List A discipline courses if students take the course in the academic year 2017-18 and thereafter.

MEBS6004 Built environment (6 credits)

External environment: human factors, climatology; internal design criteria; thermal environment (heat): insulation for energy conservation, heat transmission, e.g. solar contribution; visual environment (light): eye and vision, light production, levels of illumination; aural environment (sound or noise): noise criteria for buildings, sources of noise and vibration, noise and vibration control; functional requirement of buildings.

MEBS6005 Building automation systems (6 credits)

Principles of building automation systems: objectives and functions; system configurations; central processor and outstations; transducers, sensors and actuators; distributed processing and intelligence; network architecture; hardware and software. Control fundamentals: Laplace and Z transforms, direct digital PID control; control valve performance Microprocessor and electronics fundamentals: architecture of microprocessor systems; digital-to-analog and analog-to-digital conversions; data sampling. Open systems and interoperability: LonWorks; BACnet; IIOT. Implementation and future development: commissioning; maintenance; integration; building emulator; future development trends.

MEBS6010 Indoor air quality (6 credits)

Concept of indoor air quality, health requirements, sick building syndrome, building related illnesses, indoor air quality indicators, types, sources, characterization and heath effects of pollutants, concentration, individual and population exposure, dose-response relationships, measurement and monitoring methods, ventilation, filtration, indoor air quality assessment and control, operation and maintenance, legislation and public policy issues, energy and cost implications.

MEBS6011 Maintenance and management of building facilities (6 credits)

Areas of facilities management; security of facilities; strategies and philosophies of maintenance; optimum control and operation; fault detection and analysis; building pathology; energy management; safety and environmental maintenance. Operational techniques in maintenance: decision making techniques; spares inventory control; resource management; computerized maintenance; measures of maintenance effectiveness. Plant availability, maintainability and reliability.

MEBS6013 Testing and commissioning (6 credits)

The commissioning process: design provisions, specification, documentation, planning and management, contractual responsibilities; setting to work; measurement methods: fundamentals, instrumentation, calibration, methodology, sources of error; commissioning tests on electrical and mechanical plants; balancing of fluid networks; performance testing; post construction evaluation.

MEBS6014 Computer modelling and simulation (6 credits)

Mathematical modelling: modelling of systems; subsystems and components, deterministic and stochastic modelling, steady-state and dynamic modelling, model format, accuracy and validation, applications to thermofluid systems for design, performance evaluation and economic analysis.

Computer simulation: computer implementation of simulation models, simulation methods by successive substitution and Newton-Raphson approach for univariate and multivariate problems, steady-state

simulations for system analysis at off-design conditions, dynamic simulations for transient analysis, techniques for simulation of large systems and use of modular computer simulation packages.

MEBS6015 Natural and hybrid ventilation of buildings (6 credits)

Concepts of natural ventilation and hybrid ventilation, mixed-mode air conditioning, purposes of natural ventilation, driving forces, natural ventilation strategies for simple and complex buildings, design methods and guidelines, wind tunnel and small-scale testing, design processes and life-cycle analyses.

MEBS6016 Energy performance of buildings (6 credits)

Energy terms and concepts; energy use in buildings; energy efficient building design and operation; energy efficient technologies; building energy standards and codes; building energy analysis techniques; energy auditing of buildings; economic and financial analyses.

MEBS6017 Building intelligence (6 credits)

Fundamental concepts of intelligent building systems; whole building intelligence; evaluation of building intelligence; needs of occupants, cost effectiveness, economic benefits; engineering intelligence into buildings; information technology; building energy management and control systems; intelligent building design; intelligent controls; expert systems, artificial neural networks, genetic algorithms, fuzzy logic; potential and direction of future developments.

MEBS6018 Clean electrical energy and smart-grids for buildings (6 credits)

Smart-grid and micro-grid models for communities; clean energy sources for smart-grids, disturbance, noise and pollution in smart-grids; power quality regeneration: power conditioning and uninterruptible power supply; interconnection of smart-grids; smart meter management; power factor correction and tariff consideration; building energy codes; lightning protection.

Students who have taken and passed ELEC6095 will not be allowed to take MEBS6018.

MEBS6019 Extra-low-voltage electrical systems in buildings (6 credits)

This course focuses on extra-low-voltage electrical systems: roles, transmission medium and network, modeling, fixed and movable systems; types. Applications in building services: electrical safety; public address system, communication, cable and satellite television, conference and interpretive system, audio and visual system; service integration and automation; system monitoring. Applications in property management: fire and life-saving management equipment, electronic patrol, car park management, efficiency management, CCTV, security system, access and security control, electronic receptionist. Disturbance; electromagnetic interference and protective measures.

MEBS6020 Sustainable building design (6 credits)

Sustainable building concepts; energy and environmental design; green building assessment methods; sustainable masterplanning; analysis methods for sustainable building projects; practical examples.

MEBS7010 Vertical transportation and drive (6 credits)

Types of vertical transportation systems: lifts, escalators and passenger conveyors; their construction and features of lifts and lift-wells. Mechanical drives of systems: traction, hydraulic, and single/double-wrap. Electrical drives of systems: alternating current versus direct current. Illumination, power and ventilation requirement. Potential hazards and safety management. Prevention of overload and overspeed. Special systems: fireman lift, service lift, stairlift, fireman lift, observation lift, inclined lift, multi-deck lift, public-service escalator, parabolic escalator, and gondola. Traffic calculation and simulation model. Remote monitoring and protocols. Control and adaptive algorithm. Layout of multiple-lift and multiple- escalator. Energy management. Examination, certification and notification.

MEBS7011 Communication technology in building services (6 credits)

Analogue and digital signal encoding; signal transmission systems in buildings; baseband vs broadband; topologies, LAN/MAN/WAN; OSI model, TCP/IP model; wireline and wireless networks; PSTN; key lines, PABX, VoIP; ISDN, DSL, cable modems, FTTH; ISP, voice/data/video convergence; structured cablings; coordination with architects and structural engineers.

MEBS7014 Advanced HVAC applications (6 credits)

Fans and pumps: types and characteristics, parallel and series operation, system effects; complex fluid network analysis: graphical and iterative methods of solution, application to air and water systems and analysis of building air infiltration; room air diffusion: design strategies, application of computational fluid dynamics; sea water cooling systems: design and operation, water treatment; thermal storage systems: applications, system design and economic analysis; acoustic treatment and vibration isolation: basic principles, need for control, types and methods of control.

Students who have taken and passed MEBS6008 will not be allowed to take MEBS7014.

MEBS7015 Fire science and smoke control (6 credits)

Characteristics and behavior of fire; compartment fire: heat release rate, pre-flashover, flashover, post- flashover phases; fire hazards of materials and buildings; means of fire escape; smoke control: active and passive smoke extraction, staircase pressurization, smoke venting, atrium smoke control; statutory regulations governing smoke control installations: BS Standards, NFPA codes and local codes of practice; installation, acceptance testing and commissioning.

Students who have taken and passed MEBS6009 or MEBS6022 will not be allowed to take MEBS7015.

MECH7012 Principles of engineering management (6 credits)

The focus of this course is on the basic principles, methods, and functions of engineering management. An overview of systems engineering is provided, with coverage on the design and management of an enterprise as an integrated system. The course objectives are: (1) acquire the essential principles of engineering management and understand how to apply these principles in daily practice in industry; and (2) understand and apply methods for managing the operations of engineering companies in the global business environment.

Topics include: systems engineering; core concepts and tools for the management of operations: operations planning and control functions, ERP systems; contemporary topics and approaches in engineering management: supply chain, green management, ethics, corporate social responsibility and compliance, risk and crisis management.

MECH7012 is listed under List B discipline courses if students take the course in the academic year 2017-18 and thereafter. Otherwise MECH7012 is considered as an elective course.

Capstone Experience course[#]

MEBS6023 Dissertation (24 credits)

It involves undertaking a dissertation or report on a topic consisting of design, experimental or analytical investigation by individual students.

The objectives are to: (1) simulate a realistic working experience for students; (2) provide them an experience of applying engineering principles, engineering economics, business or management skills; and (3) train students to work independently to obtain an effective and acceptable solution to industry- related or research-type problems.

 # Special approval has been given by the Senate for candidates admitted to the part-time mode of the curriculum in the academic year 2016-17 to take additional discipline courses of the same credit value in lieu of the capstone experience to satisfy the curriculum requirements.

MSC(ENG) IN BUILDING SERVICES ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2015-16)

Objectives

The aim of the curriculum is to provide advanced postgraduate education in the fields of design, management and operation of modern building services engineering systems to practising engineers or related professionals who wish to acquire new knowledge and keep abreast of technical developments in the building services industry.

Modes of Study

There are two modes of study available: full-time or part-time. The full-time curriculum requires a student to satisfactorily complete 8 modules and a dissertation within a study period of 1 to 2 years. For the students enrolled in the part-time curriculum, they may opt to either satisfactorily complete 12 modules or 8 modules plus a dissertation within a study period of 2 to 3 years.

Study Modules

The following study modules are the discipline modules of the curriculum. A number of these discipline modules will be selected for offer to students in each academic year. A student who does not undertake a dissertation must complete at least 9 discipline modules (of which at least 3 from List A). A student who undertakes a dissertation must complete at least 5 discipline modules (of which at least 3 from List A). Students can select Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives.

The following list is not final and some modules may not be offered every year.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

List A discipline modules

MEBS6000 Utility services

Cold and hot water supply: water distribution systems, patterns of usage, estimation of requirements, simultaneous demand, storage capacity, pumping arrangements, calorifiers and water heaters; steam systems: low and high pressure systems, boilers and heat exchangers, steam supply piping and condensate return, insulation, steam trapping; drainage systems and sewage disposal: stormwater and sanitary drainage systems, rainfall intensity, simultaneous sanitary discharge, sizing of drains and sewers, methods of sewage disposal, primary and secondary treatments; security system planning and design; security devices.

MEBS6001 Electrical installations

This module covers the following topics: Supply rules, standards and codes of practice; types of electrical systems; distribution in buildings; factory built assemblies; protective devices and safety interlocks; overcurrent and fault protection; installation design principles; protective earthing and equipotential bonding arrangements; standby generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; lightning protection.

MEBS6003 Project management

Tendering procedure, contract documents and contract strategy, insurance; project planning, scheduling and control. Management and organization theory and practice; human resources development: motivation; leadership, organization structures, quality management; safety management; environmental issues; communication; disputes; delay analysis.

MEBS6006 Environmental services I

Different forms of energy supply to buildings: electricity, fuel oil, solar; heating and cooling systems: pyschrometry, thermal comfort, heating and cooling load estimation, boilers, furnaces and other heating devices, associated equipment including piping, ducting work; refrigeration; air conditioning and ventilation: fresh air requirement, air contamination, fume and dust removal, air conditioning system design, control devices.

MEBS6008 Environmental services II

Fans and pumps: types and characteristics, parallel and series operation, system effects; complex fluid network analysis: graphical and iterative methods of solution, application to air and water systems and analysis of building air infiltration; room air diffusion: design strategies, application of computational fluid dynamics; sea water cooling systems: design and operation, water treatment; thermal storage systems: applications, system design and economic analysis; acoustic treatment and vibration isolation: basic principles, need for control, types and methods of control.

MEBS6021 Fire services design I

Fire detection and alarm systems; water-based fire extinguishing systems: automatic sprinkler systems, fire hydrant and hose reel systems, drencher systems; gas-based fire extinguishing systems: CO2 and clean agent systems; special fire extinguishing systems; portable fire extinguishers; means of fire escape; statutory regulations governing fire services installations: LPC rules, NFPA codes and local Codes of Practice; installation and commissioning; maintenance requirements.

Students who have taken and passed MEBS6009 will not be allowed to take MEBS6021.

MEBS6022 Fire services design II

Characteristics and behavior of fire; fire hazards of materials and buildings; fire hazards of building services and processes; means of fire escape; smoke control; staircase pressurization; smoke vents; statutory regulations governing fire services installations: LPC rules, NFPA codes and local Codes of Practice; installation and commissioning; maintenance requirements.

Students who have taken and passed MEBS6009 will not be allowed to take MEBS6022.

MEBS7012 Air conditioning and refrigeration

Advanced pyschrometry, thermal comfort, load estimation and energy calculation, air conditioning cycles, air conditioning systems: all-air systems, air-water systems, all-water systems; refrigeration: vapour compression cycle, absorption cycle, heat pump cycle; heat rejection: air-cooling, evaporative cooling, cooling tower; ventilation: fresh air requirement, air contamination, fume and dust removal. Students who have taken and passed MEBS6006 will not be allowed to take MEBS7012.

MEBS7013 Fire service installations

Fire detection and alarm systems; water-based fire extinguishing systems: automatic sprinkler systems, fire hydrant and hose reel systems, drencher systems; gas-based fire extinguishing systems: CO2 and clean agent systems; special fire extinguishing systems; portable fire extinguishers; means of fire escape; fire resisting construction; statutory regulations governing fire services installations: BS Standards, LPC rules, NFPA codes and local codes of practice; installation, acceptance testing and commissioning.

Students who have taken and passed MEBS6009 or MEBS6021 will not be allowed to take MEBS7013.

List B discipline modules

MEBS6002 Lighting engineering

Lighting physics; vision and light measurements; human perception; photometry and spectrophotometry; colorimetry; calculations of photometric data; glare control; guidelines for lighting design. Light production; artificial light sources and luminaires; daylighting; daylight factor; split flux formula; optical control; interior lighting; maintained illuminance; uniformity; colour rendering; utilization factors; polar curves; vector/scalar ratio; lighting for safety; lighting for workplaces; floodlighting; illuminance as vector; illuminance in complex situations.

MEBS6002 is listed under List A discipline modules if students take the module in the academic year 2017-18 and thereafter.

MEBS6004 Built environment

External environment: human factors, climatology; internal design criteria; thermal environment (heat): insulation for energy conservation, heat transmission, e.g. solar contribution; visual environment (light): eye and vision, light production, levels of illumination; aural environment (sound or noise): noise criteria for buildings, sources of noise and vibration, noise and vibration control; functional requirement of buildings.

MEBS6005 Building automation systems

Principles of building automation systems: objectives and functions; system configurations; central processor and outstations; transducers, sensors and actuators; distributed processing and intelligence; network architecture; hardware and software. Control fundamentals: Laplace and Z transforms, direct digital PID control; control valve performance Microprocessor and electronics fundamentals: architecture of microprocessor systems; digital-to-analog and analog-to-digital conversions; data sampling. Open systems and interoperability: LonWorks; BACnet; IIOT. Implementation and future development: commissioning; maintenance; integration; building emulator; future development trends.

MEBS6010 Indoor air quality

Concept of indoor air quality, health requirements, sick building syndrome, building related illnesses, indoor air quality indicators, types, sources, characterization and heath effects of pollutants, concentration, individual and population exposure, dose-response relationships, measurement and monitoring methods, ventilation, filtration, indoor air quality assessment and control, operation and maintenance, legislation and public policy issues, energy and cost implications.

MEBS6011 Maintenance and management of building facilities

Areas of facilities management; security of facilities; strategies and philosophies of maintenance; optimum control and operation; fault detection and analysis; building pathology; energy management; safety and environmental maintenance. Operational techniques in maintenance: decision making techniques; spares inventory control; resource management; computerized maintenance; measures of maintenance effectiveness. Plant availability, maintainability and reliability.

MEBS6013 Testing and commissioning

The commissioning process: design provisions, specification, documentation, planning and management, contractual responsibilities; setting to work; measurement methods: fundamentals, instrumentation, calibration, methodology, sources of error; commissioning tests on electrical and mechanical plants; balancing of fluid networks; performance testing; post construction evaluation.

MEBS6014 Computer modelling and simulation

Mathematical modelling: modelling of systems; subsystems and components, deterministic and stochastic modelling, steady-state and dynamic modelling, model format, accuracy and validation, applications to thermofluid systems for design, performance evaluation and economic analysis.

Computer simulation: computer implementation of simulation models, simulation methods by successive substitution and Newton-Raphson approach for univariate and multivariate problems, steady-state simulations for system analysis at off-design conditions, dynamic simulations for transient analysis, techniques for simulation of large systems and use of modular computer simulation packages.

MEBS6015 Natural and hybrid ventilation of buildings

Concepts of natural ventilation and hybrid ventilation, mixed-mode air conditioning, purposes of natural ventilation, driving forces, natural ventilation strategies for simple and complex buildings, design methods and guidelines, wind tunnel and small-scale testing, design processes and life-cycle analyses.

MEBS6016 Energy performance of buildings

Energy terms and concepts; energy use in buildings; energy efficient building design and operation; energy efficient technologies; building energy standards and codes; building energy analysis techniques; energy auditing of buildings; economic and financial analyses.

MEBS6017 Building intelligence

Fundamental concepts of intelligent building systems; whole building intelligence; evaluation of building intelligence; needs of occupants, cost effectiveness, economic benefits; engineering intelligence into buildings; information technology; building energy management and control systems; intelligent building design; intelligent controls; expert systems, artificial neural networks, genetic algorithms, fuzzy logic; potential and direction of future developments.

MEBS6018 Clean electrical energy and smart-grids for buildings

Smart-grid and micro-grid models for communities; clean energy sources for smart-grids, disturbance, noise and pollution in smart-grids; power quality regeneration: power conditioning and uninterruptible power supply; interconnection of smart-grids; smart meter management; power factor correction and tariff consideration; building energy codes; lightning protection.

Students who have taken and passed ELEC6095 will not be allowed to take MEBS6018.

MEBS6019 Extra-low-voltage electrical systems in buildings

This module focuses on extra-low-voltage electrical systems: roles, transmission medium and network, modeling, fixed and movable systems; types. Applications in building services: electrical safety; public address system, communication, cable and satellite television, conference and interpretive system, audio and visual system; service integration and automation; system monitoring. Applications in property management: fire and life-saving management equipment, electronic patrol, car park management, efficiency management, CCTV, security system, access and security control, electronic receptionist. Disturbance; electromagnetic interference and protective measures.

MEBS6020 Sustainable building design

Sustainable building concepts; energy and environmental design; green building assessment methods; sustainable masterplanning; analysis methods for sustainable building projects; practical examples.

MEBS6023 Dissertation (4 modules)

It involves undertaking a dissertation or report on a topic consisting of design, experimental or analytical investigation by individual students.

The objectives are to: (1) simulate a realistic working experience for students; (2) provide them an experience of applying engineering principles, engineering economics, business or management skills; and (3) train students to work independently to obtain an effective and acceptable solution to industry- related or research-type problems.

MEBS7010 Vertical transportation and drive

Types of vertical transportation systems: lifts, escalators and passenger conveyors; their construction and features of lifts and lift-wells. Mechanical drives of systems: traction, hydraulic, and single/double-wrap. Electrical drives of systems: alternating current versus direct current. Illumination, power and ventilation requirement. Potential hazards and safety management. Prevention of overload and overspeed. Special systems: fireman lift, service lift, stairlift, fireman lift, observation lift, inclined lift, multi-deck lift, public-service escalator, parabolic escalator, and gondola. Traffic calculation and simulation model. Remote monitoring and protocols. Control and adaptive algorithm. Layout of multiple-lift and multiple-escalator. Energy management. Examination, certification and notification.

MEBS7011 Communication technology in building services

Analogue and digital signal encoding; signal transmission systems in buildings; baseband vs broadband; topologies, LAN/MAN/WAN; OSI model, TCP/IP model; wireline and wireless networks; PSTN; key lines, PABX, VoIP; ISDN, DSL, cable modems, FTTH; ISP, voice/data/video convergence; structured cablings; coordination with architects and structural engineers.

MEBS7014 Advanced HVAC applications

Fans and pumps: types and characteristics, parallel and series operation, system effects; complex fluid network analysis: graphical and iterative methods of solution, application to air and water systems and analysis of building air infiltration; room air diffusion: design strategies, application of computational fluid dynamics; sea water cooling systems: design and operation, water treatment; thermal storage systems: applications, system design and economic analysis; acoustic treatment and vibration isolation: basic principles, need for control, types and methods of control.

Students who have taken and passed MEBS6008 will not be allowed to take MEBS7014.

MEBS7015 Fire science and smoke control

Characteristics and behavior of fire; compartment fire: heat release rate, pre-flashover, flashover, post-flashover phases; fire hazards of materials and buildings; means of fire escape; smoke control:

active and passive smoke extraction, staircase pressurization, smoke venting, atrium smoke control; statutory regulations governing smoke control installations: BS Standards, NFPA codes and local codes of practice; installation, acceptance testing and commissioning.

Students who have taken and passed MEBS6009 or MEBS6022 will not be allowed to take MEBS7015.

MECH7012 Principles of engineering management

The focus of this module is on the basic principles, methods, and functions of engineering management. An overview of systems engineering is provided, with coverage on the design and management of an enterprise as an integrated system. The module objectives are: (1) acquire the essential principles of engineering management and understand how to apply these principles in daily practice in industry; and (2) understand and apply methods for managing the operations of engineering companies in the global business environment.

Topics include: systems engineering; core concepts and tools for the management of operations: operations planning and control functions, ERP systems; contemporary topics and approaches in engineering management: supply chain, green management, ethics, corporate social responsibility and compliance, risk and crisis management.

MECH7012 is listed under List B discipline modules if students take the module in the academic year 2017-18 and thereafter. Otherwise MECH7012 is considered as an elective module.

MSC(ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2019-20 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Electrical and Electronic Engineering that are not classified as discipline courses.

Capstone Experience – a 12-credit project or a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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:

	Enrolment Mode of 10 courses + Project	**Enrolment Mode of 8 courses + Dissertation**
Course Category	**No. of Credits**	**No. of Credits**
Discipline Courses	General stream: not less than 36 credits in Group A, B or C Communication Engineering stream: not less than 36 credits in Group B Communications Engineering Power Engineering stream: not less than 36 credits in Group C Power Engineering	General stream: not less than 30 credits in Group A, B or C Communication Engineering stream: not less than 30 credits in Group B Communications Engineering Power Engineering stream: not less than 30 credits in Group C Power Engineering
Elective Courses	Not more than 24	Not more than 18
Capstone Experience	12	24
Total	72	72

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses plus a dissertation or 10 courses plus a project.. All course selection will be subject to approval by the Course Coordinators.

Candidates are required to follow the prescribed curriculum of one of the three streams: General Stream, Communications Engineering and Power Engineering. The Department also offers an optional course in the Professional Development subject group, namely ELEC7900 Engineering and society, which will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.

The following is a list of discipline courses offered by the Department of Electrical and Electronic Engineering. 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.

Subject Groups

A. General

ELEC6008	Pattern recognition and machine learning
ELEC6027	Integrated circuit systems design
ELEC6036	High performance computer architecture
ELEC6043	Digital image processing
ELEC6049	Digital system design techniques
ELEC6063	Optoelectronics and lightwave technology
ELEC6067	Magnetic resonance imaging (MRI) technology and applications
ELEC6079	Biomedical ultrasound
ELEC6081	Biomedical signals and systems
ELEC6092	Green project management
ELEC6105	Magnetics engineering for data storage and emerging applications
ELEC6601	Industrial marketing
ELEC6602	Business venture in China
ELEC6603	Success in industrial entrepreneurship
ELEC6604	Neural networks, fuzzy systems and genetic algorithms
ELEC7078	Advanced topics in electrical and electronic engineering
ELEC7079	Investment and trading for engineering students
ELEC7080	Algorithmic trading and high frequency trading
ELEC7081	Advanced topics in computational finance
ELEC7082	Artificial intelligence in finance

B. Communications Engineering

ELEC6006	Communications policy and regulations
ELEC6026	Digital signal processing
ELEC6065	Data compression
ELEC6080	Telecommunications systems and management
ELEC6097	IP networks
ELEC6098	Electronic and mobile commerce
ELEC6099	Wireless communications and networking
ELEC6100	Digital communications
ELEC6103	Satellite communications
ELEC7051	Advanced topics in communication theory and systems
ELEC7077	Advanced topics in multimedia signals and systems

C. Power Engineering

ELEC6055	Power system distribution
ELEC6084	Power delivery management for metropolitan cities
ELEC6085	The role of a computerized SCADA system in power system operation
ELEC6095	Smart grid
ELEC7402	Advanced electric vehicle technology
ELEC7403	Advanced power electronics
ELEC7404	Advanced railway engineering
ELEC7456	Advanced power system operation
ELEC7466	Advanced topics in power system engineering
MEBS6001	Electrical installations
MEBS6019	Extra-low-voltage electrical systems in buildings

D. Professional Development

ELEC7900	Engineering and society (This course will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.)

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.

ELEC6006 Communications policy and regulations (6 credits)

This course aims to provide a comprehensive understanding of Communications Policy and Regulations, and latest ICT policy and regulatory practices in the leading markets and economies. It helps students to appreciate the integration of multi-disciplinary knowledge in ICT industry.

The course also covers some advanced policy & regulatory topics in the ICT industry including convergence licensing regime, co-regulation/self-regulation, and consumer protection regulation.

ELEC6008 Pattern recognition and machine learning (6 credits)

This course aims at providing fundamental knowledge on the principles and techniques of pattern recognition and machine learning.

Specifically, the course covers the following topics: Bayes decision theory; parametric and non-parametric methods; linear discriminant functions; unsupervised learning and clustering; feature extraction; neural networks; context-dependent classification; case studies.

Pre-requisite: A good background in linear algebra, programming experience.
Mutually exclusive with: COMP7504 Pattern recognition and applications

---

ELEC6026 Digital signal processing (6 credits)

This course provides an introduction to the fundamental concepts of digital signal processing (DSP) including a wide variety of topics such as discrete-time linear-time invariant systems, sampling theorem, z-transform, discrete-time/discrete Fourier transform, and digital filter design. Furthermore, the course will also discuss in detail about other advanced topics in digital signal processing such as multidimensional signals and systems, random processes and applications, and adaptive signal processing.

ELEC6027 Integrated circuit systems design (6 credits)

This course covers the following topics: IC design route and technology considerations; logic and circuit design with MOS and CMOS: data and control flow in systematic structures; systems design and design methods; computer aids to IC design; application case studies.

ELEC6036 High-performance computer architecture (6 credits)

This course aims at providing an in-depth understanding of the principles, architectures and implementations of modern high performance computer systems which are designed and based on the proactive use of instruction-level parallelism (ILP). Specifically, the course discusses with examples and case studies to investigate the high-performance computing models; pipelining and ILP; advanced pipelining design including the scoreboard and Tomasulo algorithm; speculative execution; advanced computing models such as the cloud computing models and their possible uses in general, scientific or financial applications; and case studies like the Amazon EC2 and Google Cloud platforms.

ELEC6043 Digital image processing (6 credits)

This course deals with the theory, techniques and applications of digital image processing, which includes characterization, enhancement, restoration, feature extraction, representation, description and classification, advance topics in image analysis, image motion, and application case studies.

Specifically, it covers the areas of image acquisition and imaging systems, 2D continuous-time and discrete-time signals and systems, time and frequency representations, sampling and quantization issues, image filtering, convolution and enhancement, image reconstruction and restoration, image quality evaluation, image transform and compression, geometric feature extraction, image representation and description, image analysis, motion and case studies.

Prerequisite: Exposure to signals and systems at the level of ELEC3241

ELEC6049 Digital system design techniques (6 credits)

This course aims to provide a structured approach to digital system design. Fundamental to this is an understanding of the underlying technologies for modern day digital systems and the methods of analysis. Systematic design methodology and computer aids are crucial to tackling systems of increasing complexity. Selected design issues (such as faults, testability) will also be presented where appropriate.

The course begins with an overview of digital technologies, their evolution and the implication on design realization. Students are updated on fundamental theories and essential building blocks to prepare them for higher level systems design. A structured approach is used to quickly guide students from basic combinational logic to more complex digital systems such as RTL or programmable processors. Design tradeoffs and optimizations are emphasized as an integral part of the design process.

The course also covers hardware description language (Verilog) as a high level design tool. Where resources allow, students will have the chance of gaining experience on the use of Verilog.

ELEC6055 Power system distribution (6 credits)

This course provides a platform for electrical engineers to strengthen their technical expertise in power distribution from design to application at an advanced level. State-of-the-art technologies for distributing electricity safely, reliably, cost-effectively and environmentally to customers are covered. Major distribution network configurations together with the associated protection systems adopted by reputable power companies worldwide for ensuring supply reliability and operational flexibility are also included. Strategies for enhancing supply reliability and power quality, as well as meter revenue loss prevention techniques are also examined.

Whilst the course is most valuable to practising electrical engineers, it also furnishes engineers of other trades with background knowledge for coordinating their work with counterparts engaged in power supply industry as well as building services engineering field.

ELEC6063 Optoelectronics and lightwave technology (6 credits)

The aim of this course is to broaden the knowledge in the hardware of in optical communication systems from optoelectronic devices to integrated optical network.

Optical communication system has almost become a "must" technique in data/signal transmission (i.e. fiber to home). Students will have the ability to address the issues:
(i) what optoelectronic components are required in the system and the operation principles and device physics,
(ii) the issues that have been be considered to build a optical network by using the optoelectronic components
(iii) to evaluate the performance of the optical network to meet the target/budget (technical) and to improve the performance (using advanced technology).

All the issues will be discussed in this course.

ELEC6065 Data compression (6 credits)

This course provides an introduction to the state-of-the-art compression techniques for typical media including files, digital images, videos and audios. Specifically, the course will discuss in detail about the coding and quantization techniques commonly used for images, videos and audios. Finally, the course will cover basic concept and terminologies of common image, video and audio standards.

ELEC6067 Magnetic resonance imaging (MRI) technology and applications (6 credits)

With advances in engineering and computing, an extraordinary body of imaging technologies and applications has developed over the last 25 years. Among the various in vivo imaging modalities available or under development today, magnetic resonance imaging (MRI) is one of the most versatile and valuable one.

This course is basically divided into two parts, covering a variety of MR related topics in detail. The first part of the course will focus on the fundamental principles and hardware of MRI while the second part will be on the advanced MRI applications.

At the end of the course, students should gain a thorough understanding in the principles of MRI and MR systems. They will also learn the latest state-of-the-art applications of MRI in research and clinical practices.

Pre-requisite: Introductory course in physics or electromagnetism

---

ELEC6079 Biomedical ultrasound (6 credits)

This is a first course on the technical aspect of biomedical ultrasound, and it is designed for senior-level MedE undergraduates. We will cover the physical principles behind ultrasound, its medical imaging

modes, and its therapeutic usages. There will be opportunity for students to learn how to operate an ultrasound imaging system.

There are two major aims for this course. First, it aims to provide students with a top-down technical overview on ultrasound and its biomedical applications. Second, it aims to equip students with hands-on experience in operating an ultrasound scanner.

ELEC6080 Telecommunications systems and management (6 credits)

This course aims to provide a comprehensive understanding of major telecommunications systems (i.e. fixed, mobile, wireless, etc.), and contemporary management practices (e.g. strategy planning, product development, marketing, customer service, etc.) in telecommunications systems. It helps students to appreciate the integration of multi-disciplinary knowledge in telecommunications sectors.
The course also covers some more advanced topics in the ICT industry including next generation networks (e.g. NGA such as FTTx, HSPA+/4G/LTE, HetNet, etc.), convergence development (i.e. device, network, service, sector, etc.), multiple-play and OTT services.

ELEC6081 Biomedical signals and systems (6 credits)

This course aims at introducing the origins, characteristics, analyses and clinical applications of the most common and clinically important medical signals, including electrocardiography (ECG), electromyography (EMG), electroencephalography (EEG), etc. Application-oriented biomedical signal processing and pattern recognition techniques will be introduced, ranging from the very basic methods (e.g., Fourier transform) to advanced methods (e.g.,neural network). With the aid of in-depth case studies, the course offers practical guidance on how to choose appropriate processing methods for solving specific problems of biomedical research. Recent developments and the state-of-the-art of biomedical signals and systems, such as brain-computer interface, will also be discussed.

ELEC6084 Power delivery management for metropolitan cities (6 credits)

This course provides a platform for electrical engineers to strengthen their technical expertise in power delivery in metropolitan cities from design to application at an advanced level. State-of-the-art technologies for safe, reliable, cost-effective and environmentally-friendly power delivery to customers are covered. Major power delivery network designs together with the associated protection systems adopted by reputable power companies worldwide for ensuring supply reliability and operational effectiveness are also included. Strategies for loss prevention management, enhancement of supply reliability and power quality are also examined.
Whilst the course is most valuable to practising electrical engineers, it also furnishes engineers of other related disciplines with necessary engineering knowledge for coordinating their work with counterparts engaged in power supply industry as well as building services engineering field.

ELEC6085 The role of a computerized SCADA system in power system operation (6 credits)

This course aims at introducing the methodologies for designing a Computerized Supervisory Control and Data Acquisition (SCADA) system for power system control and automation. The course will start with an introduction to basic power system operations for ensuring secure & effective power generation, transmission & distribution and how SCADA systems can help. Then the basic functions of a SCADA system will be analyzed and described. This is followed by automatic functions which can be implemented for power systems to enhance performance, reliability and economy. After that the

software structure of various subsystems in a SCADA system will be explained. Finally, techniques for enhancing SCADA system performance and reliability will be introduced.

ELEC6092 Green project management (6 credits)

This course aims at introducing Green Project Management. By giving a brief account on the environmental issues, the course will begin by explaining the scope and value of green projects. It will illustrate the importance of clarity of mission and goals of green projects; and how these could be done by means of audit and feasibility study. It will also describe how green project planning and control can be implemented with proper system tools. The basic theory regarding contract management: project strategy, contract documents, tendering procedure and contingency shall be introduced. It will also give examples of site implementation: partnership collaboration; project quality assurance; safety management; environmental issues and risk management. The course shall be concluded by detailing project quality assurance; safety management.

ELEC6095 Smart grid (6 credits)

This course aims at providing fundamental knowledge of various smart grid technologies. The challenges of the future electric power grid, renewable energy integration, energy utilization, energy storage system, automation and communication technologies in smart grid will be covered. Topics on the smart devices/applicances and energy saving control are included.

Mutually exclusive with: ELEC6096, MEBS6018

ELEC6097 IP Networks (6 credits)

This course aims at enabling detailed understanding about how the Internet works. The course will begin by focusing on the fundamental concepts in the Internet architecture. This is followed by detailed examinations of the key protocols at application layer, transport layer, network layer, and link layer.

Mutually exclusive with: ELEC6007, ELEC7144

ELEC6098 Electronic and mobile commerce (6 credits)

This course aims at introducing both technical, commercial and managerial knowledge on electronic commerce and mobile. The course will start with an introduction to the Business-to-Consumer (B2C) Model; Business-to- Business (B2B) model, followed by an overviews of different enabling technologies for electronic commerce and mobile commerce such as the location base technology, RFID, GPS, mobile network, electronic payment, server-side and channel security, Near Field Communication, QR Code, augmented reality and other latest technologies deploying in the industry. By the end of the course, the research trend and the way forward of the industry will be discussed.

Mutually exclusive with: ELEC6078, ELEC6086

ELEC6099 Wireless communications and networking (6 credits)

This course aims at introducing the principles for wireless communications and networking. The first half focuses on basic concepts and techniques for wireless communications including transmission

fundamentals, antennas and propagation, modulation and pulse shaping, coding and error control. The second half provides an introduction to different types of networks including cellular networks, satellite communication networks, WLAN networks, small cell networks, and cloud radio access networks.

Mutually exclusive with: ELEC6040, ELEC6071, ELEC6087

ELEC6100 Digital Communications (6 credits)

This course aims at enabling the fundamental understanding of the digital communication systems. After an overview on basic probability and random processes, the course will cover the modulation and demodulation. Then, performance analyses under additive white Gaussian noise channel and fading channel are examined. This is followed by topics on spatial diversity and channel equalization.

Mutually exclusive with: ELEC6014 and ELEC6045

ELEC6103 Satellite communications (6 credits)

This course is an introduction to satellite communications taught at a level appropriate for postgraduates reading for the MSc curriculum in electrical and electronic engineering. It is aimed at providing a general understanding and an overview on satellite communications, with emphasis on the recent applications and developments

The following topics will be covered: basics of satellite communications system: orbital aspects, launching, link budgets, modulation, error control coding, and multiple access, earth station, very small aperture terminals (VSATs), global positioning system (GPS) and satellites for mobile communication.

At the end of the course, students should have gained a general understanding on satellite communications systems and also recent applications and developments of satellite communications.

ELEC6105 Magnetics engineering for data storage and emerging applications

Magnetics supports a gigantic commercial market valued at over US$100 billion per year worldwide. A wide range of industries utilizing magnetics-based technologies require highly skilled magnetics engineers. This course is designed to provide knowledge and expertise in the field of magnetic engineering, which is vital to a number of industrial sectors including the data storage, computers, health & medical, advanced materials, non-destructive testing, transport & aerospace, energy generation and distribution, and power industries. The Nobel Prize in Physics 2007 was awarded to a new magnetics engineering regime – spintronics. It combines magnetism (electron spin) and microelectronics (charge transport) whereby spin of the electrons adds a new dimension to the practice of electronics. This new discovery opens up innovative designs and products for data storage and other emerging applications.

This course will start with the fundamentals of magnetism and magnetic materials, and then more in-depth topics such as ferromagnetism and exchange, antiferromagnetism and magnetic order, micromagnetism, domains, hysteresis, and nanoscale magnetism. Students will learn engineering techniques in characterizing magnetic properties and analyzing magnetic systems. The applications of soft and hard magnetic materials in transformers, magnetometers, chokes, microwave applications, motors, generators, actuators, magnetic separation, holding magnets, etc., will be discussed. Students will also learn how and why a hard disk drive (HDD) functions. The second part of this course will focus on spintronics. Students will know how different spintronic devices work and will be able to analyze giant magnetoresistance (GMR) and tunneling magnetoresistance (TMR) devices. A special

emphasis will be made on spintronic sensors and their innovative emerging applications in future spin-based data storage, power industries, health care, non-destructive testing, and others.

Pre-requisite: This course will be given at the level suitable for graduate and senior undergraduate students in electrical and electronic engineering, physics, materials science, or another relevant science or engineering discipline.

ELEC6601 Industrial marketing (6 credits)

This course covers the following topics: Business to business marketing; value chain; character of industrial marketing; marketing opportunities; marketing strategies; channel relationships; sales and sales management; marketing communications; customer programs; business ethics; and crisis management.

By means of problem-based learning, case studies, guest induction, team interaction and lectures, a student shall improve feeling of industrial marketing models; along with understanding of underlying practices and business concepts. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts, and where possible, be able to develop innovative models for potential applications.

ELEC6602 Business venture in China (6 credits)

This course covers the following topics: China economic landscape briefing; foreigner's perception on China; absolute advantages of overseas and SAR Chinese; forms of ventures; business competition; modeling negotiation; building successful ventures in China.

By means of problem-based learning, case studies, team interactions, opportunity visits and lectures, a student shall improve understanding of business channels and niches in China. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts and to develop business venture models for himself or potential entrants under the present circumstances.

ELEC6603 Success in industrial entrepreneurship (6 credits)

This course covers the following topics: Framework for entrepreneurship; identifying resources, capabilities, environments, opportunities and strategies; business plan; financing the new venture; risk balancing and staged financing; creating an organization.

By means of problem-based learning, case studies, guest induction, team interaction and lectures, a student shall improve feeling of entrepreneurship and new opportunities; along with understanding of successful models and business concepts. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts and to elaborate successful opportunities and extend them to potential applications.

ELEC6604 Neural networks, fuzzy systems and genetic algorithms (6 credits)

This course provides a general introduction to neural networks, fuzzy systems and genetic algorithms. The fundamental concepts and techniques of these three areas will be given. The course will also provide examples on the application of neural networks, fuzzy systems and genetic algorithms to a variety of engineering problems. This course will cover three important topics in the field of Applied

Artificial Intelligence. By the end of this course, student should possess a firm grounding in the concepts and techniques of neural network, fuzzy system and genetic algorithm. The student should be able to apply the acquired knowledge to the development of intelligent systems or to the exploration of research problems.

ELEC7021 Dissertation (24 credits)

This course aims at providing the in-depth training in conducting an individual design/research project at the master level.

The essence of the dissertation is for the student to embark on a research and development project on a specific topic agreed upon by the respective supervisor and endorsed by the Head. The aims of the project are not limited to technical achievement, but also reflected on self-awareness, self-management and probing the limitation of oneself.

ELEC7022 Project (12 credits)

The aim of the project is to provide an opportunity for the student to apply what they have learnt from classes to conduct an individual design project in a specific topic related to their profession to be agreed upon by the respective supervisor and endorsed by the Head. The objectives of the project are not limited to technical achievement, but also reflected on self-awareness, self-management and probing the limitation of oneself. Another objective is to make the learning experience inclusive, enjoyable, and career beneficial.

Upon supervision by the teacher, the student will develop skills through individually carrying out the Project Requirement and Design, Implementation and Evaluation, Report and Presentation on the designated project. Students are encouraged to explore and make suggestions on the direction of the project over the project development process. The project supervisor shall provide assistance and aids along each phase in the project development process with the student.

Each project student is generally required to have meetings and discussions with his/her supervisors on a regular basis. Mid-term Review will be held with both the supervisors and the 2nd examiner in order to review the student's progress. The final assessment will be based on Project Report, Presentation, and Demonstration.

ELEC7051 Advanced topics in communication theory and systems (6 credits)

This course covers advanced topics in communication theory and systems. The first part of the course focuses on MIMO communication that is the major breakthrough in modern communication theory and a key enabler of high-speed access in 3GPP LTE and WiFi networks. A wide range of relevant topics will be discussed including MIMO channel modeling, MIMO information theory, spatial multiplexing, space time coding, limited feedback, multiuser MIMO and multiuser diversity. In the second part of the course, we will study theories and techniques for orthogonal frequency division multiplexing (OFDM) and spread spectrum communication. The course concludes with cellular system designs where we will discuss multi-cell cooperation, dynamic resource allocation and analyze the system performance.

ELEC7077 Advanced topics in multimedia signals and systems (6 credits)

The course covers core and selected topics in multimedia signals and systems.

ELEC7078 Advanced topics in electrical and electronic engineering (6 credits)

To study timely advanced topics and issues of special current interest in some fields of electrical and electronic engineering.

ELEC7079 Investment and trading for engineering students (6 credits)

This course is designed for engineering students who wish to start a career in the financial industry. This course helps students to develop the basic knowledge, skill sets, and vocabulary that can communicate with the practitioners in financial industry. Students are expected to learn how to develop market view by analyzing the driving factors to forecast the movement of financial assets like equities and foreign exchange. Students will learn various financial instruments and quantitative models to support the development of investment and trading strategies. The financial instruments will be covered in this course include: options, futures and other derivatives of equities, commodities, and foreign exchanges as well as their pricing models. Investment and trading strategies that will be discussed in this course include those that commonly used in the market, for example, VWAP, TWAP, Bollinger Band, and RSI.

Mutually exclusive with: COMP7802 Introduction to financial computing

---

ELEC7080 Algorithmic trading and high frequency trading (6 credits)

Program trading, which includes high frequency trading (HFT), has become important that it generated over sixty percent of trading volume at Nasdaq and NYSE. There are wide range of issues involved in program trading process, which include opportunities identification, cost/friction estimation, market impact estimation, trading strategies selection, trade scheduling, capital and liquidity management, risk management, and exit management. In this course we will review the foundations of securities trading and discuss issues that related to the market microstructure. We will review important models in the microstructure and present mathematical tools in their structural and statistical representations. We will also discuss the costs associated with trading, how these costs are measured and strategies that minimize them, including the study of models for optimal splitting of the orders across time, to reduce transaction costs and control the temporary and permanent price adjustments that result from trades. "Is that possible to use HFT in China or Hong Kong equities, options, or futures markets?" was a question that constantly been asked by practitioners and we will search for the answer together.

Pre-requisite: ELEC7079 Investment and trading for engineering students

---

ELEC7081 Advanced topics in computational finance (6 credits)

This course aims to introduce finance to engineering students. Students will be introduced research that shape the frontier in finance industry.

By the end of this course, students should know what computational finance is. They should be able to realize business potentials that arise from advances in computing (the business perspective). They should also understand where in finance computational methods could be applied to (the technology perspective). They should understand what computation methods are most used in finance. They should understand the synergy between computation and finance.

Mutually exclusive with: ELEC7082 Artificial intelligence in finance

ELEC7082 Artificial intelligence in finance (6 credits)

This course aims to introduce finance to engineering students. Students will be introduced research, in particular artificial intelligence (AI) that shape the frontier in finance industry.

By the end of this course, students should know what computational finance is. They should be able to realize business potentials that arise from advances in computing (the business perspective). They should also understand where in finance AI methods could be applied to (the technology perspective).

They should understand what AI methods are most used in finance. They should understand the synergy between computation and finance.

Mutually exclusive with: ELEC7081 Advanced topics in computational finance

---

ELEC7402 Advanced electric vehicle technology (6 credits)

This course aims at providing in-depth understanding of the latest technologies of electric vehicles (EVs), with emphasis on their system configurations, propulsion systems, energy systems, and development trends.

Specifically, the course covers the following topics: latest EV system concepts and designs, advanced electric machines and drives for EVs, advanced hybrid powertrains for hybrid EVs, advanced EV energy sources and energy management systems, and EV-to-grid technology.

ELEC7403 Advanced power electronics (6 credits)

The aim of this course is to provide students with an understanding of advanced subject matters in power electronics, which include (i) high-frequency switching converters; (ii) dynamics and control of switching converters; (iii) modeling of switching converters; (iv) components and devices; and (v) industrial requirements. Students enrolled in the course are expected to have prior understanding of basic power electronic principles and the operations of rectifier and phase controlled circuits, and DC/DC buck, boost, buck-boost, and Cuk converters, and knowledge of basic power devices such as power transistor, power MOSFET, and IGBT.

ELEC7404 Advanced railway engineering (6 credits)

The aim of this course is to provide students with an understanding of advanced subject matters in railway engineering, which include (i) railway operations; (ii) rolling stock; (iii) railway traction supply systems; (iv) signaling system;(v) railway infrastructures; and (vi) railway business management. Students enrolled in the module are expected to have prior understanding of basic electrical engineering and power electronic principles, the operations of AC and DC circuits, rectifier and phase controlled circuits.

ELEC7456 Advanced power system operation (6 credits)

The course discusses advanced operation methodology and control theory for modern power systems. A rigorous treatment will be adopted for practical power system operation issues, including supply demand balance, plant scheduling and unit commitment, automatic generation control and economic dispatch, load flow and fault level control, voltage and stability control, security assessment and operational

planning, protection and communication system, process control system and real time control, switching operation and operational safety, emergency preparedness and black start strategy, and power system deregulation and open market's impact to system operation.

The course aims at providing students an in depth appreciation of the major issues in power system operation, thorough understanding of the concepts and principles to operate the system, and the ability to mastering the strategy and methodology to tackle these issues with clear objectives to ensure safety, security and efficiency of the entire power system.

ELEC7466 Advanced topics in power system engineering (6 credits)

This course aims at enabling detailed understanding about specific topics and issues of special current interest in power system engineering. In particular, by analysing how recent large system blackouts had occurred and the reasons leading to such incidents. The course will begin by focusing on the fundamental concepts in power system design and planning, operation and equipment choice. Special topics on issues and problem areas in network configuration, short circuit level coordination, generator design, power system stability, reactive power compensation and voltage control will be discussed.

The course also covers some advanced topics in practical issues in power system control in a modern power system control centre as well as discusses observations and different viewpoints about open power market operation in the Electricity Supply Industry.

ELEC7900 Engineering and society (6 credits)

Students who fulfill the requirements of this workshop will be able to understand his professional role in the society and how he/she should contribute to it. The course is a workshop platform for interaction among potential engineering professionals on topics related to professional conduct, social responsibility, sustainability and safety issues, technology and environment, as well as professional ethics. Legal foundation topics such as contract, intellectual property, tort, professional negligence will be introduced.

(This course will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.)

MEBS6001 Electrical installations (6 credits)

This course covers the following topics: Supply rules, standards and codes of practice; types of electrical systems; distribution in buildings; factory built assemblies; protective devices and safety interlocks; overcurrent and fault protection; installation design principles; protective earthing and equipotential bonding arrangements; standby generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; lightning protection.

MEBS6019 Extra-low-voltage electrical systems in buildings (6 credits)

This course focuses on extra-low-voltage electrical systems: roles, transmission medium and network, modeling, fixed and movable system; types. Applications in building services: electrical safety; public address system, communication, cable and satellite television, conference and interpretive system, audio and visual system; service integration and automation; system monitoring. Applications in property management: fire and life-saving management equipment, electronic patrol, car park management,

efficiency management, CCTV, security system, access and security control, electronic receptionist. Disturbance; electromagnetic interference and protective measures.

MSC(ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING

(Applicable to students admitted to the curriculum in the academic years 2016-17, 2017-18 and 2018-19)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Electrical and Electronic Engineering that are not classified as discipline courses.

Capstone Experience# – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	**No. of Credits**
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience#	24
Total	72

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses and a dissertation. They may select no more than 3 courses from the other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Course Coordinators.

Candidates are required to follow the prescribed curriculum of one of the three streams: General Stream, Communications Engineering and Power Engineering, each comprising a 24-credit dissertation and at least 5 discipline courses selected from subject group A, B or C. To qualify as a graduate of the Communications Engineering Stream, candidates must pass at least 5 discipline courses in the Communication Engineering subject group. To qualify as a graduate of the Power Engineering Stream, candidates must pass at least 5 discipline courses in the Power Engineering subject group. For the General Stream, candidates may choose from any of the three subject groups. The Department also offers an optional course in the Professional Development subject group, namely ELEC7900 Engineering and society, which will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.

 # Special approval has been given by the Senate for candidates admitted to curriculum in the academic year 2016-17 to take additional discipline courses of the same credit value in lieu of the capstone experience to satisfy the curriculum requirements.

The following is a list of discipline courses offered by the Department of Electrical and Electronic Engineering. 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.

Subject Groups

A. General

ELEC6008	Pattern recognition and machine learning
ELEC6027	Integrated circuit systems design
ELEC6036	High performance computer architecture
ELEC6043	Digital image processing
ELEC6049	Digital system design techniques
ELEC6063	Optoelectronics and lightwave technology
ELEC6067	Magnetic resonance imaging (MRI) technology and applications
ELEC6079	Biomedical ultrasound
ELEC6081	Biomedical signals and systems
ELEC6092	Green project management
ELEC6105	Magnetics engineering for data storage and emerging applications
ELEC6601	Industrial marketing
ELEC6602	Business venture in China
ELEC6603	Success in industrial entrepreneurship
ELEC6604	Neural networks, fuzzy systems and genetic algorithms
ELEC7078	Advanced topics in electrical and electronic engineering
ELEC7079	Investment and trading for engineering students
ELEC7080	Algorithmic trading and high frequency trading
ELEC7081	Advanced topics in computational finance
ELEC7082	Artificial intelligence in finance

B. Communications Engineering

ELEC6006	Communications policy and regulations
ELEC6026	Digital signal processing
ELEC6065	Data compression
ELEC6080	Telecommunications systems and management
ELEC6097	IP networks
ELEC6098	Electronic and mobile commerce
ELEC6099	Wireless communications and networking
ELEC6100	Digital communications
ELEC6103	Satellite communications
ELEC7051	Advanced topics in communication theory and systems
ELEC7077	Advanced topics in multimedia signals and systems

C. Power Engineering

ELEC6055	Power system distribution
ELEC6084	Power delivery management for metropolitan cities
ELEC6085	The role of a computerized SCADA system in power system operation
ELEC6095	Smart grid
ELEC7402	Advanced electric vehicle technology
ELEC7403	Advanced power electronics
ELEC7404	Advanced railway engineering
ELEC7456	Advanced power system operation
ELEC7466	Advanced topics in power system engineering
MEBS6001	Electrical installations
MEBS6019	Extra-low-voltage electrical systems in buildings

D. Professional Development

ELEC7900 Engineering and society

(This course will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.)

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.

ELEC6006 Communications policy and regulations (6 credits)

This course aims to provide a comprehensive understanding of Communications Policy and Regulations, and latest ICT policy and regulatory practices in the leading markets and economies. It helps students to appreciate the integration of multi-disciplinary knowledge in ICT industry.

The course also covers some advanced policy & regulatory topics in the ICT industry including convergence licensing regime, co-regulation/self-regulation, and consumer protection regulation.

ELEC6008 Pattern recognition and machine learning (6 credits)

This course aims at providing fundamental knowledge on the principles and techniques of pattern recognition and machine learning.

Specifically, the course covers the following topics: Bayes decision theory; parametric and non-parametric methods; linear discriminant functions; unsupervised learning and clustering; feature extraction; neural networks; context-dependent classification; case studies.

Pre-requisite: A good background in linear algebra, programming experience.
Mutually exclusive with: COMP7504 Pattern recognition and applications

---

ELEC6026 Digital signal processing (6 credits)

This course provides an introduction to the fundamental concepts of digital signal processing (DSP) including a wide variety of topics such as discrete-time linear-time invariant systems, sampling theorem, z-transform, discrete-time/discrete Fourier transform, and digital filter design. Furthermore, the course will also discuss in detail about other advanced topics in digital signal processing such as multidimensional signals and systems, random processes and applications, and adaptive signal processing.

ELEC6027 Integrated circuit systems design (6 credits)

This course covers the following topics: IC design route and technology considerations; logic and circuit design with MOS and CMOS: data and control flow in systematic structures; systems design and design methods; computer aids to IC design; application case studies.

ELEC6036 High-performance computer architecture (6 credits)

This course aims at providing an in-depth understanding of the principles, architectures and implementations of modern high performance computer systems which are designed and based on the proactive use of instruction-level parallelism (ILP). Specifically, the course discusses with examples and case studies to investigate the high-performance computing models; pipelining and ILP; advanced pipelining design including the scoreboard and Tomasulo algorithm; speculative execution; advanced computing models such as the cloud computing models and their possible uses in general, scientific or financial applications; and case studies like the Amazon EC2 and Google Cloud platforms.

ELEC6043 Digital image processing (6 credits)

This course deals with the theory, techniques and applications of digital image processing, which includes characterization, enhancement, restoration, feature extraction, representation, description and classification, advance topics in image analysis, image motion, and application case studies.

Specifically, it covers the areas of image acquisition and imaging systems, 2D continuous-time and discrete-time signals and systems, time and frequency representations, sampling and quantization issues, image filtering, convolution and enhancement, image reconstruction and restoration, image quality evaluation, image transform and compression, geometric feature extraction, image representation and description, image analysis, motion and case studies.

Prerequisite: Exposure to signals and systems at the level of ELEC3241

ELEC6049 Digital system design techniques (6 credits)

This course aims to provide a structured approach to digital system design. Fundamental to this is an understanding of the underlying technologies for modern day digital systems and the methods of analysis. Systematic design methodology and computer aids are crucial to tackling systems of increasing complexity. Selected design issues (such as faults, testability) will also be presented where appropriate.

The course begins with an overview of digital technologies, their evolution and the implication on design realization. Students are updated on fundamental theories and essential building blocks to prepare them for higher level systems design. A structured approach is used to quickly guide students from basic combinational logic to more complex digital systems such as RTL or programmable processors. Design tradeoffs and optimizations are emphasized as an integral part of the design process.

The course also covers hardware description language (Verilog) as a high level design tool. Where resources allow, students will have the chance of gaining experience on the use of Verilog.

ELEC6055 Power system distribution (6 credits)

This course provides a platform for electrical engineers to strengthen their technical expertise in power distribution from design to application at an advanced level. State-of-the-art technologies for distributing

electricity safely, reliably, cost-effectively and environmentally to customers are covered. Major distribution network configurations together with the associated protection systems adopted by reputable power companies worldwide for ensuring supply reliability and operational flexibility are also included. Strategies for enhancing supply reliability and power quality, as well as meter revenue loss prevention techniques are also examined.

Whilst the course is most valuable to practising electrical engineers, it also furnishes engineers of other trades with background knowledge for coordinating their work with counterparts engaged in power supply industry as well as building services engineering field.

ELEC6063 Optoelectronics and lightwave technology (6 credits)

The aim of this course is to broaden the knowledge in the hardware of in optical communication systems from optoelectronic devices to integrated optical network.

Optical communication system has almost become a "must" technique in data/signal transmission (i.e. fiber to home). Students will have the ability to address the issues:
(i) what optoelectronic components are required in the system and the operation principles and device physics,
(ii) the issues that have been be considered to build a optical network by using the optoelectronic components
(iii) to evaluate the performance of the optical network to meet the target/budget (technical) and to improve the performance (using advanced technology).
All the issues will be discussed in this course.

ELEC6065 Data compression (6 credits)

This course provides an introduction to the state-of-the-art compression techniques for typical media including files, digital images, videos and audios. Specifically, the course will discuss in detail about the coding and quantization techniques commonly used for images, videos and audios. Finally, the course will cover basic concept and terminologies of common image, video and audio standards.

ELEC6067 Magnetic resonance imaging (MRI) technology and applications (6 credits)

With advances in engineering and computing, an extraordinary body of imaging technologies and applications has developed over the last 25 years. Among the various in vivo imaging modalities available or under development today, magnetic resonance imaging (MRI) is one of the most versatile and valuable one.

This course is basically divided into two parts, covering a variety of MR related topics in detail. The first part of the course will focus on the fundamental principles and hardware of MRI while the second part will be on the advanced MRI applications.

At the end of the course, students should gain a thorough understanding in the principles of MRI and MR systems. They will also learn the latest state-of-the-art applications of MRI in research and clinical practices.

Pre-requisite: Introductory course in physics or electromagnetism

---

ELEC6079 Biomedical ultrasound (6 credits)

This is a first course on the technical aspect of biomedical ultrasound, and it is designed for senior-level MedE undergraduates. We will cover the physical principles behind ultrasound, its medical imaging modes, and its therapeutic usages. There will be opportunity for students to learn how to operate an ultrasound imaging system.

There are two major aims for this course. First, it aims to provide students with a top-down technical overview on ultrasound and its biomedical applications. Second, it aims to equip students with hands-on experience in operating an ultrasound scanner.

ELEC6080 Telecommunications systems and management (6 credits)

This course aims to provide a comprehensive understanding of major telecommunications systems (i.e. fixed, mobile, wireless, etc.), and contemporary management practices (e.g. strategy planning, product development, marketing, customer service, etc.) in telecommunications systems. It helps students to appreciate the integration of multi-disciplinary knowledge in telecommunications sectors.

The course also covers some more advanced topics in the ICT industry including next generation networks (e.g. NGA such as FTTx, HSPA+/4G/LTE, HetNet, etc.), convergence development (i.e. device, network, service, sector, etc.), multiple-play and OTT services.

ELEC6081 Biomedical signals and systems (6 credits)

This course aims at introducing the origins, characteristics, analyses and clinical applications of the most common and clinically important medical signals, including electrocardiography (ECG), electromyography (EMG), electroencephalography (EEG), etc. Application-oriented biomedical signal processing and pattern recognition techniques will be introduced, ranging from the very basic methods (e.g., Fourier transform) to advanced methods (e.g.,neural network). With the aid of in-depth case studies, the course offers practical guidance on how to choose appropriate processing methods for solving specific problems of biomedical research. Recent developments and the state-of-the-art of biomedical signals and systems, such as brain-computer interface, will also be discussed.

ELEC6084 Power delivery management for metropolitan cities (6 credits)

This course provides a platform for electrical engineers to strengthen their technical expertise in power delivery in metropolitan cities from design to application at an advanced level. State-of-the-art technologies for safe, reliable, cost-effective and environmentally-friendly power delivery to customers are covered. Major power delivery network designs together with the associated protection systems adopted by reputable power companies worldwide for ensuring supply reliability and operational effectiveness are also included. Strategies for loss prevention management, enhancement of supply reliability and power quality are also examined.

Whilst the course is most valuable to practising electrical engineers, it also furnishes engineers of other related disciplines with necessary engineering knowledge for coordinating their work with counterparts engaged in power supply industry as well as building services engineering field.

ELEC6085 The role of a computerized SCADA system in power system operation (6 credits)

This course aims at introducing the methodologies for designing a Computerized Supervisory Control and Data Acquisition (SCADA) system for power system control and automation. The course will start with an introduction to basic power system operations for ensuring secure & effective power generation, transmission & distribution and how SCADA systems can help. Then the basic functions of a SCADA system will be analyzed and described. This is followed by automatic functions which can be implemented for power systems to enhance performance, reliability and economy. After that the software structure of various subsystems in a SCADA system will be explained. Finally, techniques for enhancing SCADA system performance and reliability will be introduced.

ELEC6092 Green project management (6 credits)

This course aims at introducing Green Project Management. By giving a brief account on the environmental issues, the course will begin by explaining the scope and value of green projects. It will illustrate the importance of clarity of mission and goals of green projects; and how these could be done by means of audit and feasibility study. It will also describe how green project planning and control can be implemented with proper system tools. The basic theory regarding contract management: project strategy, contract documents, tendering procedure and contingency shall be introduced. It will also give examples of site implementation: partnership collaboration; project quality assurance; safety management; environmental issues and risk management. The course shall be concluded by detailing project quality assurance; safety management.

ELEC6095 Smart grid (6 credits)

This course aims at providing fundamental knowledge of various smart grid technologies. The challenges of the future electric power grid, renewable energy integration, energy utilization, energy storage system, automation and communication technologies in smart grid will be covered. Topics on the smart devices/applicances and energy saving control are included.
Mutually exclusive with: ELEC6096, MEBS6018

ELEC6097 IP Networks (6 credits)

This course aims at enabling detailed understanding about how the Internet works. The course will begin by focusing on the fundamental concepts in the Internet architecture. This is followed by detailed examinations of the key protocols at application layer, transport layer, network layer, and link layer.
Mutually exclusive with: ELEC6007, ELEC7144

ELEC6098 Electronic and mobile commerce (6 credits)

This course aims at introducing both technical, commercial and managerial knowledge on electronic commerce and mobile. The course will start with an introduction to the Business-to-Consumer (B2C) Model; Business-to- Business (B2B) model, followed by an overviews of different enabling technologies for electronic commerce and mobile commerce such as the location base technology, RFID, GPS, mobile network, electronic payment, server-side and channel security, Near Field Communication, QR Code, augmented reality and other latest technologies deploying in the industry. By the end of the course, the research trend and the way forward of the industry will be discussed.
Mutually exclusive with: ELEC6078, ELEC6086

ELEC6099 Wireless communications and networking (6 credits)

This course aims at introducing the principles for wireless communications and networking. The first half focuses on basic concepts and techniques for wireless communications including transmission fundamentals, antennas and propagation, modulation and pulse shaping, coding and error control. The second half provides an introduction to different types of networks including cellular networks, satellite communication networks, WLAN networks, small cell networks, and cloud radio access networks.
Mutually exclusive with: ELEC6040, ELEC6071, ELEC6087

ELEC6100 Digital Communications (6 credits)

This course aims at enabling the fundamental understanding of the digital communication systems. After an overview on basic probability and random processes, the course will cover the modulation and demodulation. Then, performance analyses under additive white Gaussian noise channel and fading channel are examined. This is followed by topics on spatial diversity and channel equalization.

Mutually exclusive with: ELEC6014 and ELEC6045

ELEC6103 Satellite communications (6 credits)

This course is an introduction to satellite communications taught at a level appropriate for postgraduates reading for the MSc curriculum in electrical and electronic engineering. It is aimed at providing a general understanding and an overview on satellite communications, with emphasis on the recent applications and developments.

The following topics will be covered: basics of satellite communications system: orbital aspects, launching, link budgets, modulation, error control coding, and multiple access, earth station, very small aperture terminals (VSATs), global positioning system (GPS) and satellites for mobile communication.

At the end of the course, students should have gained a general understanding on satellite communications systems and also recent applications and developments of satellite communications.

ELEC6105 Magnetics engineering for data storage and emerging applications

Magnetics supports a gigantic commercial market valued at over US$100 billion per year worldwide. A wide range of industries utilizing magnetics-based technologies require highly skilled magnetics engineers. This course is designed to provide knowledge and expertise in the field of magnetic engineering, which is vital to a number of industrial sectors including the data storage, computers, health & medical, advanced materials, non-destructive testing, transport & aerospace, energy generation and distribution, and power industries. The Nobel Prize in Physics 2007 was awarded to a new magnetics engineering regime – spintronics. It combines magnetism (electron spin) and microelectronics (charge transport) whereby spin of the electrons adds a new dimension to the practice of electronics. This new discovery opens up innovative designs and products for data storage and other emerging applications.

This course will start with the fundamentals of magnetism and magnetic materials, and then more in-depth topics such as ferromagnetism and exchange, antiferromagnetism and magnetic order, micromagnetism, domains, hysteresis, and nanoscale magnetism. Students will learn engineering techniques in characterizing magnetic properties and analyzing magnetic systems. The applications of soft and hard magnetic materials in transformers, magnetometers, chokes, microwave applications, motors, generators, actuators, magnetic separation, holding magnets, etc., will be discussed. Students will also learn how and

why a hard disk drive (HDD) functions. The second part of this course will focus on spintronics. Students will know how different spintronic devices work and will be able to analyze giant magnetoresistance (GMR) and tunneling magnetoresistance (TMR) devices. A special emphasis will be made on spintronic sensors and their innovative emerging applications in future spin-based data storage, power industries, health care, non-destructive testing, and others.

Pre-requisite: This course will be given at the level suitable for graduate and senior undergraduate students in electrical and electronic engineering, physics, materials science, or another relevant science or engineering discipline.

ELEC6601 Industrial marketing (6 credits)

This course covers the following topics: Business to business marketing; value chain; character of industrial marketing; marketing opportunities; marketing strategies; channel relationships; sales and sales management; marketing communications; customer programs; business ethics; and crisis management.
By means of problem-based learning, case studies, guest induction, team interaction and lectures, a student shall improve feeling of industrial marketing models; along with understanding of underlying practices and business concepts. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts, and where possible, be able to develop innovative models for potential applications.

ELEC6602 Business venture in China (6 credits)

This course covers the following topics: China economic landscape briefing; foreigner's perception on China; absolute advantages of overseas and SAR Chinese; forms of ventures; business competition; modeling negotiation; building successful ventures in China.
By means of problem-based learning, case studies, team interactions, opportunity visits and lectures, a student shall improve understanding of business channels and niches in China. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts and to develop business venture models for himself or potential entrants under the present circumstances.

ELEC6603 Success in industrial entrepreneurship (6 credits)

This course covers the following topics: Framework for entrepreneurship; identifying resources, capabilities, environments, opportunities and strategies; business plan; financing the new venture; risk balancing and staged financing; creating an organization.
By means of problem-based learning, case studies, guest induction, team interaction and lectures, a student shall improve feeling of entrepreneurship and new opportunities; along with understanding of successful models and business concepts. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts and to elaborate successful opportunities and extend them to potential applications.

ELEC6604 Neural networks, fuzzy systems and genetic algorithms (6 credits)

This course provides a general introduction to neural networks, fuzzy systems and genetic algorithms. The fundamental concepts and techniques of these three areas will be given. The course will also provide examples on the application of neural networks, fuzzy systems and genetic algorithms to a variety of engineering problems. This course will cover three important topics in the field of Applied Artificial Intelligence. By the end of this course, student should possess a firm grounding in the concepts and

techniques of neural network, fuzzy system and genetic algorithm. The student should be able to apply the acquired knowledge to the development of intelligent systems or to the exploration of research problems.

ELEC7021 Dissertation (24 credits)[#]

This course aims at providing the in-depth training in conducting an individual design/research project at the master level.

The essence of the dissertation is for the student to embark on a research and development project on a specific topic agreed upon by the respective supervisor and endorsed by the Head. The aims of the project are not limited to technical achievement, but also reflected on self-awareness, self-management and probing the limitation of oneself.

ELEC7051 Advanced topics in communication theory and systems (6 credits)

This course covers advanced topics in communication theory and systems. The first part of the course focuses on MIMO communication that is the major breakthrough in modern communication theory and a key enabler of high-speed access in 3GPP LTE and WiFi networks. A wide range of relevant topics will be discussed including MIMO channel modeling, MIMO information theory, spatial multiplexing, space time coding, limited feedback, multiuser MIMO and multiuser diversity. In the second part of the course, we will study theories and techniques for orthogonal frequency division multiplexing (OFDM) and spread spectrum communication. The course concludes with cellular system designs where we will discuss multi-cell cooperation, dynamic resource allocation and analyze the system performance.

ELEC7077 Advanced topics in multimedia signals and systems (6 credits)

The course covers core and selected topics in multimedia signals and systems.

ELEC7078 Advanced topics in electrical and electronic engineering (6 credits)

To study timely advanced topics and issues of special current interest in some fields of electrical and electronic engineering.

ELEC7079 Investment and trading for engineering students (6 credits)

This course is designed for engineering students who wish to start a career in the financial industry. This course helps students to develop the basic knowledge, skill sets, and vocabulary that can communicate with the practitioners in financial industry. Students are expected to learn how to develop market view by analyzing the driving factors to forecast the movement of financial assets like equities and foreign exchange. Students will learn various financial instruments and quantitative models to support the development of investment and trading strategies. The financial instruments will be covered in this course include: options, futures and other derivatives of equities, commodities, and foreign exchanges as well as their pricing models. Investment and trading strategies that will be discussed in this course include those that commonly used in the market, for example, VWAP, TWAP, Bollinger Band, and RSI.

Mutually exclusive with: COMP7802 Introduction to financial computing

[#] *Special approval has been given by the Senate for candidates admitted to curriculum in the academic year 2016-17 to take additional discipline courses of the same credit value in lieu of the capstone experience to satisfy the curriculum requirements.*

ELEC7080 Algorithmic trading and high frequency trading (6 credits)

Program trading, which includes high frequency trading (HFT), has become important that it generated over sixty percent of trading volume at Nasdaq and NYSE. There are wide range of issues involved in program trading process, which include opportunities identification, cost/friction estimation, market impact estimation, trading strategies selection, trade scheduling, capital and liquidity management, risk management, and exit management. In this course we will review the foundations of securities trading and discuss issues that related to the market microstructure. We will review important models in the microstructure and present mathematical tools in their structural and statistical representations. We will also discuss the costs associated with trading, how these costs are measured and strategies that minimize them, including the study of models for optimal splitting of the orders across time, to reduce transaction costs and control the temporary and permanent price adjustments that result from trades. "Is that possible to use HFT in China or Hong Kong equities, options, or futures markets?" was a question that constantly been asked by practitioners and we will search for the answer together.

Pre-requisite: ELEC7079 Investment and trading for engineering students

---

ELEC7081 Advanced topics in computational finance (6 credits)

This course aims to introduce finance to engineering students. Students will be introduced research that shape the frontier in finance industry.

By the end of this course, students should know what computational finance is. They should be able to realize business potentials that arise from advances in computing (the business perspective). They should also understand where in finance computational methods could be applied to (the technology perspective). They should understand what computation methods are most used in finance. They should understand the synergy between computation and finance.

Mutually exclusive with: ELEC7082 Artificial intelligence in finance

---

ELEC7082 Artificial intelligence in finance (6 credits)

This course aims to introduce finance to engineering students. Students will be introduced research, in particular artificial intelligence (AI) that shape the frontier in finance industry.

By the end of this course, students should know what computational finance is. They should be able to realize business potentials that arise from advances in computing (the business perspective). They should also understand where in finance AI methods could be applied to (the technology perspective). They should understand what AI methods are most used in finance. They should understand the synergy between computation and finance.

Mutually exclusive with: ELEC7081 Advanced topics in computational finance

---

ELEC7402 Advanced electric vehicle technology (6 credits)

This course aims at providing in-depth understanding of the latest technologies of electric vehicles (EVs), with emphasis on their system configurations, propulsion systems, energy systems, and development trends.

Specifically, the course covers the following topics: latest EV system concepts and designs, advanced electric machines and drives for EVs, advanced hybrid powertrains for hybrid EVs, advanced EV energy sources and energy management systems, and EV-to-grid technology.

ELEC7403 Advanced power electronics (6 credits)

The aim of this course is to provide students with an understanding of advanced subject matters in power electronics, which include (i) high-frequency switching converters; (ii) dynamics and control of switching converters; (iii) modeling of switching converters; (iv) components and devices; and (v) industrial requirements. Students enrolled in the course are expected to have prior understanding of basic power electronic principles and the operations of rectifier and phase controlled circuits, and DC/DC buck, boost, buck-boost, and Cuk converters, and knowledge of basic power devices such as power transistor, power MOSFET, and IGBT.

ELEC7404 Advanced railway engineering (6 credits)

The aim of this course is to provide students with an understanding of advanced subject matters in railway engineering, which include (i) railway operations; (ii) rolling stock; (iii) railway traction supply systems; (iv) signaling system;(v) railway infrastructures; and (vi) railway business management. Students enrolled in the module are expected to have prior understanding of basic electrical engineering and power electronic principles, the operations of AC and DC circuits, rectifier and phase controlled circuits.

ELEC7456 Advanced power system operation (6 credits)

The course discusses advanced operation methodology and control theory for modern power systems. A rigorous treatment will be adopted for practical power system operation issues, including supply demand balance, plant scheduling and unit commitment, automatic generation control and economic dispatch, load flow and fault level control, voltage and stability control, security assessment and operational planning, protection and communication system, process control system and real time control, switching operation and operational safety, emergency preparedness and black start strategy, and power system deregulation and open market's impact to system operation.

The course aims at providing students an in depth appreciation of the major issues in power system operation, thorough understanding of the concepts and principles to operate the system, and the ability to mastering the strategy and methodology to tackle these issues with clear objectives to ensure safety, security and efficiency of the entire power system.

ELEC7466 Advanced topics in power system engineering (6 credits)

This course aims at enabling detailed understanding about specific topics and issues of special current interest in power system engineering. In particular, by analysing how recent large system blackouts had occurred and the reasons leading to such incidents. The course will begin by focusing on the fundamental

concepts in power system design and planning, operation and equipment choice. Special topics on issues and problem areas in network configuration, short circuit level coordination, generator design, power system stability, reactive power compensation and voltage control will be discussed.

The course also covers some advanced topics in practical issues in power system control in a modern power system control centre as well as discusses observations and different viewpoints about open power market operation in the Electricity Supply Industry.

ELEC7900 Engineering and society (6 credits)

Students who fulfill the requirements of this workshop will be able to understand his professional role in the society and how he/she should contribute to it. The course is a workshop platform for interaction among potential engineering professionals on topics related to professional conduct, social responsibility, sustainability and safety issues, technology and environment, as well as professional ethics. Legal foundation topics such as contract, intellectual property, tort, professional negligence will be introduced.

(This course will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.)

MEBS6001 Electrical installations (6 credits)

This course covers the following topics: Supply rules, standards and codes of practice; types of electrical systems; distribution in buildings; factory built assemblies; protective devices and safety interlocks; overcurrent and fault protection; installation design principles; protective earthing and equipotential bonding arrangements; standby generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; lightning protection.

MEBS6019 Extra-low-voltage electrical systems in buildings (6 credits)

This course focuses on extra-low-voltage electrical systems: roles, transmission medium and network, modeling, fixed and movable system; types. Applications in building services: electrical safety; public address system, communication, cable and satellite television, conference and interpretive system, audio and visual system; service integration and automation; system monitoring. Applications in property management: fire and life-saving management equipment, electronic patrol, car park management, efficiency management, CCTV, security system, access and security control, electronic receptionist. Disturbance; electromagnetic interference and protective measures.

MSC(ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2015-16)

The Master of Science in Engineering in Electrical and Electronic Engineering curriculum has three different streams: General Stream, Communications Engineering, and Power Engineering. Each candidate is required to follow a prescribed curriculum comprising 12 modules, out of which the candidate has to pass at least 9 discipline modules selected from the three subject groups A-C. To qualify as a graduate of the Communications Engineering Stream, the candidate must pass at least 6 discipline modules in the Communications Engineering subject group. To qualify as a graduate of the Power Engineering Stream, the candidate must pass at least 6 discipline modules in the Power

Engineering subject group. For General Stream, the candidate can freely choose from the three subject groups A-C. Subject to approval, candidates can select to undertake a dissertation (ELEC7021) and in which case, General Stream candidates are required to pass at least 5 discipline modules selected from the three subject groups A-C, while candidates pursuing Communications Engineering and Power Engineering Streams are required to pass at least 5 discipline modules in their respective subject groups. The candidate can select Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives. The Department also offers an optional module, ELEC7900 Engineering and society, in the Professional Development subject group. However, this module will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.

Subject Groups

A. General

ELEC6008	Pattern recognition and machine learning
ELEC6027	Integrated circuit systems design
ELEC6036	High performance computer architecture
ELEC6043	Digital image processing
ELEC6049	Digital system design techniques
ELEC6063	Optoelectronics and lightwave technology
ELEC6067	Magnetic resonance imaging (MRI) technology and applications
ELEC6079	Biomedical ultrasound
ELEC6081	Biomedical signals and systems
ELEC6092	Green project management
ELEC6105	Magnetics engineering for data storage and emerging applications
ELEC6601	Industrial marketing
ELEC6602	Business venture in China
ELEC6603	Success in industrial entrepreneurship
ELEC6604	Neural networks, fuzzy systems and genetic algorithms
ELEC7078	Advanced topics in electrical and electronic engineering
ELEC7079	Investment and trading for engineering students
ELEC7080	Algorithmic trading and high frequency trading
ELEC7081	Advanced topics in computational finance
ELEC7082	Artificial intelligence in finance

B. Communications Engineering

ELEC6006	Communications policy and regulations
ELEC6026	Digital signal processing
ELEC6065	Data compression
ELEC6080	Telecommunications systems and management
ELEC6097	IP networks
ELEC6098	Electronic and mobile commerce
ELEC6099	Wireless communications and networking
ELEC6100	Digital communications
ELEC6103	Satellite communications
ELEC7051	Advanced topics in communication theory and systems
ELEC7077	Advanced topics in multimedia signals and systems

C. Power Engineering

ELEC6055	Power system distribution
ELEC6084	Power delivery management for metropolitan cities
ELEC6085	The role of a computerized SCADA system in power system operation
ELEC6095	Smart grid
ELEC7402	Advanced electric vehicle technology
ELEC7403	Advanced power electronics
ELEC7404	Advanced railway engineering
ELEC7456	Advanced power system operation
ELEC7466	Advanced topics in power system engineering
MEBS6001	Electrical installations
MEBS6019	Extra-low-voltage electrical systems in buildings

D. Professional Development

ELEC7900 Engineering and society
(This module will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.)

The list below is not final and some modules may not be offered every year.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

ELEC6006 Communications policy and regulations

This module aims to provide a comprehensive understanding of Communications Policy and Regulations, and latest ICT policy and regulatory practices in the leading markets and economies. It helps students to appreciate the integration of multi-disciplinary knowledge in ICT industry.

The module also covers some advanced policy & regulatory topics in the ICT industry including convergence licensing regime, co-regulation/self-regulation, and consumer protection regulation.

ELEC6008 Pattern recognition and machine learning

This module aims at providing fundamental knowledge on the principles and techniques of pattern recognition and machine learning.

Specifically, the module covers the following topics: Bayes decision theory; parametric and non-parametric methods; linear discriminant functions; unsupervised learning and clustering; feature extraction; neural networks; context-dependent classification; case studies.

Pre-requisite: A good background in linear algebra, programming experience.
Mutually exclusive with: COMP7504 Pattern recognition and applications

---

ELEC6026 Digital signal processing

This module provides an introduction to the fundamental concepts of digital signal processing (DSP) including a wide variety of topics such as discrete-time linear-time invariant systems, sampling theorem, z-transform, discrete-time/discrete Fourier transform, and digital filter design. Furthermore, the module will also discuss in detail about other advanced topics in digital signal processing such as multidimensional signals and systems, random processes and applications, and adaptive signal processing.

ELEC6027 Integrated circuit systems design

This module covers the following topics: IC design route and technology considerations; logic and circuit design with MOS and CMOS: data and control flow in systematic structures; systems design and design methods; computer aids to IC design; application case studies.

ELEC6036 High-performance computer architecture

This module aims at providing an in-depth understanding of the principles, architectures and implementations of modern high performance computer systems which are designed and based on the proactive use of instruction-level parallelism (ILP). Specifically, the module discusses with examples and case studies to investigate the high-performance computing models; pipelining and ILP; advanced pipelining design including the scoreboard and Tomasulo algorithm; speculative execution; advanced computing models such as the cloud computing models and their possible uses in general, scientific or financial applications; and case studies like the Amazon EC2 and Google Cloud platforms.

ELEC6043 Digital image processing

This module deals with the theory, techniques and applications of digital image processing, which includes characterization, enhancement, restoration, feature extraction, representation, description and classification, advance topics in image analysis, image motion, and application case studies.

Specifically, it covers the areas of image acquisition and imaging systems, 2D continuous-time and discrete-time signals and systems, time and frequency representations, sampling and quantization issues, image filtering, convolution and enhancement, image reconstruction and restoration, image quality evaluation, image transform and compression, geometric feature extraction, image representation and description, image analysis, motion and case studies.

Prerequisite: Exposure to signals and systems at the level of ELEC3241

ELEC6049 Digital system design techniques

This module aims to provide a structured approach to digital system design. Fundamental to this is an understanding of the underlying technologies for modern day digital systems and the methods of analysis. Systematic design methodology and computer aids are crucial to tackling systems of increasing complexity. Selected design issues (such as faults, testability) will also be presented where appropriate.

The module begins with an overview of digital technologies, their evolution and the implication on design realization. Students are updated on fundamental theories and essential building blocks to prepare them for higher level systems design. A structured approach is used to quickly guide students from basic combinational logic to more complex digital systems such as RTL or programmable processors. Design tradeoffs and optimizations are emphasized as an integral part of the design process.

The module also covers hardware description language (Verilog) as a high level design tool. Where resources allow, students will have the chance of gaining experience on the use of Verilog.

ELEC6055 Power system distribution

This module provides a platform for electrical engineers to strengthen their technical expertise in power distribution from design to application at an advanced level. State-of-the-art technologies for distributing

electricity safely, reliably, cost-effectively and environmentally to customers are covered. Major distribution network configurations together with the associated protection systems adopted by reputable power companies worldwide for ensuring supply reliability and operational flexibility are also included. Strategies for enhancing supply reliability and power quality, as well as meter revenue loss prevention techniques are also examined.

Whilst the module is most valuable to practising electrical engineers, it also furnishes engineers of other trades with background knowledge for coordinating their work with counterparts engaged in power supply industry as well as building services engineering field.

ELEC6063 Optoelectronics and lightwave technology

The aim of this module is to broaden the knowledge in the hardware of in optical communication systems from optoelectronic devices to integrated optical network.

Optical communication system has almost become a "must" technique in data/signal transmission (i.e. fiber to home). Students will have the ability to address the issues:
(i) what optoelectronic components are required in the system and the operation principles and device physics,
(ii) the issues that have been be considered to build a optical network by using the optoelectronic components
(iii) to evaluate the performance of the optical network to meet the target/budget (technical) and to improve the performance (using advanced technology).
All the issues will be discussed in this module.

ELEC6065 Data compression

This module provides an introduction to the state-of-the-art compression techniques for typical media including files, digital images, videos and audios. Specifically, the module will discuss in detail about the coding and quantization techniques commonly used for images, videos and audios. Finally, the module will cover basic concept and terminologies of common image, video and audio standards.

ELEC6067 Magnetic resonance imaging (MRI) technology and applications

With advances in engineering and computing, an extraordinary body of imaging technologies and applications has developed over the last 25 years. Among the various in vivo imaging modalities available or under development today, magnetic resonance imaging (MRI) is one of the most versatile and valuable one.

This module is basically divided into two parts, covering a variety of MR related topics in detail. The first part of the module will focus on the fundamental principles and hardware of MRI while the second part will be on the advanced MRI applications.

At the end of the module, students should gain a thorough understanding in the principles of MRI and MR systems. They will also learn the latest state-of-the-art applications of MRI in research and clinical practices.

Pre-requisite: Introductory module in physics or electromagnetism

---

ELEC6079 Biomedical ultrasound

This is a first module on the technical aspect of biomedical ultrasound, and it is designed for senior-level MedE undergraduates. We will cover the physical principles behind ultrasound, its medical imaging modes, and its therapeutic usages. There will be opportunity for students to learn how to operate an ultrasound imaging system.

There are two major aims for this module. First, it aims to provide students with a top-down technical overview on ultrasound and its biomedical applications. Second, it aims to equip students with hands-on experience in operating an ultrasound scanner.

ELEC6080 Telecommunications systems and management

This module aims to provide a comprehensive understanding of major telecommunications systems (i.e. fixed, mobile, wireless, etc.), and contemporary management practices (e.g. strategy planning, product development, marketing, customer service, etc.) in telecommunications systems. It helps students to appreciate the integration of multi-disciplinary knowledge in telecommunications sectors.

The module also covers some more advanced topics in the ICT industry including next generation networks (e.g. NGA such as FTTx, HSPA+/4G/LTE, HetNet, etc.), convergence development (i.e. device, network, service, sector, etc.), multiple-play and OTT services.

ELEC6081 Biomedical signals and systems

This module aims at introducing the origins, characteristics, analyses and clinical applications of the most common and important biomedical signals, including electrocardiography (ECG), electromyography (EMG), electroencephalography (EEG), etc. Application-oriented biomedical signal processing and pattern recognition techniques will be introduced, ranging from the very basic methods (e.g., Fourier transform) to advanced methods (e.g., independent component analysis). With the aid of in-depth case studies, the module offers practical guidance on how to choose appropriate processing methods for solving specific problems of biomedical research. Recent developments and the state-of-the-art of biomedical signals and systems, such as brain-computer interface, will also be discussed.

ELEC6084 Power delivery management for metropolitan cities

This module provides a platform for electrical engineers to strengthen their technical expertise in power delivery in metropolitan cities from design to application at an advanced level. State-of-the-art technologies for safe, reliable, cost-effective and environmentally-friendly power delivery to customers are covered. Major power delivery network designs together with the associated protection systems adopted by reputable power companies worldwide for ensuring supply reliability and operational effectiveness are also included. Strategies for loss prevention management, enhancement of supply reliability and power quality are also examined.

Whilst the module is most valuable to practising electrical engineers, it also furnishes engineers of other related disciplines with necessary engineering knowledge for coordinating their work with counterparts engaged in power supply industry as well as building services engineering field.

ELEC6085 The role of a computerized SCADA system in power system operation

This module aims at introducing the methodologies for designing a Computerized Supervisory Control and Data Acquisition (SCADA) system for power system control and automation. The module will start with an introduction to basic power system operations for ensuring secure & effective power generation, transmission & distribution and how SCADA systems can help. Then the basic functions of a SCADA system will be analyzed and described. This is followed by automatic functions which can be implemented for power systems to enhance performance, reliability and economy. After that the software structure of various subsystems in a SCADA system will be explained. Finally, techniques for enhancing SCADA system performance and reliability will be introduced.

ELEC6092 Green project management

This module aims at introducing Green Project Management. By giving a brief account on the environmental issues, the module will begin by explaining the scope and value of green projects. It will illustrate the importance of clarity of mission and goals of green projects; and how these could be done by means of audit and feasibility study. It will also describe how green project planning and control can be implemented with proper system tools. The basic theory regarding contract management: project strategy, contract documents, tendering procedure and contingency shall be introduced. It will also give examples of site implementation: partnership collaboration; project quality assurance; safety management; environmental issues and risk management. The module shall be concluded by detailing project quality assurance; safety management.

ELEC6095 Smart grid

This module aims at providing fundamental knowledge of various smart grid technologies. The challenges of the future electric power grid, renewable energy integration, energy utilization, energy storage system, automation and communication technologies in smart grid will be covered. Topics on the smart devices/applicances and energy saving control are included.

Mutually exclusive with: ELEC6096, MEBS6018

ELEC6097 IP Networks

This module aims at enabling detailed understanding about how the Internet works. The module will begin by focusing on the fundamental concepts in the Internet architecture. This is followed by detailed examinations of the key protocols at application layer, transport layer, network layer, and link layer.

Mutually exclusive with: ELEC6007, ELEC7144

ELEC6098 Electronic and mobile commerce

This module aims at introducing both technical, commercial and managerial knowledge on electronic commerce and mobile. The module will start with an introduction to the Business-to-Consumer (B2C) Model; Business-to- Business (B2B) model, followed by an overviews of different enabling technologies for electronic commerce and mobile commerce such as the location base technology, RFID, GPS, mobile network, electronic payment, server-side and channel security, Near Field Communication, QR Code,

augmented reality and other latest technologies deploying in the industry. By the end of the module, the research trend and the way forward of the industry will be discussed.

Mutually exclusive with: ELEC6078, ELEC6086

ELEC6099 Wireless communications and networking

This module aims at introducing the principles for wireless communications and networking. The first half focuses on basic concepts and techniques for wireless communications including transmission fundamentals, antennas and propagation, modulation and pulse shaping, coding and error control. The second half provides an introduction to different types of networks including cellular networks, satellite communication networks, WLAN networks, small cell networks, and cloud radio access networks.

Mutually exclusive with: ELEC6040, ELEC6071, ELEC6087

ELEC6100 Digital Communications

This module aims at enabling the fundamental understanding of the digital communication systems. After an overview on basic probability and random processes, the module will cover the modulation and demodulation. Then, performance analyses under additive white Gaussian noise channel and fading channel are examined. This is followed by topics on spatial diversity and channel equalization.

Mutually exclusive with: ELEC6014 and ELEC6045

ELEC6103 Satellite communications

This module is an introduction to satellite communications taught at a level appropriate for postgraduates reading for the MSc curriculum in electrical and electronic engineering. It is aimed at providing a general understanding and an overview on satellite communications, with emphasis on the recent applications and developments.

The following topics will be covered: basics of satellite communications system: orbital aspects, launching, link budgets, modulation, error control coding, and multiple access, earth station, very small aperture terminals (VSATs), global positioning system (GPS) and satellites for mobile communication.

At the end of the module, students should have gained a general understanding on satellite communications systems and also recent applications and developments of satellite communications.

ELEC6105 Magnetics engineering for data storage and emerging applications

Magnetics supports a gigantic commercial market valued at over US$100 billion per year worldwide. A wide range of industries utilizing magnetics-based technologies require highly skilled magnetics engineers. This course is designed to provide knowledge and expertise in the field of magnetic engineering, which is vital to a number of industrial sectors including the data storage, computers, health & medical, advanced materials, non-destructive testing, transport & aerospace, energy generation and distribution, and power industries. The Nobel Prize in Physics 2007 was awarded to a new magnetics engineering regime – spintronics. It combines magnetism (electron spin) and microelectronics (charge transport) whereby spin of the electrons adds a new dimension to the practice of electronics. This new discovery opens up innovative designs and products for data storage and other emerging applications.

This course will start with the fundamentals of magnetism and magnetic materials, and then more in-depth topics such as ferromagnetism and exchange, antiferromagnetism and magnetic order, micromagnetism, domains, hysteresis, and nanoscale magnetism. Students will learn engineering techniques in characterizing magnetic properties and analyzing magnetic systems. The applications of soft and hard magnetic materials in transformers, magnetometers, chokes, microwave applications, motors, generators, actuators, magnetic separation, holding magnets, etc., will be discussed. Students will also learn how and why a hard disk drive (HDD) functions. The second part of this course will focus on spintronics. Students will know how different spintronic devices work and will be able to analyze giant magnetoresistance (GMR) and tunneling magnetoresistance (TMR) devices. A special emphasis will be made on spintronic sensors and their innovative emerging applications in future spin-based data storage, power industries, health care, non-destructive testing, and others.

Pre-requisite: This course will be given at the level suitable for graduate and senior undergraduate students in electrical and electronic engineering, physics, materials science, or another relevant science or engineering discipline.

ELEC6601 Industrial marketing

This module covers the following topics: Business to business marketing; value chain; character of industrial marketing; marketing opportunities; marketing strategies; channel relationships; sales and sales management; marketing communications; customer programs; business ethics; and crisis management. By means of problem-based learning, case studies, guest induction, team interaction and lectures, a student shall improve feeling of industrial marketing models; along with understanding of underlying practices and business concepts. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts, and where possible, be able to develop innovative models for potential applications.

ELEC6602 Business venture in China

This module covers the following topics: China economic landscape briefing; foreigner's perception on China; absolute advantages of overseas and SAR Chinese; forms of ventures; business competition; modeling negotiation; building successful ventures in China.

By means of problem-based learning, case studies, team interactions, opportunity visits and lectures, a student shall improve understanding of business channels and niches in China. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts and to develop business venture models for himself or potential entrants under the present circumstances.

ELEC6603 Success in industrial entrepreneurship

This module covers the following topics: Framework for entrepreneurship; identifying resources, capabilities, environments, opportunities and strategies; business plan; financing the new venture; risk balancing and staged financing; creating an organization.

By means of problem-based learning, case studies, guest induction, team interaction and lectures, a student shall improve feeling of entrepreneurship and new opportunities; along with understanding of successful models and business concepts. The student shall acquire skill and proficiency through the projects and presentations. He shall be able to apply concepts and to elaborate successful opportunities and extend them to potential applications.

ELEC6604 Neural networks, fuzzy systems and genetic algorithms

This module provides a general introduction to neural networks, fuzzy systems and genetic algorithms. The fundamental concepts and techniques of these three areas will be given. The module will also provide examples on the application of neural networks, fuzzy systems and genetic algorithms to a variety of engineering problems. This module will cover three important topics in the field of Applied Artificial Intelligence. By the end of this module, student should possess a firm grounding in the concepts and techniques of neural network, fuzzy system and genetic algorithm. The student should be able to apply the acquired knowledge to the development of intelligent systems or to the exploration of research problems.

ELEC7021 Dissertation (4 modules)

ELEC7051 Advanced topics in communication theory and systems

This module covers advanced topics in communication theory and systems. The first part of the module focuses on MIMO communication that is the major breakthrough in modern communication theory and a key enabler of high-speed access in 3GPP LTE and WiFi networks. A wide range of relevant topics will be discussed including MIMO channel modeling, MIMO information theory, spatial multiplexing, space time coding, limited feedback, multiuser MIMO and multiuser diversity. In the second part of the module, we will study theories and techniques for orthogonal frequency division multiplexing (OFDM) and spread spectrum communication. The module concludes with cellular system designs where we will discuss multi-cell cooperation, dynamic resource allocation and analyze the system performance.

ELEC7077 Advanced topics in multimedia signals and systems

The module covers core and selected topics in multimedia signals and systems.

ELEC7078 Advanced topics in electrical and electronic engineering

To study timely advanced topics and issues of special current interest in some fields of electrical and electronic engineering.

ELEC7079 Investment and trading for engineering students

This module is designed for engineering students who wish to start a career in the financial industry. This module helps students to develop the basic knowledge, skill sets, and vocabulary that can communicate with the practitioners in financial industry. Students are expected to learn how to develop market view by analyzing the driving factors to forecast the movement of financial assets like equities and foreign exchange. Students will learn various financial instruments and quantitative models to support the development of investment and trading strategies. The financial instruments will be covered in this module include: options, futures and other derivatives of equities, commodities, and foreign exchanges as well as their pricing models. Investment and trading strategies that will be discussed in this module include those that commonly used in the market, for example, VWAP, TWAP, Bollinger Band, and RSI.

Mutually exclusive with: COMP7802 Introduction to financial computing

ELEC7080 Algorithmic trading and high frequency trading

Program trading, which includes high frequency trading (HFT), has become important that it generated over sixty percent of trading volume at Nasdaq and NYSE. There are wide range of issues involved in program trading process, which include opportunities identification, cost/friction estimation, market impact estimation, trading strategies selection, trade scheduling, capital and liquidity management, risk management, and exit management. In this module we will review the foundations of securities trading and discuss issues that related to the market microstructure. We will review important models in the microstructure and present mathematical tools in their structural and statistical representations. We will also discuss the costs associated with trading, how these costs are measured and strategies that minimize them, including the study of models for optimal splitting of the orders across time, to reduce transaction costs and control the temporary and permanent price adjustments that result from trades. "Is that possible to use HFT in China or Hong Kong equities, options, or futures markets?" was a question that constantly been asked by practitioners and we will search for the answer together.

Pre-requisite: ELEC7079 Investment and trading for engineering students

---

ELEC7081 Advanced topics in computational finance

This module aims to introduce finance to engineering students. Students will be introduced research that shape the frontier in finance industry.

By the end of this module, students should know what computational finance is. They should be able to realize business potentials that arise from advances in computing (the business perspective). They should also understand where in finance computational methods could be applied to (the technology perspective). They should understand what computation methods are most used in finance. They should understand the synergy between computation and finance.

Mutually exclusive with ELEC7082 Artificial intelligence in finance

---

ELEC7082 Artificial intelligence in finance

This module aims to introduce finance to engineering students. Students will be introduced research, in particular artificial intelligence (AI) that shape the frontier in finance industry.

By the end of this module, students should know what computational finance is. They should be able to realize business potentials that arise from advances in computing (the business perspective). They should also understand where in finance AI methods could be applied to (the technology perspective). They should understand what AI methods are most used in finance. They should understand the synergy between computation and finance.

Mutually exclusive with: ELEC7081 Advanced topics in computational finance

---

ELEC7402 Advanced electric vehicle technology

This module aims at providing in-depth understanding of the latest technologies of electric vehicles (EVs), with emphasis on their system configurations, propulsion systems, energy systems, and development trends.

Specifically, the module covers the following topics: latest EV system concepts and designs, advanced electric machines and drives for EVs, advanced hybrid powertrains for hybrid EVs, advanced EV energy sources and energy management systems, and EV-to-grid technology.

ELEC7403 Advanced power electronics

The aim of this module is to provide students with an understanding of advanced subject matters in power electronics, which include (i) high-frequency switching converters; (ii) dynamics and control of switching converters; (iii) modeling of switching converters; (iv) components and devices; and (v) industrial requirements. Students enrolled in the module are expected to have prior understanding of basic power electronic principles and the operations of rectifier and phase controlled circuits, and DC/DC buck, boost, buck-boost, and Cuk converters, and knowledge of basic power devices such as power transistor, power MOSFET, and IGBT.

ELEC7404 Advanced railway engineering

The aim of this course is to provide students with an understanding of advanced subject matters in railway engineering, which include (i) railway operations; (ii) rolling stock; (iii) railway traction supply systems; (iv) signaling system;(v) railway infrastructures; and (vi) railway business management. Students enrolled in the module are expected to have prior understanding of basic electrical engineering and power electronic principles, the operations of AC and DC circuits, rectifier and phase controlled circuits.

ELEC7456 Advanced power system operation

The module discusses advanced operation methodology and control theory for modern power systems. A rigorous treatment will be adopted for practical power system operation issues, including supply demand balance, plant scheduling and unit commitment, automatic generation control and economic dispatch, load flow and fault level control, voltage and stability control, security assessment and operational planning, protection and communication system, process control system and real time control, switching operation and operational safety, emergency preparedness and black start strategy, and power system deregulation and open market's impact to system operation.

The module aims at providing students an in depth appreciation of the major issues in power system operation, thorough understanding of the concepts and principles to operate the system, and the ability to mastering the strategy and methodology to tackle these issues with clear objectives to ensure safety, security and efficiency of the entire power system.

ELEC7466 Advanced topics in power system engineering

This module aims at enabling detailed understanding about specific topics and issues of special current interest in power system engineering. In particular, by analysing how recent large system blackouts had occurred and the reasons leading to such incidents. The module will begin by focusing on the fundamental concepts in power system design and planning, operation and equipment choice. Special topics on issues and problem areas in network configuration, short circuit level coordination, generator design, power system stability, reactive power compensation and voltage control will be discussed.

The module also covers some advanced topics in practical issues in power system control in a modern power system control centre as well as discusses observations and different viewpoints about open power market operation in the Electricity Supply Industry.

ELEC7900 Engineering and society

Students who fulfill the requirements of this workshop will be able to understand his professional role in the society and how he/she should contribute to it. The module is a workshop platform for interaction among potential engineering professionals on topics related to professional conduct, social responsibility, sustainability and safety issues, technology and environment, as well as professional ethics. Legal foundation topics such as contract, intellectual property, tort, professional negligence will be introduced.

(This module will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.)

MEBS6001 Electrical installations

This module covers the following topics: Supply rules, standards and codes of practice; types of electrical systems; distribution in buildings; factory built assemblies; protective devices and safety interlocks; overcurrent and fault protection; installation design principles; protective earthing and equipotential bonding arrangements; standby generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; lightning protection.

MEBS6019 Extra-low-voltage electrical systems in buildings

This module focuses on extra-low-voltage electrical systems: roles, transmission medium and network, modeling, fixed and movable system; types. Applications in building services: electrical safety; public address system, communication, cable and satellite television, conference and interpretive system, audio and visual system; service integration and automation; system monitoring. Applications in property management: fire and life-saving management equipment, electronic patrol, car park management, efficiency management, CCTV, security system, access and security control, electronic receptionist. Disturbance; electromagnetic interference and protective measures.

MSC(ENG) IN ENERGY ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2019-20 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Energy Engineering that are not classified as discipline courses.

Capstone Experience – a 12-credit project or a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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:

	Enrolment Mode of 10 courses + Project	**Enrolment Mode of 8 courses + Dissertation**
Course Category	**No. of Credits**	**No. of Credits**
Discipline Courses	Not less than 36	Note more than 30
Elective Courses	Not more than 24	Not more than 18
Capstone Experience	12	24
Total	72	72

Candidates shall select courses in accordance with the regulations of the degree. Candidates are required to follow a prescribed curriculum comprising either a 24-credit dissertation and another 8 courses, including at least 5 discipline courses from the List of Discipline Courses (including at least 2 fundamental courses) and no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives ;or a 12-credit project and 10 courses, including at least 6 discipline courses from the List of Discipline Courses (including at least 2 fundamental courses) and no more than 4 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Course Coordinators.

List of Discipline Courses for MSc(Eng) in Energy Engineering

Fundamental courses (select at least two out of three):

EMEE6002 Sustainability and climate change (fundamental)
EMEE6005 Renewable energy technology I: Fundamental (fundamental)
EMEE6010 Electricity quality and energy efficiency (fundamental)
ELEC7402 Advanced electric vehicle technology
ELEC7404 Advanced railway engineering
EMEE6003 Nuclear energy
EMEE6004 Energy conservation and management
EMEE6006 Renewable energy technology II: Advanced
EMEE6007 Energy and carbon audit
EMEE6008 Green project management
EMEE6009 Green facilities management
EMEE6011 Energy saving lighting
MEBS6016 Energy performance of buildings
MECH7011 Applied thermodynamics and power plant technology

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.

ELEC7402 Advanced electric vehicle technology (6 credits)

This course aims at providing in-depth understanding of the latest technologies of electric vehicles (EVs), with emphasis on their system configurations, propulsion systems, energy systems, and development trends.

Specifically, the course covers the following topics: latest EV system concepts and designs, advanced electric machines and drives for EVs, advanced hybrid powertrains for hybrid EVs, advanced EV energy sources and energy management systems, and EV-to-grid technology.

ELEC7404 Advanced railway engineering (6 credits)

The aim of this course is to provide students with an understanding of advanced subject matters in railway engineering, which include (i) railway operations; (ii) rolling stock; (iii) railway traction supply systems; (iv) signaling system;(v) railway infrastructures; and (vi) railway business management. Students enrolled in the module are expected to have prior understanding of basic electrical engineering and power electronic principles, the operations of AC and DC circuits, rectifier and phase controlled circuits.

EMEE6002 Sustainability and climate change (fundamental) **(6 credits)**

This course aims at introducing the cause and consequence of climate change. A few technical solutions for solving the climate change problems, such as solar energy, nuclear energy, smart grid, electric vehicle, green ICT and energy efficiency audit, will be introduced. In addition, other non-technical solution such as: carbon trade, Clean Development Mechanism, Kyoto protocol and carbon audit will be discussed. The course provides both theoretical background and practical knowledge of the causes and solutions of the problem. The sustainability and issues in Hong Kong and China, such as air, water, solid waste and electronic waste pollutions, will be discussed.

Mutually exclusive with ELEC7407

EMEE6003 Nuclear energy (6 credits)

Students in this course will acquire the fundamental knowledge on nuclear energy and nuclear power system, ranging from the fundamental principles of nuclear physics, nuclear power system design and operation, waste disposal, to risk assessment and safety management. In addition to technical knowledge, nuclear governance and policy governing the safe and effective operation of nuclear power plants will be covered. Students will be equipped with the necessary knowledge benefitting their careers development in the nuclear power industry.

Mutually exclusive with ELEC6104

EMEE6004 Energy conservation and management (6 credits)

This course aims to: (1) understand the technological, social, economic and environmental factors related to the use of fossil fuels and renewable energy; (2) understand the major energy consumers in buildings, transportation and industrial processes; and (3) identify effective energy conservation and conduct energy audits and management systems.

Topics include: energy sources and environmental impact; energy in buildings; energy- efficient industrial processes; waste heat recovery; energy storage; energy auditing; energy strategies and management.

Students who have taken and passed MECH 6033 will not be allowed to take EMEE6004.

EMEE6005 Renewable energy technology I: Fundamental (fundamental) **(6 credits)**

This course focuses mainly on different renewable energy technologies including hydro power, wind power, bioenergy, solar thermal, solar PV, energy storage, and energy usage. The specific course objectives are: (1) to have a deep understanding of the important role played by renewable energy in our energy supply; and (2) to grasp the fundamentals of different energy resources; (3) to understand energy storage and its important role in solving intermittency and other issues; and (4) to understand how to use energy more efficiently with solid state lighting and other energy saving technologies.

Topics include: renewable energy in a big picture; hydro power; winder power; solar thermal; solar PV; bioenergy; energy storage: intermittancy and other issues; energy usage: solid state lighting.
Students who have taken and passed MECH 6042 will not be allowed to take EMEE6005.

EMEE6006 Renewable energy technology II: Advanced (6 credits)

This course is on the working principles of advanced energy conversion devices including solar cells, fuel cells, batteries, photoelectrochemical (PEC) water splitting cells, and thermoelectric cells. Also covered are the energy carriers in different materials and the connection between different energy conversion devices. The specific course objectives are as: (1) to have a deep understanding of the energy carriers in different materials and their important roles in energy conversion; (2) to grasp the working principles of different energy conversion devices; (3) to be able to tell the differences and similarities between different energy conversion devices; and (4) to be able to design more efficient energy conversion devices.

Topics include: introduction: energy carriers in energy conversion cells; solar cells; fuel cells; electrochemical cells; photoelectrochemical (PEC) water splitting; thermoelectric cells.

Pre-requisite: EMEE6005 or for students who have previously passed MECH6042 or MECH6009 which have been obsolete with effect from 2014-2015 and 2011-2012 respectively

Students who have taken and passed MECH 6043 will not be allowed to take EMEE6006.

EMEE6007 Energy and carbon audit (6 credits)

This course aims to: (1) provide students with the fundamental principles, skills and guidelines needed to carry out effective energy and carbon audits for the commercial and industrial sectors; (2) enable students to identify energy saving and carbon reduction measures and perform quantitative analysis to predict the energy savings and carbon reduction, environmental and economic benefits; and (3) enable students to verify the performance of implemented energy saving and carbon reduction measures.

Topics include: greenhouse gas emission; global warming; energy benchmarking; electrical distribution system; power quality and power factor; energy efficient lighting; motor; HVAC energy

audit; refrigeration cycle; passive cooling; heating appliances; energy consumptions in compressors and pumps; energy saving measurements; local and international guidelines in energy and carbon audit; carbon footprint calculator.

Students who have taken and passed MECH 6044 will not be allowed to take EMEE6007.

EMEE6008 Green project management (6 credits)

This course aims at introducing Green Project Management. By giving a brief account on the environmental issues, the course will begin by explaining the scope and value of green projects. It will illustrate the importance of clarity of mission and goals of green projects; and how these could be done by means of audit and feasibility study. It will also describe how green project planning and control can be implemented with proper system tools. The basic theory regarding contract management: project strategy, contract documents, tendering procedure and contingency shall be introduced. It will also give examples of site implementation: partnership collaboration; project quality assurance; safety management; environmental issues and risk management. The course shall be concluded by detailing project quality assurance; safety management.

Mutually exclusive with ELEC6092

EMEE6009 Green facilities management (6 credits)

The course shall enhance classmates' engineering mindset in designing and performing maintenance activities and management in green facilities and related plants. The mindset shall cover analysis and synthesis of plant operations individually and also as entities in a system. The classmates shall utilize quantitative approach, qualitative approach and management rules to tackle problems. The manager so trained shall perform professionalism in achieving optimal benefits in green assets in a safe and effective manner.

This course covers the following topics: Value Chains with Green Facilities; Types of Green Facilities; Current Trend and Development; Operational Stresses in Facilities; Reliability and Availability, Maintainability and Sustainability; Preventive and Corrective Maintenance Management Tools: Quantitative Tools and Qualitative Tools; and Asset Management.

Mutually exclusive with ELEC6093

EMEE6010 Electricity quality and energy efficiency (fundamental) (6 credits)

The course shall enhance students' engineering concepts in designing the selecting activities in electrical services and related plants. The mindset shall cover analysis and synthesis of plant performance quality, plant invulnerability, and energy efficiency. The classmates shall utilize quantitative approach, qualitative approach and management rules to settle issues. The students shall perform professionalism in achieving optimal benefits.

EMEE6011 Energy saving lighting (6 credits)

This course begins with a review of the importance of lighting, the different forms of electrical lighting and their energy consumptions, as well as their environmental impacts. This is followed by an introduction to the properties and measurement of light. The physics and technologies of

different forms of electrical lighting, namely incandescent, electric discharge and semiconductor lighting will be studied in details. This includes the mechanism of light generation, the methods of driving the light sources, the efficiencies of each lighting technologies, the optical properties of light emission amongst other topics. The merits and disadvantages of each technology are highlighted and critically compared. At the end of the course, the candidate should be able to make a learned choice on energy-efficient light sources.

Mutually exclusive with ELEC6090

EMEE7001 Dissertation (24 credits)

Students will undertake an assigned and supervised dissertation which will be assessed. The dissertation must relate to the subject matter of the curriculum and be agreed by either the Department of Electrical and Electronic Engineering or the Department of Mechanical Engineering.

EMEE7002 Project (12 credits)

The aim of the project is to provide an opportunity for the student to apply what they have learnt from classes to conduct an individual design project in a specific topic related to their profession to be agreed upon by the respective supervisor and endorsed by the Head. The objectives of the project are not limited to technical achievement, but also reflected on self- awareness, self-management and probing the limitation of oneself. Another objective is to make the learning experience inclusive, enjoyable, and career beneficial.

Upon supervision by the teacher, the student will develop skills through individually carrying out the Project Requirement and Design, Implementation and Evaluation, Report and Presentation on the designated project. Students are encouraged to explore and make suggestions on the direction of the project over the project development process. The project supervisor shall provide assistance and aids along each phase in the project development process with the student.

Each project student is generally required to have meetings and discussions with his/her supervisors on a regular basis. Mid-term Review will be held with both the supervisors and the 2nd examiner in order to review the student's progress. The final assessment will be based on Project Report, Presentation, and Demonstration.

MEBS6016 Energy performance of buildings (6 credits)

Energy terms and concepts; energy use in buildings; energy efficient building design and operation; energy efficient technologies; building energy standards and codes; building energy analysis techniques; energy auditing of building; economic and financial analyses.

MECH7011 Applied thermodynamics and power plant technology (6 credits)

This course is focused on understanding the operating principles of power plants for the generation of electric power. The course objectives are to: (1) provide students with the working principles of various types of power plants, including fossil fuels, nuclear fuels and renewable energy; and (2) enable students to understand the thermodynamic principles, emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.

Topics include: sources of energy; thermodynamic properties of states; types of power plants; portable combustion engines; Brayton cycle; gas turbines; Rankine cycle; steam power plants; nuclear power plant; solar farm; wind turbines; thermoelectric energy.

Students who have taken and passed MECH6023 will not be allowed to take MECH7011.

MSC(ENG) IN ENERGY ENGINEERING

(Applicable to students admitted to the curriculum in the academic years 2016-17, 2017-18 and 2018-19)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Energy Engineering that are not classified as discipline courses.

Capstone Experience# – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	No. of Credits
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience#	24
Total	72

Candidates shall select courses in accordance with the regulations of the degree. Candidates are required to follow a prescribed curriculum comprising a 24-credit dissertation and another 8 courses, including at least 5 discipline courses from the List of Discipline Courses (including at least 2 fundamental courses). They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Course Coordinators.

[#] *Special approval has been given by the Senate for candidates admitted to curriculum in the academic year 2016-17 to take additional discipline courses of the same credit value in lieu of the capstone experience to satisfy the curriculum requirements.*

List of Discipline Courses for MSc(Eng) in Energy Engineering

Fundamental courses (select at least two out of three):

EMEE6002	Sustainability and climate change (fundamental)
EMEE6005	Renewable energy technology I: Fundamental (fundamental)
EMEE6010	Electricity quality and energy efficiency (fundamental)
ELEC7402	Advanced electric vehicle technology
ELEC7404	Advanced railway engineering
EMEE6003	Nuclear energy
EMEE6004	Energy conservation and management
EMEE6006	Renewable energy technology II: Advanced
EMEE6007	Energy and carbon audit
EMEE6008	Green project management
EMEE6009	Green facilities management
EMEE6011	Energy saving lighting
MEBS6016	Energy performance of buildings
MECH7011	Applied thermodynamics and power plant technology

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.

ELEC7402 Advanced electric vehicle technology (6 credits)

This course aims at providing in-depth understanding of the latest technologies of electric vehicles (EVs), with emphasis on their system configurations, propulsion systems, energy systems, and development trends.

Specifically, the course covers the following topics: latest EV system concepts and designs, advanced electric machines and drives for EVs, advanced hybrid powertrains for hybrid EVs, advanced EV energy sources and energy management systems, and EV-to-grid technology.

ELEC7404 Advanced railway engineering (6 credits)

The aim of this course is to provide students with an understanding of advanced subject matters in railway engineering, which include (i) railway operations; (ii) rolling stock; (iii) railway traction supply systems; (iv) signaling system;(v) railway infrastructures; and (vi) railway business management. Students enrolled in the module are expected to have prior understanding of basic electrical engineering and power electronic principles, the operations of AC and DC circuits, rectifier and phase controlled circuits.

EMEE6002 Sustainability and climate change (fundamental) **(6 credits)**

This course aims at introducing the cause and consequence of climate change. A few technical solutions for solving the climate change problems, such as solar energy, nuclear energy, smart grid, electric vehicle, green ICT and energy efficiency audit, will be introduced. In addition, other non-technical solution such as: carbon trade, Clean Development Mechanism, Kyoto protocol and carbon audit will be discussed. The course provides both theoretical background and practical knowledge of the causes and solutions of the problem. The sustainability and issues in Hong Kong and China, such as air, water, solid waste and electronic waste pollutions, will be discussed.

Mutually exclusive with ELEC7407

EMEE6003 Nuclear energy (6 credits)

Students in this course will acquire the fundamental knowledge on nuclear energy and nuclear power system, ranging from the fundamental principles of nuclear physics, nuclear power system design and operation, waste disposal, to risk assessment and safety management. In addition to technical knowledge, nuclear governance and policy governing the safe and effective operation of nuclear power plants will be covered. Students will be equipped with the necessary knowledge benefitting their careers development in the nuclear power industry.

Mutually exclusive with ELEC6104

EMEE6004 Energy conservation and management (6 credits)

This course aims to: (1) understand the technological, social, economic and environmental factors related to the use of fossil fuels and renewable energy; (2) understand the major energy consumers in buildings, transportation and industrial processes; and (3) identify effective energy conservation and conduct energy audits and management systems.

Topics include: energy sources and environmental impact; energy in buildings; energy-efficient industrial processes; waste heat recovery; energy storage; energy auditing; energy strategies and management.

Students who have taken and passed MECH 6033 will not be allowed to take EMEE6004.

EMEE6005 Renewable energy technology I: Fundamental (fundamental) **(6 credits)**

This course focuses mainly on different renewable energy technologies including hydro power, wind power, bioenergy, solar thermal, solar PV, energy storage, and energy usage. The specific course objectives are: (1) to have a deep understanding of the important role played by renewable energy in our energy supply; and (2) to grasp the fundamentals of different energy resources; (3) to understand energy storage and its important role in solving intermittency and other issues; and (4) to understand how to use energy more efficiently with solid state lighting and other energy saving technologies.

Topics include: renewable energy in a big picture; hydro power; winder power; solar thermal; solar PV; bioenergy; energy storage: intermittancy and other issues; energy usage: solid state lighting.

Students who have taken and passed MECH 6042 will not be allowed to take EMEE6005.

EMEE6006 Renewable energy technology II: Advanced (6 credits)

This course is on the working principles of advanced energy conversion devices including solar cells, fuel cells, batteries, photoelectrochemical (PEC) water splitting cells, and thermoelectric cells. Also covered are the energy carriers in different materials and the connection between different energy conversion devices. The specific course objectives are as: (1) to have a deep understanding of the energy carriers in different materials and their important roles in energy conversion; (2) to grasp the working principles of different energy conversion devices; (3) to be able to tell the differences and similarities between different energy conversion devices; and (4) to be able to design more efficient energy conversion devices.

Topics include: introduction: energy carriers in energy conversion cells; solar cells; fuel cells; electrochemical cells; photoelectrochemical (PEC) water splitting; thermoelectric cells.

Pre-requisite: EMEE6005 or for students who have previously passed MECH6042 or MECH6009 which have been obsolete with effect from 2014-2015 and 2011-2012 respectively

Students who have taken and passed MECH 6043 will not be allowed to take EMEE6006.

EMEE6007 Energy and carbon audit (6 credits)

This course aims to: (1) provide students with the fundamental principles, skills and guidelines needed to carry out effective energy and carbon audits for the commercial and industrial sectors; (2) enable students to identify energy saving and carbon reduction measures and perform quantitative analysis to predict the energy savings and carbon reduction, environmental and economic benefits; and (3) enable students to verify the performance of implemented energy saving and carbon reduction measures.

Topics include: greenhouse gas emission; global warming; energy benchmarking; electrical distribution system; power quality and power factor; energy efficient lighting; motor; HVAC energy audit; refrigeration cycle; passive cooling; heating appliances; energy consumptions in compressors and pumps; energy saving measurements; local and international guidelines in energy and carbon audit; carbon footprint calculator.

Students who have taken and passed MECH 6044 will not be allowed to take EMEE6007.

EMEE6008 Green project management (6 credits)

This course aims at introducing Green Project Management. By giving a brief account on the environmental issues, the course will begin by explaining the scope and value of green projects. It will illustrate the importance of clarity of mission and goals of green projects; and how these could be done by means of audit and feasibility study. It will also describe how green project planning and control can be implemented with proper system tools. The basic theory regarding contract management: project strategy, contract documents, tendering procedure and contingency shall be introduced. It will also give examples of site implementation: partnership collaboration; project quality assurance; safety management; environmental issues and risk management. The course shall be concluded by detailing project quality assurance; safety management.

Mutually exclusive with ELEC6092

EMEE6009 Green facilities management (6 credits)

The course shall enhance classmates' engineering mindset in designing and performing maintenance activities and management in green facilities and related plants. The mindset shall cover analysis and synthesis of plant operations individually and also as entities in a system. The classmates shall utilize quantitative approach, qualitative approach and management rules to tackle problems. The manager so trained shall perform professionalism in achieving optimal benefits in green assets in a safe and effective manner.

This course covers the following topics: Value Chains with Green Facilities; Types of Green Facilities; Current Trend and Development; Operational Stresses in Facilities; Reliability and Availability, Maintainability and Sustainability; Preventive and Corrective Maintenance Management Tools:

Quantitative Tools and Qualitative Tools; and Asset Management.

Mutually exclusive with ELEC6093

EMEE6010 Electricity quality and energy efficiency (fundamental) **(6 credits)**

The course shall enhance students' engineering concepts in designing the selecting activities in electrical services and related plants. The mindset shall cover analysis and synthesis of plant performance quality, plant invulnerability, and energy efficiency. The classmates shall utilize quantitative approach, qualitative approach and management rules to settle issues. The students shall perform professionalism in achieving optimal benefits.

EMEE6011 Energy saving lighting (6 credits)

This course begins with a review of the importance of lighting, the different forms of electrical lighting and their energy consumptions, as well as their environmental impacts. This is followed by an introduction to the properties and measurement of light. The physics and technologies of different forms of electrical lighting, namely incandescent, electric discharge and semiconductor lighting will be studied in details. This includes the mechanism of light generation, the methods of driving the light sources, the efficiencies of each lighting technologies, the optical properties of light emission amongst other topics. The merits and disadvantages of each technology are highlighted and critically compared. At the end of the course, the candidate should be able to make a learned choice on energy-efficient light sources.

Mutually exclusive with ELEC6090

EMEE7001 Dissertation (24 credits)#

Students will undertake an assigned and supervised dissertation which will be assessed. The dissertation must relate to the subject matter of the curriculum and be agreed by either the Department of Electrical and Electronic Engineering or the Department of Mechanical Engineering.

MEBS6016 Energy performance of buildings (6 credits)

Energy terms and concepts; energy use in buildings; energy efficient building design and operation; energy efficient technologies; building energy standards and codes; building energy analysis techniques; energy auditing of building; economic and financial analyses.

MECH7011 Applied thermodynamics and power plant technology (6 credits)

This course is focused on understanding the operating principles of power plants for the generation of electric power. The course objectives are to: (1) provide students with the working principles of various types of power plants, including fossil fuels, nuclear fuels and renewable energy; and (2) enable students to understand the thermodynamic principles, emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.

Topics include: sources of energy; thermodynamic properties of states; types of power plants; portable combustion engines; Brayton cycle; gas turbines; Rankine cycle; steam power plants; nuclear power

plant; solar farm; wind turbines; thermoelectric energy.

Students who have taken and passed MECH6023 will not be allowed to take MECH7011.

[#] *Special approval has been given by the Senate for candidates admitted to curriculum in the academic year 2016-17 to take additional discipline courses of the same credit value in lieu of the capstone experience to satisfy the curriculum requirements.*

MSC(ENG) IN ENVIRONMENTAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2016-17 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Environmental Engineering that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	**No. of Credits**
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience	24
Total	72

The curriculum provides advanced education in the field of Water and Environmental Engineering.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses and a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Head of Department of Civil Engineering.

The following is a list of discipline courses offered by the Department of Civil Engineering. 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.

(A) FIVE to EIGHT courses from the following list of discipline courses or courses approved by the Department of Civil Engineering:

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.

CIVL6023 Environmental chemistry (6 credits)

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

CIVL6024 Environmental hydraulics (6 credits)

Effluent disposal; environmental transport phenomena in receiving waters; turbulent diffusion; jets and plumes; mixing in rivers and coastal waters; determination of assimilative capacity.

Prerequisite: Undergraduate course in fluid mechanics and environmental engineering or equivalent

---

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.

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.

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.

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.

CIVL6051 Water quality modelling (6 credits)

Mass balance and transport; biochemical processes and particle phenomena in natural environment; eutrophication; dissolved oxygen and algal dynamics; sediment-water-pollutant interactions; modelling application to rivers and estuaries.

Prerequisite: Undergraduate course in environmental engineering or equivalent

---

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.

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.

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

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

---

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.

(B) Not more than THREE courses from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or elective courses at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) 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. In addition to satisfying MSc(Eng) Regulations MSc5, MSc7 and MSc8, the progress of the dissertation work will be assessed for the purpose of General Regulations G11 and G12 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 under the provisions of General Regulation G11.

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.

MSC(ENG) IN ENVIRONMENTAL ENGINEERING
(Applicable to students admitted to the curriculum in the academic year 2015-16 and before)

The curriculum provides advanced education in the field of Water and Environmental Engineering. Students are required to successfully complete twelve modules which must include a dissertation of four modules, on a subject within his/her approved field of study. The list of modules below is not final and some modules may not be offered every year. Students who intend to complete the curriculum in one academic year should check with the Department of Civil Engineering for the availability of modules.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

(A) FIVE to EIGHT modules from the following list of discipline modules or modules approved by the Department of Civil Engineering:

CIVL6005 Data analysis in hydrology

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

CIVL6006 Advanced water and wastewater treatment

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

CIVL6023 Environmental chemistry

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

CIVL6024 Environmental hydraulics

Effluent disposal; environmental transport phenomena in receiving waters; turbulent diffusion; jets and plumes; mixing in rivers and coastal waters; determination of assimilative capacity.

Prerequisite: Undergraduate course in fluid mechanics and environmental engineering or equivalent

---

CIVL6025 Environmental impact assessment of engineering projects

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.

CIVL6029 Groundwater hydrology

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

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

CIVL6040 Solid and hazardous waste management engineering

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.

CIVL6050 Urban hydrology and hydraulics

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

CIVL6051 Water quality modelling

Mass balance and transport; biochemical processes and particle phenomena in natural environment; eutrophication; dissolved oxygen and algal dynamics; sediment-water-pollutant interactions; modelling application to rivers and estuaries.

Prerequisite: Undergraduate course in environmental engineering or equivalent

---

CIVL6053 Wind engineering

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.

CIVL6061 Special topic in environmental engineering A

This module 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 module is offered.

CIVL6062 Special topic in environmental engineering B

This module 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 module is offered.

CIVL6081 Recent advances in water and environmental engineering

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

MEBS6004 Built environment

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

MEBS6010 Indoor air quality

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

MECH6017 Noise and vibration

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

MECH6019 Sources and control of air pollution

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

(B) Not more than THREE modules from the MSc(Eng) modules offered by the Department of Civil Engineering other than those listed in (A) above, or elective modules at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001 Project (4 modules)

For MSc(Eng) students admitted before the academic year of 2014-2015.

On admission to the curriculum, students will undertake a supervised project which will be assessed. The project must relate to the subject matter and be agreed by the Department of Civil Engineering. In addition to satisfying MSc(Eng) Regulations E18 and E19, the progress of the project work will be assessed for the purpose of General Regulations G11 and G12 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 project,

(b) a written report on the preliminary findings of the project, and

(c) a draft dissertation and the final version of dissertation.

Failure to satisfy the examiners in the project milestones specified by the Department of Civil Engineering shall be considered as unsatisfactory performance or progress under the provisions of General Regulation G11.

The final assessment of the project study shall be by an oral presentation AND a dissertation. Students are REQUIRED to give an oral presentation on the findings of their project studies 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 project study as a whole.

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in the academic years of 2014-15 and 2015-2016.

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. In addition to satisfying MSc(Eng) Regulations E7 and E8, the progress of the dissertation work will be assessed for the purpose of General Regulations G11 and G12 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 under the provisions of General Regulation G11.

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.

MSC(ENG) IN GEOTECHNICAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2016-17 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Geotechnical Engineering that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	**No. of Credits**
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience	24
Total	72

The curriculum provides advanced education in the field of Geotechnical Engineering.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses and a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Head of Department of Civil Engineering.

The following is a list of discipline courses offered by the Department of Civil Engineering. 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.

(A) FIVE to EIGHT courses from the following list of discipline courses or courses approved by the Department of Civil Engineering:

CIVL6002 Advanced finite elements (6 credits)

Equilibrium and Virtual Work Principle; Variation principle; Numerical integration; Computer applications; Convergence and Error estimate; material and geometrical nonlinearity; resolution of nonlinear systems.

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.

CIVL6025 Environmental impact assessment of engineering projects (6 credits)

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

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.

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.

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.

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 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; landslip investigation; soil nailing; slope stabilization measures; surface drainage and protection; slope construction and monitoring; slope safety management and maintenance; natural terrain study.

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.

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.

(B) Not more than THREE courses from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or elective courses at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL7009 Dissertation (24 credits)

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

MSC(ENG) IN GEOTECHNICAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2015-16 and before)

The curriculum provides advanced education in the field of Geotechnical Engineering. Students are required to successfully complete twelve modules which must include a dissertation of four modules, on a subject within his/her approved field of study. The list of modules below is not final and some modules may not be offered every year. Students who intend to complete the curriculum in one academic year should check with the Department of Civil Engineering for the availability of modules.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%- 100%).

(A) FIVE to EIGHT modules from the following list of discipline modules or modules approved by the Department of Civil Engineering:

CIVL6002 Advanced finite elements

Equilibrium and Virtual Work Principle; Variation principle; Numerical integration; Computer applications; Convergence and Error estimate; material and geometrical nonlinearity; resolution of nonlinear systems.

CIVL6004 Advanced soil mechanics

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.

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6026 Finite element method

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

CIVL6027 Foundation engineering

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

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.

CIVL6035 Highway pavement engineering

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

CIVL6043 Special topic in geotechnical engineering A

This module 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 module is offered.

CIVL6044 Special topic in geotechnical engineering B

This module 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 module is offered.

CIVL6077 Ground investigation and soil testing

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 engineering

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

Slope engineering in Hong Kong; geological models for slopes; slope stability analysis methods; landslip investigation; soil nailing; slope stabilization measures; surface drainage and protection; slope construction and monitoring; slope safety management and maintenance; natural terrain study.

CIVL6083 Practical design and construction of tunnels in Hong Kong

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

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.

CIVL7010 Advanced engineering geology

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.

(B) Not more than THREE modules from the MSc(Eng) modules offered by the Department of Civil Engineering other than those listed in (A) above, or elective modules at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001 Project (4 modules)

For MSc(Eng) students admitted before the academic year of 2014-2015.

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in the academic years of 2014-15 and 2015-2016.

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

MSC(ENG) IN INDUSTRIAL ENGINEERING AND LOGISTICS MANAGEMENT

(Applicable to students admitted to the curriculum in the academic year 2019-20 and thereafter)

Definition and Terminology

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

Fundamental courses – a specific number of discipline courses in the curriculum that a student must pass.

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Industrial Engineering and Logistics Management that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	**No. of Credits**
Discipline Courses (including at least 2 Fundamental Courses)	Not less than 36
Elective Courses	Not more than 12
Capstone (Dissertation)	24
Total	72

The curriculum is offered in both part-time and full-time modes. For the part-time mode of study, the curriculum shall extend over not less than two and not more than three academic years of study. For the full-time mode of study, the curriculum shall extend over not less than one and not more than two academic years of study. It provides advanced education and training in the philosophy, methods and techniques of Industrial Engineering and Industrial / Logistics Management which are appropriate to industrial and service organizations in both the private and the public sectors.

Candidates are permitted to select courses in accordance with Regulations MSc4, MSc5 and MSc6. Candidates must complete the following categories of courses: (i) at least 6 discipline courses (including at least 2 fundamental courses); (ii) 24 credits of capstone course and (iii) no more than 2 elective courses. He / she can select no more than two Taught Postgraduate level courses offered by other curricula in the Faculty of Engineering as electives. All selection will be subjected to approval by the Course Coordinator.

The following is a list of discipline courses offered by the Department of Industrial and Manufacturing Systems Engineering. 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.

List of Discipline Courses

Fundamental Courses (Students are required to choose at least 2 out of 3):
IELM6034 Operational Research Techniques (fundamental course)
IELM6044 Supply Chain Management (fundamental course)
IELM7016 Engineering Economics and Finance (fundamental course)
IELM6001 Concurrent Engineering
IELM6002 Operations Management

IELM6004 Industrial Project Management
IELM6028 Enterprise Logistics and Facilities Design
IELM6030 Ergonomics
IELM6037 Costing and Finance
IELM6042 Quality Management
IELM6046 Supply Management
IELM6048 Terminal and Warehousing Operations
IELM6050 Industrial Applications of Radio Frequency Identification
IELM6051 Fundamentals of Law for Logistics
IELM7011 Supply Chain and Logistics Finance
IELM7012 Physical Internet
IELM7013 Digital Enterprises and E-Commerce
IELM7014 Organisation Management and Strategy
IELM7015 Global Logistics
IELM7017 Operational Risk Management
IELM7018 Financial Engineering
IELM7019 Financial Technologies
IELM7020 Asset and Portfolio Management

Capstone (Dissertation)
IELM7045 Dissertation

The following is a list of discipline courses offered by the Department of Industrial and Manufacturing Systems Engineering. 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.

IELM6001 Concurrent engineering (6 credits)

Product development process analysis and reengineering: performance measurement, organisation and management issues and extended enterprises. Formal methods and techniques, "Design for X", arc conjoint analysis. Product management, product variety, and engineering changes. Collaborative product commerce: information/task sharing, customer/supplier involvement and e-commerce/e-business applications. Case studies in logistics, service and manufacturing industries.

IELM6002 Operations management (6 credits)

Elements of operations strategies; quantitative forecasting models; strategic decisions; planning products, processes, technologies, and facilities; selection and management of production technology; capacity planning and facility location; production planning systems; aggregate planning; master production scheduling; inventory systems; material requirement planning; shop floor planning and control; Just-In-Time manufacturing.

IELM6004 Industrial project management (6 credits)

Fundamental of project management; PMBOK's project management framework; Project initiating, planning, executing, monitoring and controlling, and closing; Project integration management; Project scope management; CPM/PERT techniques for project time management, resource allocation and cost management; Earned value analysis for project tracking; Application of techniques such as EMV, decision

tree analysis, and Monte Carlo simulation in project risk management, human resource management, communication, procurement and quality management for industrial projects; Project change control and management; Project team-building; Case studies in logistics and manufacturing industries.

IELM6028 Enterprise logistics and facilities design (6 credits)

Enterprise logistics: materials handling systems, storage and warehousing operations, competitive manufacturing, modelling and analysis of enterprise logistics systems; location analysis; methodologies for facilities planning: systematic layout planning approaches (SLP); manufacturing strategies; layout planning algorithms.

IELM6030 Ergonomics (6 credits)

Ergonomics and systems design. Physical ergonomics, anthropometry, biomechanics. Human information processing, person-machine interface design, displays and controls. The visual environment and visual performance. Thermal environment and effects on performance, indices of comfort. Noise; noise measurement, effects of noise, control of noise. Vibration and acceleration; human tolerance.

IELM6034 Operational research techniques (6 credits) (fundamental course)

The philosophy and methodology of Operational Research: problem analysis, model building, and implementation of solutions. Mathematical programming and its applications in logistics and supplies: vehicle scheduling, transportation and transhipments problems. Replacement models for capital equipment and preventive replacement for components of low capital value. Risk analysis for capital expenditure proposals. Queuing theory and event simulation with applications in serial and parallel supply chains.

IELM6037 Costing and finance (6 credits)

Cost terms and purposes, allocation and absorption of overheads, cost volume analysis, product costing, activity-based costing, budgetary control and standard costing, variance analysis, cost for decision making. Capital investment appraisal including discount cash flow, net present value and internal rate of return, risk analysis. Interpretation of financial statements, ratio analysis, fund flow statement, sources of funds, management of working capital.

IELM6042 Quality management (6 credits)

The principals of Total Quality Management and BS 7850. Basic tools of quality management, the Japanese approaches to quality management, 5S and Kaizen. Deming's approach to quality management. International quality assurance management system -- the ISO 9000 series, quality documentation, quality audit. Zero defects and Six Sigma. The American Malcolm Baldrige quality award. Quality Function Deployment. The Taguchi Methods.

IELM6044 Supply chain management (6 credits) (fundamental course)

Supply chain characterisation; operation objectives; distribution channels; channel design considerations; logistics network design. Inventory management; risk pooling; distribution strategies.

Strategic alliances; international issues in supply chain management; coordinating product and supply chain design; customer value. Information technology; decision support systems; the value of information in supply chains. Case studies and contemporary topics on supply chain management; the beer game.

IELM6046 Supply management (6 credits)

Purchasing in the supply chain, strategic purchasing, implementation and evaluation of strategy; purchasing organisation in a corporation, impact of e-procurement; out-sourcing, supplier selection, partnership with suppliers; pricing agreement, price analysis; global sourcing.

IELM6048 Terminal and warehousing operations (6 credits)

Materials handling systems, automated storage and distribution systems, hardware and software, routing. Case studies from cargo terminals. Warehouse management systems, missions, functions, receiving and shipping operations planning, dock design, storage space, layout and location planning, order picking. Cost and performance analysis in logistics and warehouse management. Material handling principles, system design, selection of handling equipment, unit load design. Automation of warehouse and material handling systems, costing and audits. Applications of modelling and simulation for warehouse design and optimisation. Logistics security, logistics park and third party logistics service providers.

IELM6050 Industrial applications of radio frequency identification technologies (6 credits)

Introduction to radio frequency identification (RFID); features and characteristics of readers and tags, typical frequencies, materials and orientations, middleware, standards for electronic product coding, and physical markup language. Design, development and implementation of RFID solutions; business process analysis, technology and vendor selection, deployment of readers and tags, infrastructure architecture, integration with enterprise application systems, and cost-benefits and constraints. RFID case studies and applications in object identification and tracking, asset management, warehouse management, supply chain integration, and manufacturing automation.

IELM6051 Fundamentals of law for logistics (6 credits)

The course focuses on five areas of law essential to industrial and logistics managers: contracts, agency, shipping law, negligence and dispute resolution; overview of sources of law and legal structure of businesses; elements of a binding contract; duties of an agent, including common carriers, employees and professionals; claims arising in international shipment of goods, arbitration, mediation or litigation and venue for dispute resolution.

IELM7011 Supply chain and logistics finance (6 credits)

Basics of financial markets; sources and channels for supply chain and logistics finance; financing conditions. Financial derivatives for managing risks; risk measures; theories and methods of financial hedging. Supply chain risks arising from global manufacturing, trading and logistics activities: uncertain price, demand and exchange rates; financing of logistics businesses and risks; development of risk hedging models: price models, demand models, optimal hedging policies.

IELM7012 Physical internet (6 credits)

Logistics network history and topology, organisation and performance, logistics networks sustainability, asset utilization. Interconnection principles; Digital Internet, Physical Internet, Internet of Things. Physical Internet components: containerisation diversity, modularity, handling and sorting. Logistics information capture, publication, EPCglobal standards. Flow routing and assets management in open-loop supply networks. Collaborative logistics business models, small scale cooperative game with transferable utility, Shapley value and core solution, big scale collaboration models, mechanism design, combinatorial optimisation. Case studies, web search, serious game.

IELM7013 Digital enterprises and e-commerce (6 credits)

Overview and development of e-business; e-business technologies and solutions: appraisal and selection, implementation and adoption; Enterprise information and knowledge portals, virtual enterprises; Roles of e-business in enterprise development and integration; corporate social accountability and responsibility standards; digital technologies for product design and development; cryptographic algorithms for corporate data and IP protection; mobile technology and electronic payment, smart cards, RFID and NFC.

(Students who have passed "IELM6047 Digital enterprises" are not allowed to take this course.)

IELM7014 Organisation management and strategy (6 credits)

The role of the manager, teams and task design, team based systems, team leadership, measuring the performance of teams. Theories of motivation with case studies from industry. Theories of organisation design, socio-technical theory, contingency and markets and clans theory. Behavioural control and change issues, organisation dynamics. Understanding organisational structures. Classifying types of system, Mintzberg typologies and configurations. The Global Business: Strategic decisions in the global business, global culture, leadership, vision, ethics and corporate social responsibility. The design of organisations. The systems view of organisations. Global business issues. Specify appropriate organisation structures to match market needs. Explain cultural implications for global organisations. The fundamentals of strategic management.

(Students who have passed "IELM6027 Organisation theory and behavioural science" are not allowed to take this course.)

IELM7015 Global logistics (6 credits)

Global operations and logistics strategies, strategic changes required by globalization, the strategic framework for global operations, the role of logistics in global operations and marketing strategies; global operations and logistics planning, supplier network development, physical distribution, global logistics network design, global supply chain management, risk management in global operations; management of global operations and logistics, operations analysis of global supply chains, information management for global logistics, performance measurement and evaluation in global logistics.

(Students who have passed "IELM6045 Global operations and logistics" are not allowed to take this course.)

IELM7016 Engineering economics and finance (6 credits) (fundamental course)

Engineering economics fundamentals: cost concepts, money-time relationships, comparing alternatives, depreciation and income taxes, cost estimation, price changes and exchange rates, replacement analysis, effects of uncertainties; financial statements, ratio analysis, financial performance, financial planning and growth; capital budgeting: investment criteria, project analysis and evaluation, project cash flow; cost of capital, long-term financial policy, financial leverage and capital structure policy.

IELM7017 Operational risk management (6 credits)

Basics of risk management, risk and return, lifecycle of risk management, operational risk management (ORM) components; risk management framework: standards, management environment, management processes; operational risk assessment: assessment, identification, scale of assessment; risk reporting: risk indicators, risk map. Risk management strategies: risk avoidance, mitigation, transfer and acceptance; applications: supply chain management, product development, environment, health and safety risks; crisis management.

(Students who have passed "IELM6052 Operational risk management practices" are not allowed to take this course.)

IELM7018 Financial engineering (6 credits)

Basics of financial markets; cash flow analysis; capital asset pricing model (CAPM); portfolio optimisation; arbitrage and fundamental theorem of asset pricing; types of derivatives including forward, futures and options for various underlying assets; returns, value-at-risk (VaR), utility functions; pricing and hedging of derivative securities; numerical studies.

IELM7019 Financial technologies (6 credits)

Applications of the state-of-the-art technologies that drive the rapid growth and disruptive innovations in the financial services sector: big data analytics and predictive modelling, mobility, payments and transactions, infrastructure and operational technologies for financial investments, P2P lending and crowdfunding, and cybersecurity. Understanding on how the financial technology innovations are disrupting traditional established business models and reshaping the way financial services are structured, provisioned and consumed.

IELM7020 Asset and portfolio management (6 credits)

Statistics of asset and portfolio management: univariate statistics, multivariate statistics, modelling the market; portfolio selection theories: mean-variance analysis, asset pricing theory; factor model: arbitrage pricing theory, factor model estimation, principal component analysis; asset price dynamics; portfolio management strategies: tracking error, information ratio, passive and active strategies; portfolio monitor and adjustment; rebalancing; basic machine learning algorithms.

Capstone courses

IELM7045 Dissertation (24 credits)

Student individuals or groups will undertake a supervised project which will be assessed. The dissertation module must relate to the subject matter and be agreed by the Department of Industrial and Manufacturing Systems Engineering. The Dissertation can be related to research projects within the department or industry-related projects.

MSC(ENG) IN INDUSTRIAL ENGINEERING AND LOGISTICS MANAGEMENT

(Applicable to students admitted to the curriculum in the academic years 2017-18 and 2018-19)

Definition and Terminology

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

Core courses - a set of discipline courses in the curriculum that a student must take and pass.

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Industrial Engineering and Logistics Management that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	**No. of Credits**
Core Courses	18
Discipline Courses	Not less than 18
Elective Courses	Not more than 12
Capstone (Dissertation)	24
Total	72

The curriculum is offered in both part-time and full-time modes. For the part-time mode of study, the curriculum shall extend over not less than two and not more than three academic years of study. For the full-time mode of study, the curriculum shall extend over not less than one and not more than two academic years of study. It provides advanced education and training in the philosophy, methods and techniques of Industrial Engineering and Industrial / Logistics Management which are appropriate to industrial and service organizations in both the private and the public sectors.

Candidates are permitted to select courses in accordance with Regulations MSc4, MSc5 and MSc6. Candidates must complete the following categories of courses: (i) 18 credits of core courses; (ii) 24 credits of capstone course and (iii) 5 discipline or elective courses. He / she can select no more than two Taught Postgraduate level courses offered by other curricula in the Faculty of Engineering as electives. All selection will be subjected to approval by the Course Coordinator.

The following is a list of discipline courses offered by the Department of Industrial and Manufacturing Systems Engineering. 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.

Core courses

IELM6034 Operational Research Techniques
IELM6044 Supply Chain Management
IELM7016 Engineering Economics and Finance

Discipline Courses

IELM6001 Concurrent Engineering
IELM6002 Operations Management
IELM6004 Industrial Project Management
IELM6028 Enterprise Logistics and Facilities Design
IELM6030 Ergonomics
IELM6037 Costing and Finance
IELM6042 Quality Management
IELM6046 Supply Management
IELM6048 Terminal and Warehousing Operations
IELM6050 Industrial Applications of Radio Frequency Identification
IELM6051 Fundamentals of Law for Logistics
IELM7011 Supply Chain and Logistics Finance
IELM7012 Physical Internet
IELM7013 Digital Enterprises and E-Commerce
IELM7014 Organisation Management and Strategy
IELM7015 Global Logistics
IELM7017 Operational Risk Management
IELM7018 Financial Engineering
IELM7019 Financial Technologies
IELM7020 Asset and Portfolio Management

Capstone (Dissertation)

IELM7045 Dissertation

The following is a list of discipline courses offered by the Department of Industrial and Manufacturing Systems Engineering. 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.

IELM6001 Concurrent engineering (6 credits)

Product development process analysis and reengineering: performance measurement, organisation and management issues and extended enterprises. Formal methods and techniques, “Design for X”, arc

conjoint analysis. Product management, product variety, and engineering changes. Collaborative product commerce: information/task sharing, customer/supplier involvement and e-commerce/e-business applications. Case studies in logistics, service and manufacturing industries.

IELM6002 Operations management (6 credits)

Elements of operations strategies; quantitative forecasting models; strategic decisions; planning products, processes, technologies, and facilities; selection and management of production technology; capacity planning and facility location; production planning systems; aggregate planning; master production scheduling; inventory systems; material requirement planning; shop floor planning and control; Just-In-Time manufacturing.

IELM6004 Industrial project management (6 credits)

Fundamental of project management; PMBOK's project management framework; Project initiating, planning, executing, monitoring and controlling, and closing; Project integration management; Project scope management; CPM/PERT techniques for project time management, resource allocation and cost management; Earned value analysis for project tracking; Application of techniques such as EMV, decision tree analysis, and Monte Carlo simulation in project risk management, human resource management, communication, procurement and quality management for industrial projects; Project change control and management; Project team-building; Case studies in logistics and manufacturing industries.

IELM6028 Enterprise logistics and facilities design (6 credits)

Enterprise logistics: materials handling systems, storage and warehousing operations, competitive manufacturing, modelling and analysis of enterprise logistics systems; location analysis; methodologies for facilities planning: systematic layout planning approaches (SLP); manufacturing strategies; layout planning algorithms.

IELM6030 Ergonomics (6 credits)

Ergonomics and systems design. Physical ergonomics, anthropometry, biomechanics. Human information processing, person-machine interface design, displays and controls. The visual environment and visual performance. Thermal environment and effects on performance, indices of comfort. Noise; noise measurement, effects of noise, control of noise. Vibration and acceleration; human tolerance.

IELM6034 Operational research techniques (6 credits)

The philosophy and methodology of Operational Research: problem analysis, model building, and implementation of solutions. Mathematical programming and its applications in logistics and supplies: vehicle scheduling, transportation and transhipments problems. Replacement models for capital equipment and preventive replacement for components of low capital value. Risk analysis for capital expenditure proposals. Queuing theory and event simulation with applications in serial and parallel supply chains.

IELM6037 Costing and finance (6 credits)

Cost terms and purposes, allocation and absorption of overheads, cost volume analysis, product costing, activity-based costing, budgetary control and standard costing, variance analysis, cost for decision making. Capital investment appraisal including discount cash flow, net present value and internal rate of return, risk analysis. Interpretation of financial statements, ratio analysis, fund flow statement, sources of funds, management of working capital.

IELM6042 Quality management (6 credits)

The principals of Total Quality Management and BS 7850. Basic tools of quality management, the Japanese approaches to quality management, 5S and Kaizen. Deming's approach to quality management. International quality assurance management system -- the ISO 9000 series, quality documentation, quality audit. Zero defects and Six Sigma. The American Malcolm Baldrige quality award. Quality Function Deployment. The Taguchi Methods.

IELM6044 Supply chain management (6 credits)

Supply chain characterisation; operation objectives; distribution channels; channel design considerations; logistics network design. Inventory management; risk pooling; distribution strategies. Strategic alliances; international issues in supply chain management; coordinating product and supply chain design; customer value. Information technology; decision support systems; the value of information in supply chains. Case studies and contemporary topics on supply chain management; the beer game.

IELM6046 Supply management (6 credits)

Purchasing in the supply chain, strategic purchasing, implementation and evaluation of strategy; purchasing organisation in a corporation, impact of e-procurement; out-sourcing, supplier selection, partnership with suppliers; pricing agreement, price analysis; global sourcing.

IELM6048 Terminal and warehousing operations (6 credits)

Materials handling systems, automated storage and distribution systems, hardware and software, routing. Case studies from cargo terminals. Warehouse management systems, missions, functions, receiving and shipping operations planning, dock design, storage space, layout and location planning, order picking. Cost and performance analysis in logistics and warehouse management. Material handling principles, system design, selection of handling equipment, unit load design. Automation of warehouse and material handling systems, costing and audits. Applications of modelling and simulation for warehouse design and optimisation. Logistics security, logistics park and third party logistics service providers.

IELM6050 Industrial applications of radio frequency identification technologies (6 credits)

Introduction to radio frequency identification (RFID); features and characteristics of readers and tags, typical frequencies, materials and orientations, middleware, standards for electronic product coding, and physical markup language. Design, development and implementation of RFID solutions; business process analysis, technology and vendor selection, deployment of readers and tags, infrastructure

architecture, integration with enterprise application systems, and cost-benefits and constraints. RFID case studies and applications in object identification and tracking, asset management, warehouse management, supply chain integration, and manufacturing automation.

IELM6051 Fundamentals of law for logistics (6 credits)

The course focuses on five areas of law essential to industrial and logistics managers: contracts, agency, shipping law, negligence and dispute resolution; overview of sources of law and legal structure of businesses; elements of a binding contract; duties of an agent, including common carriers, employees and professionals; claims arising in international shipment of goods, arbitration, mediation or litigation and venue for dispute resolution.

IELM7011 Supply chain and logistics finance (6 credits)

Basics of financial markets; sources and channels for supply chain and logistics finance; financing conditions. Financial derivatives for managing risks; risk measures; theories and methods of financial hedging. Supply chain risks arising from global manufacturing, trading and logistics activities: uncertain price, demand and exchange rates; financing of logistics businesses and risks; development of risk hedging models: price models, demand models, optimal hedging policies.

IELM7012 Physical internet (6 credits)

Logistics network history and topology, organisation and performance, logistics networks sustainability, asset utilization. Interconnection principles; Digital Internet, Physical Internet, Internet of Things. Physical Internet components: containerisation diversity, modularity, handling and sorting. Logistics information capture, publication, EPCglobal standards. Flow routing and assets management in open-loop supply networks. Collaborative logistics business models, small scale cooperative game with transferable utility, Shapley value and core solution, big scale collaboration models, mechanism design, combinatorial optimisation. Case studies, web search, serious game.

IELM7013 Digital enterprises and e-commerce (6 credits)

Overview and development of e-business; e-business technologies and solutions: appraisal and selection, implementation and adoption; Enterprise information and knowledge portals, virtual enterprises; Roles of e-business in enterprise development and integration; corporate social accountability and responsibility standards; digital technologies for product design and development; cryptographic algorithms for corporate data and IP protection; mobile technology and electronic payment, smart cards, RFID and NFC.

(Students who have passed "IELM6047 Digital enterprises" are not allowed to take this course.)

IELM7014 Organisation management and strategy (6 credits)

The role of the manager, teams and task design, team based systems, team leadership, measuring the performance of teams. Theories of motivation with case studies from industry. Theories of organisation design, socio-technical theory, contingency and markets and clans theory. Behavioural control and change issues, organisation dynamics. Understanding organisational structures. Classifying types of system, Mintzberg typologies and configurations. The Global Business: Strategic decisions in the global

business, global culture, leadership, vision, ethics and corporate social responsibility. The design of organisations. The systems view of organisations. Global business issues. Specify appropriate organisation structures to match market needs. Explain cultural implications for global organisations. The fundamentals of strategic management.

(Students who have passed "IELM6027 Organisation theory and behavioural science" are not allowed to take this course.)

IELM7015 Global logistics (6 credits)

Global operations and logistics strategies, strategic changes required by globalization, the strategic framework for global operations, the role of logistics in global operations and marketing strategies; global operations and logistics planning, supplier network development, physical distribution, global logistics network design, global supply chain management, risk management in global operations; management of global operations and logistics, operations analysis of global supply chains, information management for global logistics, performance measurement and evaluation in global logistics.

(Students who have passed "IELM6045 Global operations and logistics" are not allowed to take this course.)

IELM7016 Engineering economics and finance (6 credits)

Engineering economics fundamentals: cost concepts, money-time relationships, comparing alternatives, depreciation and income taxes, cost estimation, price changes and exchange rates, replacement analysis, effects of uncertainties; financial statements, ratio analysis, financial performance, financial planning and growth; capital budgeting: investment criteria, project analysis and evaluation, project cash flow; cost of capital, long-term financial policy, financial leverage and capital structure policy.

IELM7017 Operational risk management (6 credits)

Basics of risk management, risk and return, lifecycle of risk management, operational risk management (ORM) components; risk management framework: standards, management environment, management processes; operational risk assessment: assessment, identification, scale of assessment; risk reporting: risk indicators, risk map. Risk management strategies: risk avoidance, mitigation, transfer and acceptance; applications: supply chain management, product development, environment, health and safety risks; crisis management.

(Students who have passed "IELM6052 Operational risk management practices" are not allowed to take this course.)

IELM7018 Financial engineering (6 credits)

Basics of financial markets; cash flow analysis; capital asset pricing model (CAPM); portfolio optimisation; arbitrage and fundamental theorem of asset pricing; types of derivatives including forward, futures and options for various underlying assets; returns, value-at-risk (VaR), utility functions; pricing and hedging of derivative securities; numerical studies.

IELM7019 Financial technologies (6 credits)

Applications of the state-of-the-art technologies that drive the rapid growth and disruptive innovations in the financial services sector: big data analytics and predictive modelling, mobility, payments and transactions, infrastructure and operational technologies for financial investments, P2P lending and crowdfunding, and cybersecurity. Understanding on how the financial technology innovations are disrupting traditional established business models and reshaping the way financial services are structured, provisioned and consumed.

IELM7020 Asset and portfolio management (6 credits)

Statistics of asset and portfolio management: univariate statistics, multivariate statistics, modelling the market; portfolio selection theories: mean-variance analysis, asset pricing theory; factor model: arbitrage pricing theory, factor model estimation, principal component analysis; asset price dynamics; portfolio management strategies: tracking error, information ratio, passive and active strategies; portfolio monitor and adjustment; rebalancing; basic machine learning algorithms.

Capstone courses

IELM7045 Dissertation (24 credits)

Student individuals or groups will undertake a supervised project which will be assessed. The dissertation module must relate to the subject matter and be agreed by the Department of Industrial and Manufacturing Systems Engineering. The Dissertation can be related to research projects within the department or industry-related projects.

MSC(ENG) IN INFRASTRUCTURE PROJECT MANAGEMENT

(Applicable to students admitted to the curriculum in the academic year 2016-17 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Infrastructure Project Management that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	No. of Credits
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience	24
Total	72

The curriculum provides advanced education in the Management of Infrastructure Projects over their entire life cycle, i.e. from conceptualisation and feasibility studies, through financing, contract administration, design, construction, commissioning, operation & maintenance, evaluation and decommissioning. This will draw on and synergise relevant Departmental strengths in Construction Engineering and Management, Transport and Development, Environmental Engineering, Structural Engineering and Geotechnical Engineering, as well as relevant industry expertise.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses and a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Head of Department of Civil Engineering.

The following is a list of discipline courses offered by the Department of Civil Engineering. 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.

(A) FIVE to EIGHT courses from the following list of discipline courses or courses approved by the Department of Civil Engineering:

CIVL6009 Building planning and control (6 credits)

Buildings Ordinance and its implementation, regulations, codes of practice and practice notes; building planning process; site safety supervision and safety assurance; quality assurance of materials and construction; demolition; temporary works; drainage works; case studies.

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.

CIVL6021 Infrastructure contracts management (6 credits)

Infrastructure project packaging; different types and forms of construction contracts; selection of consultants and contractors; management of the tendering phase; management of design; administration of construction contracts; construction claims management.

CIVL6025 Environmental impact assessment of engineering projects (6 credits)

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

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.

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.

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.

CIVL6059 Special topic in infrastructure project management (6 credits)

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

CIVL6060 Operation and maintenance of building and civil engineering works (6 credits)

Policies, principles and practices in operation, maintenance and rehabilitation of buildings and civil engineering infrastructure such as: bridges, roadworks, marine and port works, water supply systems and sewerage schemes; and including aspects of: inspection, appraisal, materials repair methods, monitoring systems and forensic engineering.

CIVL6073 Professional practice in building development (6 credits)

Buildings Ordinance and allied regulations; classification of site, plot ratio / site coverage; Town Planning Board, density zoning plan, outline zoning plans, development permission area; old and new

leases; means of escape; lighting & ventilation, environmental noise control; submission to the Buildings Department / Fire Services Department / Water Services Department; application for occupation permit; checklist for occupation permit site inspection.

CIVL6074 Rights, liabilities and claims in construction contracts (6 credits)

Construction contracts; contractual rights and obligations; performance; breach of contract; remedies for breach; preparation and submission of claims; claims analysis.

CIVL6075 Hong Kong, PRC and international construction law (6 credits)

Construction law in Hong Kong, PRC and abroad; UNCITRAL and WTO procurement frameworks; international construction contracts - FIDIC and NEC; administration of PRC projects; construction- related legislation and regulations in PRC.

CIVL7001 Railway asset management (6 credits)

Requirements and obligations of physical asset stewardship, with emphasis on railway asset management; and their relationships with the growing demand of regulatory and business environments.

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.

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.

(B) Not more than THREE courses from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or elective courses at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL7009 Dissertation (24 credits)

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

---

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

MSC(ENG) IN INFRASTRUCTURE PROJECT MANAGEMENT

(Applicable to students admitted to the curriculum in the academic year 2015-16 and before)

The curriculum provides advanced education in the Management of Infrastructure Projects over their entire life cycle, i.e. from conceptualisation and feasibility studies, through financing, contract administration, design, construction, commissioning, operation & maintenance, evaluation and decommissioning. This will draw on and synergise relevant Departmental strengths in Construction Engineering and Management, Transport and Development, Environmental Engineering, Structural Engineering and Geotechnical Engineering, as well as relevant industry expertise.

Students are required to successfully complete twelve modules which must include a dissertation of four modules, on a subject within his/her approved field of study. The list of modules below is not final and some modules may not be offered every year. Students who intend to complete the curriculum in one academic year should check with the Department of Civil Engineering for the availability of module.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

(A) FIVE to EIGHT modules from the following list of discipline modules or modules approved by the Department of Civil Engineering:

CIVL6009 Building planning and control

Buildings Ordinance and its implementation, regulations, codes of practice and practice notes; building planning process; site safety supervision and safety assurance; quality assurance of materials and construction; demolition; temporary works; drainage works; case studies.

CIVL6014 Construction dispute resolution

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 *

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

CIVL6021 Infrastructure contracts management

Infrastructure project packaging; different types and forms of construction contracts; selection of consultants and contractors; management of the tendering phase; management of design; administration of construction contracts; construction claims management.

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6037 Project management - human and organisational factors *

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

CIVL6049 Urban development management by engineering approach

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.

CIVL6058 Management of infrastructure megaprojects

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.

CIVL6059 Special topic in infrastructure project management

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

CIVL6060 Operation and maintenance of building and civil engineering works

Policies, principles and practices in operation, maintenance and rehabilitation of buildings and civil engineering infrastructure such as: bridges, roadworks, marine and port works, water supply systems and sewerage schemes; and including aspects of: inspection, appraisal, materials repair methods, monitoring systems and forensic engineering.

CIVL6073 Professional practice in building development

Buildings Ordinance and allied regulations; classification of site, plot ratio / site coverage; Town Planning Board, density zoning plan, outline zoning plans, development permission area; old and new leases; means of escape; lighting & ventilation, environmental noise control; submission to the Buildings Department / Fire Services Department / Water Services Department; application for occupation permit; checklist for occupation permit site inspection.

CIVL6074 Rights, liabilities and claims in construction contracts

Construction contracts; contractual rights and obligations; performance; breach of contract; remedies for breach; preparation and submission of claims; claims analysis.

CIVL6075 Hong Kong, PRC and international construction law

Construction law in Hong Kong, PRC and abroad; UNCITRAL and WTO procurement frameworks; international construction contracts - FIDIC and NEC; administration of PRC projects; construction-related legislation and regulations in PRC.

CIVL7001 Railway asset management

Requirements and obligations of physical asset stewardship, with emphasis on railway asset management; and their relationships with the growing demand of regulatory and business environments.

CIVL7005 Sustainable construction technology: principles and practices

This module 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.

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

This module 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.

---

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

(B) Not more than THREE modules from the MSc(Eng) modules offered by the Department of Civil Engineering other than those listed in (A) above, or elective modules at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001 Project (4 modules)

For MSc(Eng) students admitted before the academic year of 2014-2015.

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in the academic years of 2014-15 and 2015-2016.

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

MSC(ENG) IN MECHANICAL ENGINEERING
(Applicable to students admitted to the curriculum in the academic year 2017-18 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Mechanical Engineering that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	**No. of Credits**
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience	24
Total	72

The curriculum provides advanced postgraduate education in the fields of energy and power; environmental engineering; material technology; theoretical mechanics and computer integrated design and manufacturing to graduates in engineering or related science.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses, including at least 3 courses from List A, and a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Course Coordinators.

The following is a list of discipline courses offered by the Department of Mechanical Engineering. 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.

List A discipline courses

MECH6010 Service behaviour of materials (6 credits)

The aims of this course are: (1) to study the relevant physical basis for the understanding and prediction of the service behaviour, such as creep, fracture, fatigue and corrosion, of materials

in industrial applications; and (2) to provide the knowledge to engineers the microstructure in such a way that the service behaviour of materials can be improved.

Topics include: creep regimes; creep mechanisms; creep resistant alloys; brittle fracture; ductile fracture; brittle-ductile transition; fracture mechanism maps; fatigue; Basquins and Coffin-Manson Laws; Goodman's relation; Palmgren-Miner rule; corrosion; electrochemical principles; forms of corrosion; corrosion control; case studies; service behaviour of engineering plastics; polymer-matrix composites.

MECH6026 Computational fluid dynamics (6 credits)

This course aims to provide practicing engineers and researchers who are learning about Computational Fluid Dynamics (CFD) for the first time with the basic knowledge of numerical techniques and applications of CFD to solve engineering problems.

Topics include: fundamental concepts and equations of fluid dynamics; finite-difference method for solving partial differential equations (stability, consistency, convergence, accuracy and efficiency, and solution of system of algebraic equations); simplified models for fluid flow (wave equation) and heat transfer (heat equation); grid generation; turbulent diffusion and shear flow dispersion; numerical solution of transport equations (mass; momentum and energy transport); applications involving the built environment, air pollution, atmospheric diffusion and dissipation, power-plant design, land-air- and marine-vehicle design; etc.

MECH6034 Computer-aided product development (CAPD) (6 credits)

This course will focus on main technologies related to computer-aided product development, including popular product development methodologies, computer-aided design, haptic shape modelling, reverse engineering, additive manufacturing and rapid tooling. The specific course objectives are: (1) To have a good understanding of popular product development methodologies, product development processes; (2) to understand major technologies that can be used to assist product development at different phases; (3) to be able to apply the computer-aided product development technologies to develop a simple product; and (4) to understand the constraints of manufacturing and cost in product development.

Topics include: product development methodologies; basic product manufacturing technologies; design for manufacturing; product costing and value engineering; solid modelling techniques; reverse engineering; additive manufacturing.

MECH6047 Finite element analysis in mechanics (6 credits)

This course aims to: (1) introduce the basic concepts and procedures in finite element analysis; (2) introduce the methods of analysis using the finite element method for mechanics problems in engineering; and (3) provide hands-on experience on conducting various mechanics analyses by using a state-of-the-art finite element software.

Topics include: concepts and procedures in finite element analysis; elasticity analysis of truss, beam, plane and plate problems; thermo-mechanical analysis; modal analysis; direct integration methods for dynamic analysis; geometric and material nonlinear analyses; contact analysis; hands-on experience of finite element analysis.

MECH7011 Applied thermodynamics and power plant technology (6 credits)

This course is focused on understanding the operating principles of power plants for the generation of electric power. The course objectives are to: (1) provide students with the working principles of various types of power plants, including fossil fuels, nuclear fuels and renewable energy; and (2) enable students to understand the thermodynamic principles, emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.

Topics include: sources of energy; thermodynamic properties of states; types of power plants; portable combustion engines; Brayton cycle; gas turbines; Rankine cycle; steam power plants; nuclear power plant; solar farm; wind turbines; thermoelectric energy.

Students who have taken and passed MECH6023 will not be allowed to take MECH7011.

List B discipline courses

MECH6017 Noise and vibration (6 credits)

This course aims to provide an integrated treatment for vibration system, noise radiation and the available control methods in engineering. Upon completing this course, the students are expected to:

(1) explain the basic characteristics of a simple vibration system; (2) understand the mechanism of noise radiation by structural vibration or turbulent flow, and its impact on human hearing; and (3) offer solution to typical noise and vibration problems. The following are covered in the course: (i) fundamentals of vibration and its control, (ii) human hearing and environmental noise sources and their mitigation, (iii) noise control.

Topics include: fundamentals of single- and multiple degree of freedom systems; vibration modes and finite element analyses; vibration measurement; vibration isolation; sound radiation by vibration and flow; human hearing; environmental legislation and guidelines; sound propagation and duct acoustics; noise absorption and reflection; control of noise at the source.

MECH6018 Atmospheric environment modelling (6 credits)

This course aims to: (1) provide rigorous and comprehensive treatment of various modelling methodologies on the atmospheric environment and air pollution dispersion; and (2) introduce the state-of-the-art of various modelling packages for use in industry.

Topics include: foundations of atmospheric dynamics, models of winds, atmospheric turbulence modelling, boundary layer climate, air pollution in the boundary layer and atmospheric dispersion modelling.

MECH6019 Sources and control of air pollution (6 credits)

This course aims to: (1) provide understanding of the natural and anthropogenic sources of air pollution; and (2) introduce ways to prevent, control and minimize pollution by application of various control practices.

Topics include: concepts and procedures in basis of air pollution, air pollutant transport, sources of air pollutants, control of gaseous pollutants, control of particulate matter, atmospheric dispersion modelling.

MECH6024 Applied mathematics for engineers (6 credits)

This course aims to introduce some advanced knowledge of computational and statistical analysis and methods and provide the students with the ability to apply computational and statistical methods to solve engineering problems.

Topics include: statistical and numerical methods in engineering; hypothesis testing; estimation of parameters and confidence intervals; correlation coefficient; direct and iterative methods for systems of equations; optimization; numerical analysis.

EMEE6004 Energy conservation and management (6 credits)

This course aims to: (1) understand the technological, social, economic and environmental factors related to the use of fossil fuels and renewable energy; (2) understand the major energy consumers in buildings, transportation and industrial processes; and (3) identify effective energy conservation and conduct energy audits and management systems.

Topics include: energy sources and environmental impact; energy in buildings; energy-efficient industrial processes; waste heat recovery; energy storage; energy auditing; energy strategies and management.

Students who have taken and passed MECH6033 will not be allowed to take EMEE6004.

MECH6039 Biomaterials and tissue engineering (6 credits)

This course aims to: (1) equip students with a broad knowledge of biomaterials science and engineering and also tissue engineering; (2) have an in-depth understanding of various types of biomaterials currently in clinical use; (3) learn various techniques for developing, analysing and testing new biomaterials; and (4) make students aware of prosthetic medical device regulations and standards for materials and devices; to learn the most recent developments in the biomaterials and tissue engineering field and also future trends.

Topics include: definitions and fundamentals in biomaterials science and engineering; classification for biomaterials; criteria for biomaterials; bioceramics; metallic biomaterials; bioactive ceramic coatings; biomedical polymers; biomedical composites; analytical and testing techniques for developing new biomaterials; long-term performance of biomaterials; degradation of biomaterials in the human body environment; tissue engineering: principles, methods and applications; standards and regulatory issues; new trends in R & D of biomaterials and tissue engineering.

EMEE6005 Renewable energy technology I: Fundamental (6 credits)

This course focuses mainly on different renewable energy technologies including hydro power, wind power, bioenergy, solar thermal, solar PV, energy storage, and energy usage. The specific course objectives are: (1) to have a deep understanding of the important role played by renewable energy in our energy supply; and (2) to grasp the fundamentals of different energy resources; (3) to understand energy storage and its important role in solving intermittency and other issues; and (4)

to understand how to use energy more efficiently with solid state lighting and other energy saving technologies.

Topics include: renewable energy in a big picture; hydro power; winder power; solar thermal; solar PV; bioenergy; energy storage: intermittancy and other issues; energy usage: solid state lighting.

Students who have taken and passed MECH6042 will not be allowed to take EMEE6005.

EMEE6006 Renewable energy technology II: Advanced (6 credits)

This course is on the working principles of advanced energy conversion devices including solar cells, fuel cells, batteries, photoelectrochemical (PEC) water splitting cells, and thermoelectric cells. Also covered are the energy carriers in different materials and the connection between different energy conversion devices. The specific course objectives are as: (1) to have a deep understanding of the energy carriers in different materials and their important roles in energy conversion; (2) to grasp the working principles of different energy conversion devices; (3) to be able to tell the differences and similarities between different energy conversion devices; and (4) to be able to design more efficient energy conversion devices.

Topics include: introduction: energy carriers in energy conversion cells; solar cells; fuel cells; electrochemical cells; photoelectrochemical (PEC) water splitting; thermoelectric cells.

Pre-requisite: EMEE6005 or for students who have previously passed MECH6042 or MECH6009 which have been obsolete with effect from 2014-2015 and 2011-2012 respectively

Students who have taken and passed MECH6043 will not be allowed to take EMEE6006.

EMEE6007 Energy and carbon audit (6 credits)

This course aims to: (1) provide students with the fundamental principles, skills and guidelines needed to carry out effective energy and carbon audits for the commercial and industrial sectors; (2) enable students to identify energy saving and carbon reduction measures and perform quantitative analysis to predict the energy savings and carbon reduction, environmental and economic benefits; and (3) enable students to verify the performance of implemented energy saving and carbon reduction measures.

Topics include: greenhouse gas emission; global warming; energy benchmarking; electrical distribution system; power quality and power factor; energy efficient lighting; motor; HVAC energy audit; refrigeration cycle; passive cooling; heating appliances; energy consumptions in compressors and pumps; energy saving measurements; local and international guidelines in energy and carbon audit; carbon footprint calculator.

Students who have taken and passed MECH6044 will not be allowed to take EMEE6007.

MECH6045 Nanotechnology: fundamentals and applications (6 credits)

Nanotechnology is a rapidly developing discipline which has emerged from foundations based in microtechnology built up during the past few decades. Many exciting engineering applications in nanotechnology have been proposed and some are already in use. The current intensive research activities world-wide make it highly likely that many more products and applications in

nanotechnology will emerge in the next few decades. This course aims at: (1) to equip students with fundamental knowledge and concepts on micro- and nano-technology, and to enable the students to apply such knowledge in future careers in both industry and universities; (2) to enable students to understand the effects of material size on behaviour and properties, and from these to appreciate the new possibilities in both fundamental science and practical applications brought about by nanotechnology; and (3) to introduce students to promising and emerging applications of nanotechnology in energy storage/conversion, unconventional materials and optical metamaterials, and help students to further research and/or work in specific application areas.

Topics include: characteristic length scales, nanomaterials, nanostructures, physical properties of nanostructures, deposition techniques of nanofabrication, micro/nanolithography, high resolution analysis and characterization, scanning probe methods, nanoindentation, mechanical behaviours of bulk nanostructured materials, processing techniques for bulk nanostructured materials, ultrahigh strength of nanostructures, bio-nanotechnology, energy storage, energy conversion, nanophotonics, plasmonics, optical metamaterial.

Students who have taken and passed MECH6040 will not be allowed to take MECH6045.

MECH6046 Microsystems for energy, biomedical and consumer electronics applications (6 credits)

Microelectromechanical systems (MEMS) and microfluidics have gradually found numerous applications in modern energy, mechanical engineering and biomedical engineering applications. This course aims to provide students with the necessary fundamental knowledge and experience in the working principles, design, materials, fabrication and packaging, and applications of MEMS and microfluidic systems. MEMS and microfluidic devices are emerging platforms for modern engineering applications in biomedicine, chemistry, material sciences and micro-machines. This is the course that will introduce graduate students and practicing engineers into the growing field of microsystem engineering. Practical examples will be given when delivering each major topic. Teaching of the course is also strengthened with case studies on carefully chosen topics. At the end of this course, students who fulfill the requirements of this course will be able to: (1) demonstrate ability to understand the fundamental principles behind MEMS and microfluidic; (2) differentiate different MEMS and microfluidic techniques and understand their importance in modern engineering; (3) apply concepts of micro-systems for industrial applications, particularly in energy, mechanical engineering and biomedical engineering.

Topics include: MEMS and microsystem products; microsensors; microactuators; microfluidic devices; multidisciplinary nature of microsystem design and manufacture; fluid mechanics in microscaled flows; materials for MEMS and microfluidic devices; fluid mechanics in microscaled flows; fabrication techniques of MEMS and microfluidic devices; flow characterization techniques; flow control with microfluidics; microfluidics for life sciences and chemistry.

Students who have taken and passed MECH6032 will not be allowed to take MECH6046.

MECH6048 Dissertation (24 credits)

It involves undertaking a dissertation or report on a topic consisting of design, experimental or analytical investigation by individual students. The objectives are to: (1) simulate a realistic working experience for students; (2) provide them an experience of applying engineering principles, engineering economics, business or management skills; and (3) train students to work independently to obtain an effective and acceptable solution to industry-related or research-type problems.

MECH7010 Contemporary robotics (6 credits)

This course aims to explore the major technologies related to modern robotic systems, including the components and working principles of robots, automatic and computer-aided control, kinematics and control of industrial robotic manipulators, humanoid and biomimetic robots. The specific course objectives are listed as follows: (1) to have a comprehensive understanding of robotic systems in terms of their principles, historical evolutions, and applications for both industrial and civilian applications; (2) to understand the mathematical foundations, designs, data processing, and real-time control of various sensing and actuation units which comprise a robotic system; (3) to study the robot kinematics modelling, and the basic knowledge of intelligent motion planning that can enable effective manipulation in various applications; and (4) to explore the challenges and trends in contemporary robotic research, and the future directions for application of robotic components.

Topics include: a) Historical and contemporary robotic systems; b) Concept and components of robots, sensors and actuators; c) Robot kinematics; d) Robotic control and human interaction; e) Intelligent motion planning and localization; f) Applications and challenges of robots; g) Social, economic and ethical aspects of robotic applications.

MECH7012 Principles of engineering management (6 credits)

The focus of this course is on the basic principles, methods, and functions of engineering management. An overview of systems engineering is provided, with coverage on the design and management of an enterprise as an integrated system. The course objectives are: (1) acquire the essential principles of engineering management and understand how to apply these principles in daily practice in industry; and (2) understand and apply methods for managing the operations of engineering companies in the global business environment.

Topics include: systems engineering; core concepts and tools for the management of operations: operations planning and control functions, ERP systems; contemporary topics and approaches in engineering management: supply chain, green management, ethics, corporate social responsibility and compliance, risk and crisis management.

MECH7013 Gas engineering (6 credits)

This course is mainly related to gas engineering theories and technologies that are commonly used in our society in various applications such as power and gas utilities, as well as domestic and commercial heating appliances. The world gas and energy market will be firstly highlighted to indicate the importance of the gas as a clean fuel. Then, operation principles of basic gas production, gas transportation systems and gas utilization systems, their advantages, and major drawbacks will be taught. The environmental and safety aspects due to the production, transportation and utilization of the gaseous fuels will also be included in the course.

CIVL6002 Advanced finite elements (6 credits)

Equilibrium and virtual work principle; variation principle; numerical integration; computer applications; convergence and error estimate; hybrid and mixed methods for multi-field problems; enhanced and assumed strain method; nonlinear problems.

Cross-listed Undergraduate courses

The following cross-listed undergraduate courses, which are not counted for the fulfilment of the curriculum requirements and the classification of award of the degree of MSc(Eng) in Mechanical Engineering, are provided to make up the academic discrepancy and strengthen mechanical engineering fundamentals for students from different academic background, e.g. overseas curricula or non-local universities. Students can take up to two (equivalent 12 credits) courses from the list below:

MECH4411 Heat transfer (6 credits)

This course is on the fundamental principles of heat transfer, covering heat conduction, heat convection and heat exchangers. The course objectives are: (1) to provide an understanding of fundamental principles of heat transfer; and (2) to enable students to use the fundamental principles for conducting thermal analysis and design of engineering problems. At the end of this course, students who fulfill the requirements of this course will be able to: (1) demonstrate an understanding of the principles that govern heat transfer processes; (2) analyze heat-transfer problems quantitatively; and (3) identify relevant engineering solutions in thermal systems.

Topics include: Fourier's law; heat-conduction equation; thermal conductivity; conduction; fins; basic convection principles; laminar and turbulent heat transfer in tubes and over plates; Reynolds analogy; types of heat exchangers; overall heat-transfer coefficient; log mean temperature difference; effectiveness-NTU method; heat exchanger design.

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

---

MECH4415 Applied stress and strength analysis (6 credits)

The aims of this course are to: (1) formulate three-dimensional theory of elasticity and introduce the theory of plasticity; (2) introduce analytical and numerical methods for solving practical engineering problems; and (3) introduce theories of fracture and fatigue and their applications to practical engineering problems.

Topics include: theory of elasticity; plastic analysis; finite element methods for two- and three- dimensional continua; rectangular plate bending; fracture mechanics.

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

---

MECH4421 Viscous flow (6 credits)

This course aims to: (1) elucidate the advanced dynamics of liquids and gases, including steady and unsteady solutions of the Navier-Stokes equations, (2) perform a study on the properties, mass flux and momentum flux of a boundary layer, (3) explain the basic mechanics of a compressible fluid flow and applications to aerodynamics, (4) discuss the ideas of surface tension and stability in simple multiphase flows; To derive the Plateau-Rayleigh instability as the basic governing model for the linear stability of droplet formation, and (5) understand the complex flow patterns behind bluff bodies, mechanisms associated with vortex shedding and drag force; To characterize the low Reynolds number flow around a sphere and to measure viscosity using the Stokes' drag formula, and (6) introduce elementary concepts of turbulence.

Topics include: continuity and Navier-Stokes equations; Laminar boundary layers; Surface tension; Elementary concepts of compressible flows and shock waves; stability theory; flow behind bluff bodies; low Reynolds number flows and turbulent flows.

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

Course approved for reimbursement from the Continuing Education Fund (CEF) (applicable to Hong Kong Residents only)

MECH6034 Computer-aided product development (CAPD) (6 credits)

MSC(ENG) IN MECHANICAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2016-17)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Mechanical Engineering that are not classified as discipline courses.

Capstone Experience# – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	**No. of Credits**
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience#	24
Total	72

The curriculum provides advanced postgraduate education in the fields of energy and power; environmental engineering; material technology; theoretical mechanics and computer integrated design and manufacturing to graduates in engineering or related science.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses, including at least 3 courses from List A, and a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Course Coordinators.

The following is a list of discipline courses offered by the Department of Mechanical Engineering. 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.

[#] *Special approval has been given by the Senate for candidates admitted to the part-time mode of the curriculum in the academic year 2016-17 to take additional discipline courses of the same credit value in lieu of the capstone experience to satisfy the curriculum requirements.*

List A discipline courses

MECH6010 Service behaviour of materials (6 credits)

The aims of this course are: (1) to study the relevant physical basis for the understanding and prediction of the service behaviour, such as creep, fracture, fatigue and corrosion, of materials in industrial applications; and (2) to provide the knowledge to engineers the microstructure in such a way that the service behaviour of materials can be improved.

Topics include: creep regimes; creep mechanisms; creep resistant alloys; brittle fracture; ductile fracture; brittle-ductile transition; fracture mechanism maps; fatigue; Basquins and Coffin-Manson Laws; Goodman's relation; Palmgren-Miner rule; corrosion; electrochemical principles; forms of corrosion; corrosion control; case studies; service behaviour of engineering plastics; polymer-matrix composites.

MECH6026 Computational fluid dynamics (6 credits)

This course aims to provide practicing engineers and researchers who are learning about Computational Fluid Dynamics (CFD) for the first time with the basic knowledge of numerical techniques and applications of CFD to solve engineering problems.

Topics include: fundamental concepts and equations of fluid dynamics; finite-difference method for solving partial differential equations (stability, consistency, convergence, accuracy and efficiency, and solution of system of algebraic equations); simplified models for fluid flow (wave equation) and heat transfer (heat equation); grid generation; turbulent diffusion and shear flow dispersion; numerical solution of transport equations (mass; momentum and energy transport); applications involving the built environment, air pollution, atmospheric diffusion and dissipation, power-plant design, land-air- and marine-vehicle design; etc.

MECH6034 Computer-aided product development (CAPD) (6 credits)

This course will focus on main technologies related to computer-aided product development, including popular product development methodologies, computer-aided design, haptic shape modelling, reverse engineering, additive manufacturing and rapid tooling. The specific course objectives are: (1) To have a good understanding of popular product development methodologies, product development processes; (2) to understand major technologies that can be used to assist product development at different phases; (3) to be able to apply the computer-aided product development technologies to develop a simple product; and (4) to understand the constraints of manufacturing and cost in product development.

Topics include: product development methodologies; basic product manufacturing technologies; design for manufacturing; product costing and value engineering; solid modelling techniques; reverse engineering; additive manufacturing.

MECH6047 Finite element analysis in mechanics (6 credits)

This course aims to: (1) introduce the basic concepts and procedures in finite element analysis; (2) introduce the methods of analysis using the finite element method for mechanics problems in engineering; and (3) provide hands-on experience on conducting various mechanics analyses by using a state-of-the-art finite element software.

Topics include: concepts and procedures in finite element analysis; elasticity analysis of truss, beam, plane and plate problems; thermo-mechanical analysis; direct integration methods for dynamic analysis; geometric and material nonlinear analyses; contact analysis; hands-on experience of finite element analysis.

For students taking the course in the academic year 2017-18 and thereafter:

This course aims to: (1) introduce the basic concepts and procedures in finite element analysis; (2) introduce the methods of analysis using the finite element method for mechanics problems in engineering; and (3) provide hands-on experience on conducting various mechanics analyses by using a state-of-the-art finite element software.

Topics include: concepts and procedures in finite element analysis; elasticity analysis of truss, beam, plane and plate problems; thermo-mechanical analysis; modal analysis; direct integration methods for dynamic analysis; geometric and material nonlinear analyses; contact analysis; hands-on experience of finite element analysis.

MECH7011 Applied thermodynamics and power plant technology (6 credits)

This course is focused on understanding the operating principles of power plants for the generation of electric power. The course objectives are to: (1) provide students with the working principles of various types of power plants, including fossil fuels, nuclear fuels and renewable energy; and (2) enable students to understand the thermodynamic principles, emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.

Topics include: sources of energy; thermodynamic properties of states; types of power plants; portable combustion engines; Brayton cycle; gas turbines; Rankine cycle; steam power plants; nuclear power plant; solar farm; wind turbines; thermoelectric energy.

Students who have taken and passed MECH6023 will not be allowed to take MECH7011.

<u>List B discipline courses</u>

MECH6017 Noise and vibration (6 credits)

This course aims to provide an integrated treatment for vibration system, noise radiation and the available control methods in engineering. Upon completing this course, the students are expected to: (1) explain the basic characteristics of a simple vibration system; (2) understand the mechanism of noise radiation by structural vibration or turbulent flow, and its impact on human hearing; and (3) offer solution to typical noise and vibration problems. The following are covered in the course: (i) fundamentals of vibration and its control, (ii) human hearing and environmental noise sources and their mitigation, (iii) noise control.

Topics include: fundamentals of single- and multiple degree of freedom systems; vibration modes and finite element analyses; vibration measurement; vibration isolation; sound radiation by vibration and flow; human hearing; environmental legislation and guidelines; sound propagation and duct acoustics; noise absorption and reflection; control of noise at the source.

MECH6018 Atmospheric environment modelling (6 credits)

This course aims to: (1) provide rigorous and comprehensive treatment of various modelling methodologies on the atmospheric environment and air pollution dispersion; and (2) introduce the state-of-the-art of various modelling packages for use in industry.

Topics include: foundations of atmospheric dynamics, models of winds, atmospheric turbulence modelling, boundary layer climate, air pollution in the boundary layer and atmospheric dispersion modelling.

MECH6019 Sources and control of air pollution (6 credits)

This course aims to: (1) provide understanding of the natural and anthropogenic sources of air pollution; and (2) introduce ways to prevent, control and minimize pollution by application of various control practices.

Topics include: concepts and procedures in basis of air pollution, air pollutant transport, sources of air pollutants, control of gaseous pollutants, control of particulate matter, atmospheric dispersion modelling.

MECH6024 Applied mathematics for engineers (6 credits)

This course aims to introduce some advanced knowledge of computational and statistical analysis and methods and provide the students with the ability to apply computational and statistical methods to solve engineering problems.

Topics include: statistical and numerical methods in engineering; hypothesis testing; estimation of parameters and confidence intervals; correlation coefficient; direct and iterative methods for systems of equations; optimization; numerical analysis.

EMEE6004 Energy conservation and management (6 credits)

This course aims to: (1) understand the technological, social, economic and environmental factors related to the use of fossil fuels and renewable energy; (2) understand the major energy consumers in buildings, transportation and industrial processes; and (3) identify effective energy conservation and conduct energy audits and management systems.

Topics include: energy sources and environmental impact; energy in buildings; energy-efficient industrial processes; waste heat recovery; energy storage; energy auditing; energy strategies and management.

Students who have taken and passed MECH6033 will not be allowed to take EMEE6004.

MECH6039 Biomaterials and tissue engineering (6 credits)

This course aims to: (1) equip students with a broad knowledge of biomaterials science and engineering and also tissue engineering; (2) have an in-depth understanding of various types of biomaterials currently in clinical use; (3) learn various techniques for developing, analysing and testing new biomaterials; and (4) make students aware of prosthetic medical device regulations and standards for materials and devices; to learn the most recent developments in the biomaterials and tissue engineering field and also future trends.

Topics include: definitions and fundamentals in biomaterials science and engineering; classification for biomaterials; criteria for biomaterials; bioceramics; metallic biomaterials; bioactive ceramic coatings; biomedical polymers; biomedical composites; analytical and testing techniques for developing new biomaterials; long-term performance of biomaterials; degradation of biomaterials in the human body environment; tissue engineering: principles, methods and applications; standards and regulatory issues; new trends in R & D of biomaterials and tissue engineering.

EMEE6005 Renewable energy technology I: Fundamental (6 credits)

This course focuses mainly on different renewable energy technologies including hydro power, wind power, bioenergy, solar thermal, solar PV, energy storage, and energy usage. The specific course objectives are: (1) to have a deep understanding of the important role played by renewable energy in our energy supply; and (2) to grasp the fundamentals of different energy resources; (3) to understand energy storage and its important role in solving intermittency and other issues; and (4) to understand how to use energy more efficiently with solid state lighting and other energy saving technologies.

Topics include: renewable energy in a big picture; hydro power; winder power; solar thermal; solar PV; bioenergy; energy storage: intermittancy and other issues; energy usage: solid state lighting.

Students who have taken and passed MECH6042 will not be allowed to take EMEE6005.

EMEE6006 Renewable energy technology II: Advanced (6 credits)

This course is on the working principles of advanced energy conversion devices including solar cells, fuel cells, batteries, photoelectrochemical (PEC) water splitting cells, and thermoelectric cells. Also covered are the energy carriers in different materials and the connection between different energy conversion devices. The specific course objectives are as: (1) to have a deep understanding of the energy carriers in different materials and their important roles in energy conversion; (2) to grasp the working principles of different energy conversion devices; (3) to be able to tell the differences and similarities between different energy conversion devices; and (4) to be able to design more efficient energy conversion devices.

Topics include: introduction: energy carriers in energy conversion cells; solar cells; fuel cells; electrochemical cells; photoelectrochemical (PEC) water splitting; thermoelectric cells.

Pre-requisite: EMEE6005 or for students who have previously passed MECH6042 or MECH6009 which have been obsolete with effect from 2014-2015 and 2011-2012 respectively

Students who have taken and passed MECH6043 will not be allowed to take EMEE6006.

EMEE6007 Energy and carbon audit (6 credits)

This course aims to: (1) provide students with the fundamental principles, skills and guidelines needed to carry out effective energy and carbon audits for the commercial and industrial sectors; (2) enable students to identify energy saving and carbon reduction measures and perform quantitative analysis to predict the energy savings and carbon reduction, environmental and economic benefits; and (3) enable students to verify the performance of implemented energy saving and carbon reduction measures.

Topics include: greenhouse gas emission; global warming; energy benchmarking; electrical distribution system; power quality and power factor; energy efficient lighting; motor; HVAC energy audit; refrigeration cycle; passive cooling; heating appliances; energy consumptions in compressors and pumps; energy saving measurements; local and international guidelines in energy and carbon audit; carbon footprint calculator.

Students who have taken and passed MECH6044 will not be allowed to take EMEE6007.

MECH6045 Nanotechnology: fundamentals and applications (6 credits)

Nanotechnology is a rapidly developing discipline which has emerged from foundations based in microtechnology built up during the past few decades. Many exciting engineering applications in nanotechnology have been proposed and some are already in use. The current intensive research activities world-wide make it highly likely that many more products and applications in nanotechnology will emerge in the next few decades. This course aims at: (1) to equip students with fundamental knowledge and concepts on micro- and nano-technology, and to enable the students to apply such knowledge in future careers in both industry and universities; (2) to enable students to understand the effects of material size on behaviour and properties, and from these to appreciate the new possibilities in both fundamental science and practical applications brought about by nanotechnology; and (3) to introduce students to promising and emerging applications of nanotechnology in energy storage/conversion, unconventional materials and optical metamaterials, and help students to further research and/or work in specific application areas.

Topics include: characteristic length scales, nanomaterials, nanostructures, physical properties of nanostructures, deposition techniques of nanofabrication, micro/nanolithography, high resolution analysis and characterization, scanning probe methods, nanoindentation, mechanical behaviours of bulk nanostructured materials, processing techniques for bulk nanostructured materials, ultrahigh strength of nanostructures, bio-nanotechnology, energy storage, energy conversion, nanophotonics, plasmonics, optical metamaterial.

Students who have taken and passed MECH6040 will not be allowed to take MECH6045.

MECH6046 Microsystems for energy, biomedical and consumer electronics applications (6 credits)

Microelectromechanical systems (MEMS) and microfluidics have gradually found numerous applications in modern energy, mechanical engineering and biomedical engineering applications. This course aims to provide students with the necessary fundamental knowledge and experience in the working principles, design, materials, fabrication and packaging, and applications of MEMS and microfluidic systems. MEMS and microfluidic devices are emerging platforms for modern engineering applications in biomedicine, chemistry, material sciences and micro-machines. This is the course that will introduce graduate students and practicing engineers into the growing field of microsystem engineering. Practical examples will be given when delivering each major topic. Teaching of the course is also strengthened

with case studies on carefully chosen topics. At the end of this course, students who fulfill the requirements of this course will be able to: (1) demonstrate ability to understand the fundamental principles behind MEMS and microfluidic; (2) differentiate different MEMS and microfluidic techniques and understand their importance in modern engineering; (3) apply concepts of micro-systems for industrial applications, particularly in energy, mechanical engineering and biomedical engineering.

Topics include: MEMS and microsystem products; microsensors; microactuators; microfluidic devices; multidisciplinary nature of microsystem design and manufacture; fluid mechanics in microscaled flows; materials for MEMS and microfluidic devices; fluid mechanics in microscaled flows; fabrication techniques of MEMS and microfluidic devices; flow characterization techniques; flow control with microfluidics; microfluidics for life sciences and chemistry.

Students who have taken and passed MECH6032 will not be allowed to take MECH6046.

MECH6048 Dissertation (24 credits)[#]

It involves undertaking a dissertation or report on a topic consisting of design, experimental or analytical investigation by individual students. The objectives are to: (1) simulate a realistic working experience for students; (2) provide them an experience of applying engineering principles, engineering economics, business or management skills; and (3) train students to work independently to obtain an effective and acceptable solution to industry-related or research-type problems.

MECH7010 Contemporary robotics (6 credits)

This course aims to explore the major technologies related to modern robotic systems, including the components and working principles of robots, automatic and computer-aided control, kinematics and control of industrial robotic manipulators, humanoid and biomimetic robots. The specific course objectives are listed as follows: (1) to have a comprehensive understanding of robotic systems in terms of their principles, historical evolutions, and applications for both industrial and civilian applications; (2) to understand the mathematical foundations, designs, data processing, and real-time control of various sensing and actuation units which comprise a robotic system; (3) to study the robot kinematics modelling, and the basic knowledge of intelligent motion planning that can enable effective manipulation in various applications; and (4) to explore the challenges and trends in contemporary robotic research, and the future directions for application of robotic components.

Topics include: a) Historical and contemporary robotic systems; b) Concept and components of robots, sensors and actuators; c) Robot kinematics; d) Robotic control and human interaction; e) Intelligent motion planning and localization; f) Applications and challenges of robots; g) Social, economic and ethical aspects of robotic applications.

MECH7012 Principles of engineering management (6 credits)

The focus of this course is on the basic principles, methods, and functions of engineering management. An overview of systems engineering is provided, with coverage on the design and management of an enterprise as an integrated system. The course objectives are: (1) acquire the essential principles of engineering management and understand how to apply these principles in daily practice in industry; and (2) understand and apply methods for managing the operations of engineering companies in the global business environment.

Topics include: systems engineering; core concepts and tools for the management of operations: operations planning and control functions, ERP systems; contemporary topics and approaches in engineering management: supply chain, green management, ethics, corporate social responsibility and compliance, risk and crisis management.

[#] *Special approval has been given by the Senate for candidates admitted to the part-time mode of the curriculum in the academic year 2016-17 to take additional discipline courses of the same credit value in lieu of the capstone experience to satisfy the curriculum requirements.*

MECH7013 Gas engineering (6 credits)

This course is mainly related to gas engineering theories and technologies that are commonly used in our society in various applications such as power and gas utilities, as well as domestic and commercial heating appliances. The world gas and energy market will be firstly highlighted to indicate the importance of the gas as a clean fuel. Then, operation principles of basic gas production, gas transportation systems and gas utilization systems, their advantages, and major drawbacks will be taught. The environmental and safety aspects due to the production, transportation and utilization of the gaseous fuels will also be included in the course.

CIVL6002 Advanced finite elements (6 credits)

Equilibrium and virtual work principle; variation principle; numerical integration; computer applications; convergence and error estimate; hybrid and mixed methods for multi-field problems; enhanced and assumed strain method; nonlinear problems.

Cross-listed Undergraduate courses

The following cross-listed undergraduate courses, which are not counted for the fulfilment of the curriculum requirements and the classification of award of the degree of MSc(Eng) in Mechanical Engineering, are provided to make up the academic discrepancy and strengthen mechanical engineering fundamentals for students from different academic background, e.g. overseas curricula or non-local universities. Students can take up to 12 credits of courses from the list below:

MECH4411 Heat transfer (6 credits)

This course is on the fundamental principles of heat transfer, covering heat conduction, heat convection and heat exchangers. The course objectives are: (1) to provide an understanding of fundamental principles of heat transfer; and (2) to enable students to use the fundamental principles for conducting thermal analysis and design of engineering problems. At the end of this course, students who fulfill the requirements of this course will be able to: (1) demonstrate an understanding of the principles that govern heat transfer processes; (2) analyze heat-transfer problems quantitatively; and (3) identify relevant engineering solutions in thermal systems.

Topics include: Fourier's law; heat-conduction equation; thermal conductivity; conduction; fins; basic convection principles; laminar and turbulent heat transfer in tubes and over plates; Reynolds analogy; types of heat exchangers; overall heat-transfer coefficient; log mean temperature difference; effectiveness-NTU method; heat exchanger design.

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

MECH4415 Applied stress and strength analysis (6 credits)

The aims of this course are to: (1) formulate three-dimensional theory of elasticity and introduce the theory of plasticity; (2) introduce analytical and numerical methods for solving practical engineering problems; and (3) introduce theories of fracture and fatigue and their applications to practical engineering problems.

Topics include: theory of elasticity; plastic analysis; finite element methods for two- and three- dimensional continua; rectangular plate bending; fracture mechanics.

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

---

MECH4421 Viscous flow (6 credits)

This course aims to: (1) elucidate the advanced dynamics of liquids and gases, including steady and unsteady solutions of the Navier-Stokes equations, (2) perform a study on the properties, mass flux and momentum flux of a boundary layer, (3) explain the basic mechanics of a compressible fluid flow and applications to aerodynamics, (4) discuss the ideas of surface tension and stability in simple multiphase flows; To derive the Plateau-Rayleigh instability as the basic governing model for the linear stability of droplet formation, and (5) understand the complex flow patterns behind bluff bodies, mechanisms associated with vortex shedding and drag force; To characterize the low Reynolds number flow around a sphere and to measure viscosity using the Stokes' drag formula, and (6) introduce elementary concepts of turbulence.

Topics include: continuity and Navier-Stokes equations; Laminar boundary layers; Surface tension; Elementary concepts of compressible flows and shock waves; stability theory; flow behind bluff bodies; low Reynolds number flows and turbulent flows.

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

---

Course approved for reimbursement from the Continuing Education Fund (CEF) (applicable to Hong Kong Residents only)

MECH6034 Computer-aided product development (CAPD) (6 credits)

MSC(ENG) IN MECHANICAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2015-16)

Objectives

The aim of the curriculum is to provide advanced postgraduate education in the fields of energy and power; environmental engineering; material technology; theoretical mechanics and computer integrated design and manufacturing to graduates in engineering or related science.

Modes of Study

There are two modes of study available: full-time or part-time. The full-time curriculum requires a student to satisfactorily complete 8 modules and a dissertation within a study period of 1 to 2 years. For students enrolled in the part-time curriculum, they may opt to either satisfactorily complete 12 modules or 8 modules plus a dissertation within a study period of 2 to 3 years.

Study Modules

The following study modules are the discipline modules of the curriculum. A number of these discipline modules will be selected for offer to students in each academic year. A student who does not undertake a dissertation must complete at least 9 discipline modules (of which at least 3 from List A). A student who undertakes a dissertation must complete at least 5 discipline modules (of which at least 3 from List A). Students can select Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives.

The following list is not final and some modules may not be offered every year.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

List A discipline modules

MECH6010 Service behaviour of materials

The aims of this module are: (1) to study the relevant physical basis for the understanding and prediction of the service behaviour, such as creep, fracture, fatigue and corrosion, of materials in industrial applications; and (2) to provide the knowledge to engineers the microstructure in such a way that the service behaviour of materials can be improved.

Topics include: creep regimes; creep mechanisms; creep resistant alloys; brittle fracture; ductile fracture; brittle-ductile transition; fracture mechanism maps; fatigue; Basquins and Coffin-Manson Laws; Goodman's relation; Palmgren-Miner rule; corrosion; electrochemical principles; forms of corrosion; corrosion control; case studies; service behaviour of engineering plastics; polymer-matrix composites.

MECH6026 Computational fluid dynamics

This module aims to provide practicing engineers and researchers who are learning about Computational Fluid Dynamics (CFD) for the first time with the basic knowledge of numerical techniques and applications of CFD to solve engineering problems.

Topics include: fundamental concepts and equations of fluid dynamics; finite-difference method for solving partial differential equations (stability, consistency, convergence, accuracy and efficiency, and solution of system of algebraic equations); simplified models for fluid flow (wave equation) and heat

transfer (heat equation); grid generation; turbulent diffusion and shear flow dispersion; numerical solution of transport equations (mass; momentum and energy transport); applications involving the built environment, air pollution, atmospheric diffusion and dissipation, power-plant design, land-air- and marine-vehicle design; etc.

MECH6034 Computer-aided product development (CAPD) *

This module will focus on main technologies related to computer-aided product development, including popular product development methodologies, computer-aided design, haptic shape modelling, reverse engineering, additive manufacturing and rapid tooling. The specific module objectives are: (1) To have a good understanding of popular product development methodologies, product development processes; (2) to understand major technologies that can be used to assist product development at different phases; (3) to be able to apply the computer-aided product development technologies to develop a simple product; and (4) to understand the constraints of manufacturing and cost in product development.

Topics include: product development methodologies; basic product manufacturing technologies; design for manufacturing; product costing and value engineering; solid modelling techniques; reverse engineering; additive manufacturing.

MECH6047 Finite element analysis in mechanics

This module aims to: (1) introduce the basic concepts and procedures in finite element analysis; (2) introduce the methods of analysis using the finite element method for mechanics problems in engineering; and (3) provide hands-on experience on conducting various mechanics analyses by using a state-of-the-art finite element software.

Topics include: concepts and procedures in finite element analysis; elasticity analysis of truss, beam, plane and plate problems; thermo-mechanical analysis; direct integration methods for dynamic analysis; geometric and material nonlinear analyses; contact analysis; hands-on experience of finite element analysis.

For students taking the module in the academic year 2017-18 and thereafter:

This module aims to: (1) introduce the basic concepts and procedures in finite element analysis; (2) introduce the methods of analysis using the finite element method for mechanics problems in engineering; and (3) provide hands-on experience on conducting various mechanics analyses by using a state-of-the-art finite element software.

Topics include: concepts and procedures in finite element analysis; elasticity analysis of truss, beam, plane and plate problems; thermo-mechanical analysis; modal analysis; direct integration methods for dynamic analysis; geometric and material nonlinear analyses; contact analysis; hands-on experience of finite element analysis.

MECH7011 Applied thermodynamics and power plant technology

This module is focused on understanding the operating principles of power plants for the generation of electric power. The module objectives are to: (1) provide students with the working principles of various types of power plants, including fossil fuels, nuclear fuels and renewable energy; and (2) enable students to understand the thermodynamic principles, emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.

Topics include: sources of energy; thermodynamic properties of states; types of power plants; portable combustion engines; Brayton cycle; gas turbines; Rankine cycle; steam power plants; nuclear power plant; solar farm; wind turbines; thermoelectric energy.

Students who have taken and passed MECH6023 will not be allowed to take MECH7011.

List B discipline modules

MECH6017 Noise and vibration

This module aims to provide an integrated treatment for vibration system, noise radiation and the available control methods in engineering. Upon completing this module, the students are expected to: (1) explain the basic characteristics of a simple vibration system; (2) understand the mechanism of noise radiation by structural vibration or turbulent flow, and its impact on human hearing; and (3) offer solution to typical noise and vibration problems. The following are covered in the module: (i) fundamentals of vibration and its control, (ii) human hearing and environmental noise sources and their mitigation, (iii) noise control.

Topics include: fundamentals of single- and multiple degree of freedom systems; vibration modes and finite element analyses; vibration measurement; vibration isolation; sound radiation by vibration and flow; human hearing; environmental legislation and guidelines; sound propagation and duct acoustics; noise absorption and reflection; control of noise at the source.

MECH6018 Atmospheric environment modelling

This module aims to: (1) provide rigorous and comprehensive treatment of various modelling methodologies on the atmospheric environment and air pollution dispersion; and (2) introduce the state-of-the-art of various modelling packages for use in industry.

Topics include: foundations of atmospheric dynamics, models of winds, atmospheric turbulence modelling, boundary layer climate, air pollution in the boundary layer and atmospheric dispersion modelling.

MECH6019 Sources and control of air pollution

This module aims to: (1) provide understanding of the natural and anthropogenic sources of air pollution; and (2) introduce ways to prevent, control and minimize pollution by application of various control practices.

Topics include: concepts and procedures in basis of air pollution, air pollutant transport, sources of air pollutants, control of gaseous pollutants, control of particulate matter, atmospheric dispersion modelling.

MECH6024 Applied mathematics for engineers

This module aims to introduce some advanced knowledge of computational and statistical analysis and methods and provide the students with the ability to apply computational and statistical methods to solve engineering problems.

Topics include: statistical and numerical methods in engineering; hypothesis testing; estimation of parameters and confidence intervals; correlation coefficient; direct and iterative methods for systems of equations; optimization; numerical analysis.

EMEE6004 Energy conservation and management

This module aims to: (1) understand the technological, social, economic and environmental factors related to the use of fossil fuels and renewable energy; (2) understand the major energy consumers in buildings, transportation and industrial processes; and (3) identify effective energy conservation and conduct energy audits and management systems.

Topics include: energy sources and environmental impact; energy in buildings; energy-efficient industrial processes; waste heat recovery; energy storage; energy auditing; energy strategies and management.

Students who have taken and passed MECH 6033 will not be allowed to take EMEE6004.

MECH6039 Biomaterials and tissue engineering

This module aims to: (1) equip students with a broad knowledge of biomaterials science and engineering and also tissue engineering; (2) have an in-depth understanding of various types of biomaterials currently in clinical use; (3) learn various techniques for developing, analysing and testing new biomaterials; and (4) make students aware of prosthetic medical device regulations and standards for materials and devices; to learn the most recent developments in the biomaterials and tissue engineering field and also future trends.

Topics include: definitions and fundamentals in biomaterials science and engineering; classification for biomaterials; criteria for biomaterials; bioceramics; metallic biomaterials; bioactive ceramic coatings; biomedical polymers; biomedical composites; analytical and testing techniques for developing new biomaterials; long-term performance of biomaterials; degradation of biomaterials in the human body environment; tissue engineering: principles, methods and applications; standards and regulatory issues; new trends in R & D of biomaterials and tissue engineering.

EMEE6005 Renewable energy technology I: Fundamental

This module focuses mainly on different renewable energy technologies including hydro power, wind power, bioenergy, solar thermal, solar PV, energy storage, and energy usage. The specific module objectives are: (1) to have a deep understanding of the important role played by renewable energy in our energy supply; and (2) to grasp the fundamentals of different energy resources; (3) to understand energy storage and its important role in solving intermittency and other issues; and (4) to understand how to use energy more efficiently with solid state lighting and other energy saving technologies.

Topics include: renewable energy in a big picture; hydro power; winder power; solar thermal; solar PV; bioenergy; energy storage: intermittancy and other issues; energy usage: solid state lighting.

Students who have taken and passed MECH 6042 will not be allowed to take EMEE6005.

EMEE6006 Renewable energy technology II: Advanced

This module is on the working principles of advanced energy conversion devices including solar cells, fuel cells, batteries, photoelectrochemical (PEC) water splitting cells, and thermoelectric cells. Also covered are the energy carriers in different materials and the connection between different energy conversion devices. The specific module objectives are as: (1) to have a deep understanding of the energy carriers in different materials and their important roles in energy conversion; (2) to grasp the

working principles of different energy conversion devices; (3) to be able to tell the differences and similarities between different energy conversion devices; and (4) to be able to design more efficient energy conversion devices.

Topics include: introduction: energy carriers in energy conversion cells; solar cells; fuel cells; electrochemical cells; photoelectrochemical (PEC) water splitting; thermoelectric cells.

Pre-requisite: EMEE6005 or for students who have previously passed MECH6042 or MECH6009 which have been obsolete with effect from 2014-2015 and 2011-2012 respectively

Students who have taken and passed MECH 6043 will not be allowed to take EMEE6006.

EMEE6007 Energy and carbon audit

This module aims to: (1) provide students with the fundamental principles, skills and guidelines needed to carry out effective energy and carbon audits for the commercial and industrial sectors; (2) enable students to identify energy saving and carbon reduction measures and perform quantitative analysis to predict the energy savings and carbon reduction, environmental and economic benefits; and (3) enable students to verify the performance of implemented energy saving and carbon reduction measures.

Topics include: greenhouse gas emission; global warming; energy benchmarking; electrical distribution system; power quality and power factor; energy efficient lighting; motor; HVAC energy audit; refrigeration cycle; passive cooling; heating appliances; energy consumptions in compressors and pumps; energy saving measurements; local and international guidelines in energy and carbon audit; carbon footprint calculator.

Students who have taken and passed MECH 6044 will not be allowed to take EMEE6007.

MECH6045 Nanotechnology: fundamentals and applications

Nanotechnology is a rapidly developing discipline which has emerged from foundations based in microtechnology built up during the past few decades. Many exciting engineering applications in nanotechnology have been proposed and some are already in use. The current intensive research activities world-wide make it highly likely that many more products and applications in nanotechnology will emerge in the next few decades. This module aims at: (1) to equip students with fundamental knowledge and concepts on micro- and nano-technology, and to enable the students to apply such knowledge in future careers in both industry and universities; (2) to enable students to understand the effects of material size on behaviour and properties, and from these to appreciate the new possibilities in both fundamental science and practical applications brought about by nanotechnology; and (3) to introduce students to promising and emerging applications of nanotechnology in energy storage/conversion, unconventional materials and optical metamaterials, and help students to further research and/or work in specific application areas.

Topics include: characteristic length scales, nanomaterials, nanostructures, physical properties of nanostructures, deposition techniques of nanofabrication, micro/nanolithography, high resolution analysis and characterization, scanning probe methods, nanoindentation, mechanical behaviours of bulk nanostructured materials, processing techniques for bulk nanostructured materials, ultrahigh strength of nanostructures, bio-nanotechnology, energy storage, energy conversion, nanophotonics, plasmonics, optical metamaterial.

Students who have taken and passed MECH 6040 will not be allowed to take MECH6045.

MECH6046 Microsystems for energy, biomedical and consumer electronics applications

Microelectromechanical systems (MEMS) and microfluidics have gradually found numerous applications in modern energy, mechanical engineering and biomedical engineering applications. This module aims to provide students with the necessary fundamental knowledge and experience in the working principles, design, materials, fabrication and packaging, and applications of MEMS and microfluidic systems. MEMS and microfluidic devices are emerging platforms for modern engineering applications in biomedicine, chemistry, material sciences and micro-machines. This is the module that will introduce graduate students and practicing engineers into the growing field of microsystem engineering. Practical examples will be given when delivering each major topic. Teaching of the module is also strengthened with case studies on carefully chosen topics. At the end of this module, students who fulfill the requirements of this module will be able to: (1) demonstrate ability to understand the fundamental principles behind MEMS and microfluidic; (2) differentiate different MEMS and microfluidic techniques and understand their importance in modern engineering;
(3) apply concepts of micro-systems for industrial applications, particularly in energy, mechanical engineering and biomedical engineering.

Topics include: MEMS and microsystem products; microsensors; microactuators; microfluidic devices; multidisciplinary nature of microsystem design and manufacture; fluid mechanics in microscaled flows; materials for MEMS and microfluidic devices; fluid mechanics in microscaled flows; fabrication techniques of MEMS and microfluidic devices; flow characterization techniques; flow control with microfluidics; microfluidics for life sciences and chemistry.

Students who have taken and passed MECH 6032 will not be allowed to take MECH6046.

MECH6048 Dissertation (4 modules)

It involves undertaking a dissertation or report on a topic consisting of design, experimental or analytical investigation by individual students. The objectives are to: (1) simulate a realistic working experience for students; (2) provide them an experience of applying engineering principles, engineering economics, business or management skills; and (3) train students to work independently to obtain an effective and acceptable solution to industry-related or research-type problems.

MECH7010 Contemporary robotics

This module aims to explore the major technologies related to modern robotic systems, including the components and working principles of robots, automatic and computer-aided control, kinematics and control of industrial robotic manipulators, humanoid and biomimetic robots. The specific module objectives are listed as follows: (1) to have a comprehensive understanding of robotic systems in terms of their principles, historical evolutions, and applications for both industrial and civilian applications; (2) to understand the mathematical foundations, designs, data processing, and real-time control of various sensing and actuation units which comprise a robotic system; (3) to study the robot kinematics modelling, and the basic knowledge of intelligent motion planning that can enable effective manipulation in various applications; and (4) to explore the challenges and trends in contemporary robotic research, and the future directions for application of robotic components.

Topics include: a) Historical and contemporary robotic systems; b) Concept and components of robots, sensors and actuators; c) Robot kinematics; d) Robotic control and human interaction; e) Intelligent motion planning and localization; f) Applications and challenges of robots; g) Social, economic and ethical aspects of robotic applications.

MECH7012 Principles of engineering management

The focus of this module is on the basic principles, methods, and functions of engineering management. An overview of systems engineering is provided, with coverage on the design and management of an enterprise as an integrated system. The module objectives are: (1) acquire the essential principles of engineering management and understand how to apply these principles in daily practice in industry; and (2) understand and apply methods for managing the operations of engineering companies in the global business environment.

Topics include: systems engineering; core concepts and tools for the management of operations: operations planning and control functions, ERP systems; contemporary topics and approaches in engineering management: supply chain, green management, ethics, corporate social responsibility and compliance, risk and crisis management.

MECH7013 Gas engineering

This course is mainly related to gas engineering theories and technologies that are commonly used in our society in various applications such as power and gas utilities, as well as domestic and commercial heating appliances. The world gas and energy market will be firstly highlighted to indicate the importance of the gas as a clean fuel. Then, operation principles of basic gas production, gas transportation systems and gas utilization systems, their advantages, and major drawbacks will be taught. The environmental and safety aspects due to the production, transportation and utilization of the gaseous fuels will also be included in the course.

CIVL6002 Advanced finite elements

Equilibrium and virtual work principle; variation principle; numerical integration; computer applications; convergence and error estimate; hybrid and mixed methods for multi-field problems; enhanced and assumed strain method; nonlinear problems.

---

* Approved for reimbursement from the Continuing Education Fund (CEF) (applicable to Hong Kong Residents only)

MSC(ENG) IN MECHANICAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2014-15)

Objectives

The aim of the curriculum is to provide advanced postgraduate education in the fields of energy and power; environmental engineering; material technology; theoretical mechanics and computer integrated design and manufacturing to graduates in engineering or related science.

Modes of Study

There are two modes of study available: full-time or part-time. The full-time curriculum requires a student to satisfactorily complete 8 modules and a dissertation within a study period of 1 to 2 years. For students enrolled in the part-time curriculum, they may opt to either satisfactorily complete 12 modules or 8 modules plus a dissertation within a study period of 2 to 3 years.

Study Modules

The following study modules are the discipline modules of the curriculum. A number of these discipline modules will be selected for offer to students in each academic year. A student who does not undertake a dissertation must complete at least 9 discipline modules (of which at least 3 from List A). A student who undertakes a dissertation must complete at least 5 discipline modules (of which at least 3 from List A). Students can select Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives.

The following list is not final and some modules may not be offered every year.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

List A discipline modules

MECH6010 Service behaviour of materials

The aims of this module are: (1) to study the relevant physical basis for the understanding and prediction of the service behaviour, such as creep, fracture, fatigue and corrosion, of materials in industrial applications; and (2) to provide the knowledge to engineers the microstructure in such a way that the service behaviour of materials can be improved.

Topics include: creep regimes; creep mechanisms; creep resistant alloys; brittle fracture; ductile fracture; brittle-ductile transition; fracture mechanism maps; fatigue; Basquins and Coffin-Manson Laws; Goodman's relation; Palmgren-Miner rule; corrosion; electrochemical principles; forms of corrosion; corrosion control; case studies; service behaviour of engineering plastics; polymer-matrix composites.

MECH6017 Noise and vibration

This module aims to provide an integrated treatment for vibration system, noise radiation and the available control methods in engineering. Upon completing this module, the students are expected to: (1) explain the basic characteristics of a simple vibration system; (2) understand the mechanism of noise radiation by structural vibration or turbulent flow, and its impact on human hearing; and (3) offer solution to typical noise and vibration problems. The following are covered in the module: (i) fundamentals of vibration and its control, (ii) human hearing and environmental noise sources and their mitigation, (iii) noise control.

Topics include: fundamentals of single- and multiple degree of freedom systems; vibration modes and finite element analyses; vibration measurement; vibration isolation; sound radiation by vibration and flow; human hearing; environmental legislation and guidelines; sound propagation and duct acoustics; noise absorption and reflection; control of noise at the source.

MECH6026 Computational fluid dynamics

This module aims to provide practicing engineers and researchers who are learning about Computational Fluid Dynamics (CFD) for the first time with the basic knowledge of numerical techniques and applications of CFD to solve engineering problems.

Topics include: fundamental concepts and equations of fluid dynamics; finite-difference method for solving partial differential equations (stability, consistency, convergence, accuracy and efficiency, and

solution of system of algebraic equations); simplified models for fluid flow (wave equation) and heat transfer (heat equation); grid generation; turbulent diffusion and shear flow dispersion; numerical solution of transport equations (mass; momentum and energy transport); applications involving the built environment, air pollution, atmospheric diffusion and dissipation, power-plant design, land-air- and marine-vehicle design; etc.

MECH6034 Computer-aided product development (CAPD) *

This module will focus on main technologies related to computer-aided product development, including popular product development methodologies, computer-aided design, haptic shape modelling, reverse engineering, additive manufacturing and rapid tooling. The specific module objectives are: (1) To have a good understanding of popular product development methodologies, product development processes; (2) to understand major technologies that can be used to assist product development at different phases; (3) to be able to apply the computer-aided product development technologies to develop a simple product; and (4) to understand the constraints of manufacturing and cost in product development.

Topics include: product development methodologies; basic product manufacturing technologies; design for manufacturing; product costing and value engineering; solid modelling techniques; reverse engineering; additive manufacturing.

MECH6047 Finite element analysis in mechanics

This module aims to: (1) introduce the basic concepts and procedures in finite element analysis; (2) introduce the methods of analysis using the finite element method for mechanics problems in engineering; and (3) provide hands-on experience on conducting various mechanics analyses by using a state-of-the-art finite element software.

Topics include: concepts and procedures in finite element analysis; elasticity analysis of truss, beam, plane and plate problems; thermo-mechanical analysis; direct integration methods for dynamic analysis; geometric and material nonlinear analyses; contact analysis; hands-on experience of finite element analysis.

For students taking the module in the academic year 2017-18 and thereafter:

This module aims to: (1) introduce the basic concepts and procedures in finite element analysis; (2) introduce the methods of analysis using the finite element method for mechanics problems in engineering; and (3) provide hands-on experience on conducting various mechanics analyses by using a state-of-the-art finite element software.

Topics include: concepts and procedures in finite element analysis; elasticity analysis of truss, beam, plane and plate problems; thermo-mechanical analysis; modal analysis; direct integration methods for dynamic analysis; geometric and material nonlinear analyses; contact analysis; hands-on experience of finite element analysis.

List B discipline modules

MECH6018 Atmospheric environment modelling

This module aims to: (1) provide rigorous and comprehensive treatment of various modelling methodologies on the atmospheric environment and air pollution dispersion; and (2) introduce the state-of-the-art of various modelling packages for use in industry.

Topics include: foundations of atmospheric dynamics, models of winds, atmospheric turbulence modelling, boundary layer climate, air pollution in the boundary layer and atmospheric dispersion modelling.

MECH6019 Sources and control of air pollution

This module aims to: (1) provide understanding of the natural and anthropogenic sources of air pollution; and (2) introduce ways to prevent, control and minimize pollution by application of various control practices.

Topics include: concepts and procedures in basis of air pollution, air pollutant transport, sources of air pollutants, control of gaseous pollutants, control of particulate matter, atmospheric dispersion modelling.

MECH6024 Applied mathematics for engineers

This module aims to introduce some advanced knowledge of computational and statistical analysis and methods and provide the students with the ability to apply computational and statistical methods to solve engineering problems.

Topics include: statistical and numerical methods in engineering; hypothesis testing; estimation of parameters and confidence intervals; correlation coefficient; direct and iterative methods for systems of equations; optimization; numerical analysis.

EMEE6004 Energy conservation and management

This module aims to: (1) understand the technological, social, economic and environmental factors related to the use of fossil fuels and renewable energy; (2) understand the major energy consumers in buildings, transportation and industrial processes; and (3) identify effective energy conservation and conduct energy audits and management systems.

Topics include: energy sources and environmental impact; energy in buildings; energy-efficient industrial processes; waste heat recovery; energy storage; energy auditing; energy strategies and management.

Students who have taken and passed MECH 6033 will not be allowed to take EMEE6004.

MECH6039 Biomaterials and tissue engineering

This module aims to: (1) equip students with a broad knowledge of biomaterials science and engineering and also tissue engineering; (2) have an in-depth understanding of various types of biomaterials currently in clinical use; (3) learn various techniques for developing, analysing and testing new biomaterials; and (4) make students aware of prosthetic medical device regulations and standards for materials and devices; to learn the most recent developments in the biomaterials and tissue engineering field and also future trends.

Topics include: definitions and fundamentals in biomaterials science and engineering; classification for biomaterials; criteria for biomaterials; bioceramics; metallic biomaterials; bioactive ceramic coatings; biomedical polymers; biomedical composites; analytical and testing techniques for developing new biomaterials; long-term performance of biomaterials; degradation of biomaterials in the human body

environment; tissue engineering: principles, methods and applications; standards and regulatory issues; new trends in R & D of biomaterials and tissue engineering.

EMEE6005 Renewable energy technology I: Fundamental

This module focuses mainly on different renewable energy technologies including hydro power, wind power, bioenergy, solar thermal, solar PV, energy storage, and energy usage. The specific module objectives are: (1) to have a deep understanding of the important role played by renewable energy in our energy supply; and (2) to grasp the fundamentals of different energy resources; (3) to understand energy storage and its important role in solving intermittency and other issues; and (4) to understand how to use energy more efficiently with solid state lighting and other energy saving technologies.

Topics include: renewable energy in a big picture; hydro power; winder power; solar thermal; solar PV; bioenergy; energy storage: intermittency and other issues; energy usage: solid state lighting.

Students who have taken and passed MECH 6042 will not be allowed to take EMEE6005.

EMEE6006 Renewable energy technology II: Advanced

This module is on the working principles of advanced energy conversion devices including solar cells, fuel cells, batteries, photoelectrochemical (PEC) water splitting cells, and thermoelectric cells. Also covered are the energy carriers in different materials and the connection between different energy conversion devices. The specific module objectives are as: (1) to have a deep understanding of the energy carriers in different materials and their important roles in energy conversion; (2) to grasp the working principles of different energy conversion devices; (3) to be able to tell the differences and similarities between different energy conversion devices; and (4) to be able to design more efficient energy conversion devices.

Topics include: introduction: energy carriers in energy conversion cells; solar cells; fuel cells; electrochemical cells; photoelectrochemical (PEC) water splitting; thermoelectric cells.

Pre-requisite: EMEE6005 or for students who have previously passed MECH6042 or MECH6009 which have been obsolete with effect from 2014-2015 and 2011-2012 respectively

Students who have taken and passed MECH 6043 will not be allowed to take EMEE6006.

EMEE6007 Energy and carbon audit

This module aims to: (1) provide students with the fundamental principles, skills and guidelines needed to carry out effective energy and carbon audits for the commercial and industrial sectors; (2) enable students to identify energy saving and carbon reduction measures and perform quantitative analysis to predict the energy savings and carbon reduction, environmental and economic benefits; and (3) enable students to verify the performance of implemented energy saving and carbon reduction measures.

Topics include: greenhouse gas emission; global warming; energy benchmarking; electrical distribution system; power quality and power factor; energy efficient lighting; motor; HVAC energy audit; refrigeration cycle; passive cooling; heating appliances; energy consumptions in compressors and pumps; energy saving measurements; local and international guidelines in energy and carbon audit; carbon footprint calculator.

Students who have taken and passed MECH 6044 will not be allowed to take EMEE6007.

MECH6045 Nanotechnology: fundamentals and applications

Nanotechnology is a rapidly developing discipline which has emerged from foundations based in microtechnology built up during the past few decades. Many exciting engineering applications in nanotechnology have been proposed and some are already in use. The current intensive research activities world-wide make it highly likely that many more products and applications in nanotechnology will emerge in the next few decades. This module aims at: (1) to equip students with fundamental knowledge and concepts on micro- and nano-technology, and to enable the students to apply such knowledge in future careers in both industry and universities; (2) to enable students to understand the effects of material size on behaviour and properties, and from these to appreciate the new possibilities in both fundamental science and practical applications brought about by nanotechnology; and (3) to introduce students to promising and emerging applications of nanotechnology in energy storage/conversion, unconventional materials and optical metamaterials, and help students to further research and/or work in specific application areas.

Topics include: characteristic length scales, nanomaterials, nanostructures, physical properties of nanostructures, deposition techniques of nanofabrication, micro/nanolithography, high resolution analysis and characterization, scanning probe methods, nanoindentation, mechanical behaviours of bulk nanostructured materials, processing techniques for bulk nanostructured materials, ultrahigh strength of nanostructures, bio-nanotechnology, energy storage, energy conversion, nanophotonics, plasmonics, optical metamaterial.

Students who have taken and passed MECH 6040 will not be allowed to take MECH6045.

MECH6046 Microsystems for energy, biomedical and consumer electronics applications

Microelectromechanical systems (MEMS) and microfluidics have gradually found numerous applications in modern energy, mechanical engineering and biomedical engineering applications. This module aims to provide students with the necessary fundamental knowledge and experience in the working principles, design, materials, fabrication and packaging, and applications of MEMS and microfluidic systems. MEMS and microfluidic devices are emerging platforms for modern engineering applications in biomedicine, chemistry, material sciences and micro-machines. This is the module that will introduce graduate students and practicing engineers into the growing field of microsystem engineering. Practical examples will be given when delivering each major topic. Teaching of the module is also strengthened with case studies on carefully chosen topics. At the end of this module, students who fulfill the requirements of this module will be able to: (1) demonstrate ability to understand the fundamental principles behind MEMS and microfluidic; (2) differentiate different MEMS and microfluidic techniques and understand their importance in modern engineering; (3) apply concepts of micro-systems for industrial applications, particularly in energy, mechanical engineering and biomedical engineering.

Topics include: MEMS and microsystem products; microsensors; microactuators; microfluidic devices; multidisciplinary nature of microsystem design and manufacture; fluid mechanics in microscaled flows; materials for MEMS and microfluidic devices; fluid mechanics in microscaled flows; fabrication techniques of MEMS and microfluidic devices; flow characterization techniques; flow control with microfluidics; microfluidics for life sciences and chemistry.

Students who have taken and passed MECH 6032 will not be allowed to take MECH6046.

MECH6048 Dissertation (4 modules)

It involves undertaking a dissertation or report on a topic consisting of design, experimental or analytical investigation by individual students. The objectives are to: (1) simulate a realistic working experience for students; (2) provide them an experience of applying engineering principles, engineering economics, business or management skills; and (3) train students to work independently to obtain an effective and acceptable solution to industry-related or research-type problems.

MECH7010 Contemporary robotics

This module aims to explore the major technologies related to modern robotic systems, including the components and working principles of robots, automatic and computer-aided control, kinematics and control of industrial robotic manipulators, humanoid and biomimetic robots. The specific module objectives are listed as follows: (1) to have a comprehensive understanding of robotic systems in terms of their principles, historical evolutions, and applications for both industrial and civilian applications; (2) to understand the mathematical foundations, designs, data processing, and real-time control of various sensing and actuation units which comprise a robotic system; (3) to study the robot kinematics modelling, and the basic knowledge of intelligent motion planning that can enable effective manipulation in various applications; and (4) to explore the challenges and trends in contemporary robotic research, and the future directions for application of robotic components.

Topics include: a) Historical and contemporary robotic systems; b) Concept and components of robots, sensors and actuators; c) Robot kinematics; d) Robotic control and human interaction; e) Intelligent motion planning and localization; f) Applications and challenges of robots; g) Social, economic and ethical aspects of robotic applications.

MECH7011 Applied thermodynamics and power plant technology

This module is focused on understanding the operating principles of power plants for the generation of electric power. The module objectives are to: (1) provide students with the working principles of various types of power plants, including fossil fuels, nuclear fuels and renewable energy; and (2) enable students to understand the thermodynamic principles, emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.

Topics include: sources of energy; thermodynamic properties of states; types of power plants; portable combustion engines; Brayton cycle; gas turbines; Rankine cycle; steam power plants; nuclear power plant; solar farm; wind turbines; thermoelectric energy.

Students who have taken and passed MECH6023 will not be allowed to take MECH7011.

MECH7012 Principles of engineering management

The focus of this module is on the basic principles, methods, and functions of engineering management. An overview of systems engineering is provided, with coverage on the design and management of an enterprise as an integrated system. The module objectives are: (1) acquire the essential principles of engineering management and understand how to apply these principles in daily practice in industry; and (2) understand and apply methods for managing the operations of engineering companies in the global business environment.

Topics include: systems engineering; core concepts and tools for the management of operations: operations planning and control functions, ERP systems; contemporary topics and approaches in engineering management: supply chain, green management, ethics, corporate social responsibility and compliance, risk and crisis management.

MECH7013 Gas engineering

This course is mainly related to gas engineering theories and technologies that are commonly used in our society in various applications such as power and gas utilities, as well as domestic and commercial heating appliances. The world gas and energy market will be firstly highlighted to indicate the importance of the gas as a clean fuel. Then, operation principles of basic gas production, gas transportation systems and gas utilization systems, their advantages, and major drawbacks will be taught. The environmental and safety aspects due to the production, transportation and utilization of the gaseous fuels will also be included in the course.

CIVL6002 Advanced finite elements

Equilibrium and virtual work principle; variation principle; numerical integration; computer applications; convergence and error estimate; hybrid and mixed methods for multi-field problems; enhanced and assumed strain method; nonlinear problems.

---

*Approved for reimbursement from the Continuing Education Fund (CEF) (applicable to Hong Kong Residents only)

MSC(ENG) IN STRUCTURAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2016-17 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Structural Engineering that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	No. of Credits
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience	24
Total	72

The curriculum provides advanced education in the field of Structural Engineering.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses and a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Head of Department of Civil Engineering.

The following is a list of discipline courses offered by the Department of Civil Engineering. 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.

(A) FIVE to EIGHT courses from the following list of discipline courses or courses approved by the Department of Civil Engineering:

CIVL6002 Advanced finite elements (6 credits)

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

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.

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.

CIVL6009 Building planning and control (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6013 Concrete technology (6 credits)

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

CIVL6025 Environmental impact assessment of engineering projects (6 credits)

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

CIVL6026 Finite element method (6 credits)

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

CIVL6027 Foundation engineering (6 credits)

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

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.

CIVL6053 Wind engineering (6 credits)

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

CIVL6060 Operation and maintenance of building and civil engineering works (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

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.

CIVL6072 Design of cold-formed steel structures (6 credits)

Cold-formed steel structures; concepts of local buckling; effective width design method; shift of effective centroid; new design approach using direct strength method; design of structural steel building.

CIVL6073 Professional practice in building development (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

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.

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.

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.

CIVL7015 Durability design of concrete structures

Cement chemistry and microstructure; carbonation and induced steel corrosion; chloride ingress and induced corrosion; shrinkage cracking and its impact on corrosion; corrosion propagation and kinetic; service life model of reinforced concrete structure in marine environments; thermodynamic modelling and its application.

(B) Not more than THREE courses from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or elective courses at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL7009 Dissertation (24 credits)

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

MSC(ENG) IN STRUCTURAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2015-16 and before)

The curriculum provides advanced education in the field of Structural Engineering. Students are required to successfully complete twelve modules which must include a dissertation of four modules, on a subject within his/her approved field of study.

The list of modules below is not final, and may be changed from time to time. Students who intend to complete the curriculum in one academic year should check with the Department of Civil Engineering for the availability of the modules.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

(A) FIVE to EIGHT modules from the following list of discipline modules or modules approved by the Department of Civil Engineering:

CIVL6002 Advanced finite elements

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

CIVL6003 Advanced reinforced concrete structure design

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.

CIVL6008 Bridge engineering

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

CIVL6009 Building planning and control

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6013 Concrete technology

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

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6026 Finite element method

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

CIVL6027 Foundation engineering

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

CIVL6045 Tall building structures

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.

CIVL6053 Wind engineering

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

CIVL6060 Operation and maintenance of building and civil engineering works

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6063 Special topic in structural engineering A

This module 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 module is offered.

CIVL6064 Special topic in structural engineering B

This module 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 module is offered.

CIVL6072 Design of cold-formed steel structures

Cold-formed steel structures; concepts of local buckling; effective width design method; shift of effective centroid; new design approach using direct strength method; design of structural steel building.

CIVL6073 Professional practice in building development

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6080 Fire engineering design of structures

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.

CIVL7003 Space structures

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.

CIVL7008 Seismic analysis for building structures

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.

CIVL7015 Durability design of concrete structures

Cement chemistry and microstructure; carbonation and induced steel corrosion; chloride ingress and induced corrosion; shrinkage cracking and its impact on corrosion; corrosion propagation and kinetic; service life model of reinforced concrete structure in marine environments; thermodynamic modelling and its application.

(B) Not more than THREE modules from the MSc(Eng) modules offered by the Department of Civil Engineering other than those listed in (A) above, or elective modules at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001 Project (4 modules)

For MSc(Eng) students admitted before the academic year of 2014-2015.

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in the academic years of 2014-15 and 2015-2016.

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

MSC(ENG) IN TRANSPORTATION ENGINEERING
(Applicable to students admitted to the curriculum in the academic year 2016-17 and thereafter)

Definition and Terminology

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

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Transportation Engineering that are not classified as discipline courses.

Capstone Experience – a 24-credit dissertation which is a compulsory and integral part of the curriculum.

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	**No. of Credits**
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience	24
Total	72

The curriculum provides advanced education in the field of Transportation Engineering.

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 8 courses and a dissertation. They may select no more than 3 courses offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Head of Department of Civil Engineering.

The following is a list of discipline courses offered by the Department of Civil Engineering. 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.

(A) FIVE to EIGHT courses from the following list of discipline courses or courses approved by the Department of Civil Engineering:

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.

CIVL6025 Environmental impact assessment of engineering projects (6 credits)

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

CIVL6035 Highway pavement engineering (6 credits)

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

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

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

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)

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

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.

CIVL6056 Special topic in transportation engineering A (6 credits)

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

CIVL6057 Special topic in transportation engineering B (6 credits)

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

CIVL6070 Logistics and transportation * (6 credits)

The logistics supply chain, evolution of logistics and the supply chain as management disciplines; the customer service dimensions; transportation fundamentals, transportation decisions; inventory concepts, inventory management; facility location decisions, the network planning process; logistics organization, best practice and benchmarking; discussion on contemporary issues in logistics.

CIVL6084 Statistical methods for transportation (6 credits)

Basic tools for statistical model building; linear models; count and discrete dependent variables; duration models; analysis of panel data.

CIVL7001 Railway asset management (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL7006 Optimization techniques for transportation applications (6 credits)

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

CIVL7011 The economics of transport (6 credits)

Transport versus widgets; profit maximization and competitive equilibrium; costs and externalities; travel demand and the value of travel time; optimal pricing and investment; sustainable transportation; national income change and benefit measures; and cost-benefit analysis of transport projects.

CIVL7012 Traffic impact assessment: Techniques (6 credits)

Traffic impact assessment techniques that involve single isolated developments, transit oriented developments, extensive developments and reclamation areas, highway and public transport infrastructures, special traffic generators, and changes of transport policies; applications of traffic engineering and transport planning techniques to traffic impact assessment in Hong Kong and Mainland, China.

CIVL7013 Traffic impact assessment: Case studies (6 credits)

Review of Traffic Impact Assessment (TIA) Studies and fundamental approach; Conducting TIA Studies including data collection and traffic forecasting techniques, problem identification and quantitative analysis; application of traffic engineering and transport planning techniques and improvement measures development of creative thinking, technical presentational and public relation skills for professional report writing and presentation of study findings.

CIVL7014 Transport planning and infrastructure systems (6 credits)

Introduction to transport and land use planning, transport modelling techniques and application, transport infrastructure appraisal and planning, traffic impact assessment.

(B) Not more than THREE courses from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or elective courses at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL7009 Dissertation (24 credits)

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

---

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

MSC(ENG) IN TRANSPORTATION ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2015-16 and before)

The curriculum provides advanced education in the field of Transportation Engineering. Students are required to successfully complete twelve modules which must include a dissertation of four modules, on a subject within his/her approved field of study. The list below is not final and some modules may not be offered every year. Students who intend to complete the curriculum in one academic year should check with the Department of Civil Engineering for the availability of the modules.

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

(A) FIVE to EIGHT modules from the following list of discipline modules or modules approved by the Department of Civil Engineering:

CIVL6007 Behavioural travel demand modelling *

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

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6035 Highway pavement engineering

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

CIVL6037 Project management - human and organisational factors *

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6046 Theory of traffic flow *

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 *

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

CIVL6049 Urban development management by engineering approach

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6054 Engineering for transport systems *

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

CIVL6056 Special topic in transportation engineering A

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

CIVL6057 Special topic in transportation engineering B

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

CIVL6070 Logistics and transportation *

The logistics supply chain, evolution of logistics and the supply chain as management disciplines; the customer service dimensions; transportation fundamentals, transportation decisions; inventory concepts, inventory management; facility location decisions, the network planning process; logistics organization, best practice and benchmarking; discussion on contemporary issues in logistics.

CIVL6084 Statistical methods for transportation

Basic tools for statistical model building; linear models; count and discrete dependent variables; duration models; analysis of panel data.

CIVL7001 Railway asset management

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL7006 Optimization techniques for transportation applications

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

CIVL7011 The economics of transport

Transport versus widgets; profit maximization and competitive equilibrium; costs and externalities; travel demand and the value of travel time; optimal pricing and investment; sustainable transportation; national income change and benefit measures; and cost-benefit analysis of transport projects.

CIVL7012 Traffic impact assessment: Techniques

Traffic impact assessment techniques that involve single isolated developments, transit oriented developments, extensive developments and reclamation areas, highway and public transport infrastructures, special traffic generators, and changes of transport policies; applications of traffic engineering and transport planning techniques to traffic impact assessment in Hong Kong and Mainland, China.

CIVL7013 Traffic impact assessment: Case studies

Review of Traffic Impact Assessment (TIA) Studies and fundamental approach; Conducting TIA Studies including data collection and traffic forecasting techniques, problem identification and quantitative analysis; application of traffic engineering and transport planning techniques and improvement measures development of creative thinking, technical presentational and public relation skills for professional report writing and presentation of study findings.

CIVL7014 Transport planning and infrastructure systems

Introduction to transport and land use planning, transport modelling techniques and application, transport infrastructure appraisal and planning, traffic impact assessment.

---

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

(B) Not more than THREE modules from the MSc(Eng) modules offered by the Department of Civil Engineering other than those listed in (A) above, or elective modules at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001 Project (4 modules)

For MSc(Eng) students admitted before the academic year of 2014-2015.

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in the academic years of 2014-15 and 2015-2016.

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