SYLLABUSES FOR THE DEGREE OF
MASTER OF SCIENCE IN ENGINEERING

MSC(ENG) IN BUILDING SERVICES ENGINEERING

Programme Objectives

The programme provides advanced 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. Classes will normally be arranged in the evening on weekdays and in the morning on Saturdays. For the full-time students, some courses may also be taught in the daytime on weekdays.

The full-time programme requires a student to satisfactorily complete 8 modules and a project within a study period of 1 to 2 years. For the students enrolled in the part-time programme, they may opt to either satisfactorily complete 12 modules or 8 modules plus a project within a study period of 2 to 3 years.

Study Modules

The following study modules are the core courses of the programme. A number of these core courses will be selected for offer to students in each academic year. A student who does not undertake a project must complete at least 8 core courses whereas a student who undertakes a project must complete at least 5 core courses. Optional courses are available from other MSc programmes in the Faculty of Engineering for selection by students.

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

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; types of electric motors; electromagnetism for utilities; lifts, escalators and conveyors: lift traffic analysis, design calculation, electrical and mechanical features, code of practice; electric heating; design challenges in futuristic buildings.

MEBS6001. Electrical installations

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

Candidates who have failed to satisfy the examiners for the Degree of M.Sc.(Eng.) may on termination of their study be awarded a Postgraduate Diploma in Engineering, subject to approval of the Faculty Board.
generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; electromagnetic interference; lightning protection.

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.

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.

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: system configurations; distributed processing and intelligence; types of input and output points; integrated control; direct digital control; energy, security and maintenance management. Microprocessor fundamentals: signal conditioning, processing and transmission; hardware and software development. Field devices; structured cabling; networking; interoperability; home automation. Current development; selection criteria; cost, reliability and system maintenance.

MEBS6006. Environmental services I

Different forms of energy supply to buildings: electricity, fuel oil, solar; heating and cooling systems: pyschomometry, 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.

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**MEBS6009. Fire services design (2 modules)**

Characteristics and behaviour of fire, fire hazards of materials and buildings, fire hazards of building services and processes; smoke production and properties, smoke management principles, zone smoke control, smoke extraction and smoke vent design, staircase pressurisation, design and computational analysis; legal aspects of fire safety management and statutory regulations – COP, LPC rules and N.F.P.A. codes; fire protection strategies, architectural and structural designs, means of escape, fire detection and alarm systems, water-based fire extinguishing systems, gas-based fire extinguishing systems, special building facilities for fire safety; fire protection and design principles for special hazardous areas; hydraulic analysis; performance-based fire codes and approaches, installation and commissioning; maintenance requirements.

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**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.

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**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.

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**MEBS6012. Project (4 modules)**

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

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**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.

MEBS6019. Extra-low-voltage electrical systems in buildings

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 systems, audio and visual systems; 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.

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**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.

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**MSC(ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING**

*(applicable to students admitted to the programme before the academic year 2012-2013)*

(The syllabus is subject to University’s approval.)

The Master of Science in Electrical and Electronic Engineering Programme, based on eight study fields of advanced technologies and management, has four different streams: General Stream, Communications Engineering, Computer and Information Engineering and Green Technology. Each candidate is required to follow a prescribed course of study comprising 12 modules, out of which the candidate has to pass at least 8 modules selected from the study fields listed below. To qualify as a graduate of the Communications Engineering Stream, the candidate must pass at least 6 modules in the Communications Engineering study field. To qualify as a graduate of the Computer and Information Engineering Stream, the candidate must pass at least 6 modules in the Computer Engineering and Networking study field. To qualify as a graduate of the Green Technology Stream, the candidate must pass at least 6 modules in the Green Technology study field. Subject to approval, candidates can select to undertake a project (ELEC6021) and in which case, General Stream candidates are required to pass at least 5 modules selected from the study fields listed below, while Communications Engineering, Computer and Information Engineering, and Green Technology Streams candidates are required to pass at least 4 modules in their respective study fields.

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**The Eight Study Fields**

**A. Communications Engineering**

- ELEC6006 Communications policy and regulations
- ELEC6007 Internet protocols and services
- ELEC6014 Digital communications I
- ELEC6026 Digital signal processing
- ELEC6040 Mobile radio communications
- ELEC6045 Digital communications II
- ELEC6065 Data compression
- ELEC6070 Cryptography and network security
- ELEC6071 Wireless networking
- ELEC6080 Telecommunications systems and management
- ELEC6086 Mobile commerce
- ELEC6087 Wireless data network standards
- ELEC6089 Antennas
- 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
ELEC7073  Digital communications III
ELEC7077  Advanced topics in multimedia signals and systems
ELEC7078  Advanced topics in electrical and electronic engineering
ELEC7144  Advanced Internet infrastructure technologies

B. Computer Engineering and Networking
ELEC6007  Internet protocols and services
ELEC6008  Pattern recognition and machine learning
ELEC6036  High performance computer architecture
ELEC6043  Digital image processing
ELEC6049  Digital system design techniques
ELEC6065  Data compression
ELEC6069  Multimedia storage systems
ELEC6070  Cryptography and network security
ELEC6071  Wireless networking
ELEC6078  Electronic commerce
ELEC6086  Mobile commerce
ELEC6087  Wireless data network standards
ELEC6097  IP networks
ELEC6098  Electronic and mobile commerce
ELEC6099  Wireless communications and networking
ELEC6102  Reconfigurable computing systems
ELEC6604  Neural networks, fuzzy systems and genetic algorithms
ELEC7078  Advanced topics in electrical and electronic engineering
ELEC7101  Quantum computing
ELEC7141  Advanced image processing
ELEC7144  Advanced Internet infrastructure technologies
ELEC7150  Advanced topics in computer engineering and networking
ELEC7162  Scalable parallel computing

C. Control Systems and Biomedical Engineering
ELEC6008  Pattern recognition and machine learning
ELEC6067  Magnetic resonance imaging (MRI) technology and applications
ELEC6079  Biomedical ultrasound
ELEC6081  Biomedical signals and systems
ELEC6083  Computer vision and applications
ELEC7252  Advanced topics in control theory and systems

D. Electronics
ELEC6027  Integrated circuit systems design
ELEC6032  Process and device design for VLSI circuits
ELEC6063  Optoelectronics and lightwave technology
ELEC6077  CMOS analogue integrated circuit design
ELEC6088  Flexible organic electronics
ELEC7364  Advanced topics in microelectronics

E. Electrical energy
ELEC6054  Power system dynamics
ELEC6055  Power system distribution
ELEC6057  Power system planning
ELEC6058  Power transmission
ELEC6084  Power delivery management for metropolitan cities
ELEC6085  The role of a computerized SCADA system in power system operation
ELEC6092  Green project management
EMEE6003 Nuclear energy
EMEE6010 Electricity quality and energy efficiency
ELEC7401 Advanced topics in electric drives and control
ELEC7402 Advanced electric vehicle technology
ELEC7403 Advanced power electronics
ELEC7456 Advanced power system operation
ELEC7466 Advanced topics in power system engineering
ELEC7467 Sliding mode control applications in power electronics
MEBS6001 Electrical installations

F. Engineering Mathematics
ELEC6031 Numerical methods for computer applications
ELEC6082 Convex programming and applications

G. Engineering Management
ELEC6601 Industrial marketing
ELEC6602 Business venture in China
ELEC6603 Success in industrial entrepreneurship
ELEC7079 Investment and trading for engineering students
ELEC7080 Algorithmic trading and high frequency trading
MEBS6019 Extra-low-voltage electrical systems in buildings

H. Green Technology
ELEC6078 Electronic commerce
ELEC6084 Power delivery management for metropolitan cities
ELEC6085 The role of a computerized SCADA system in power system operation
ELEC6090 Energy saving lighting
ELEC6091 Energy saving installations
EMEE6008 Green project management
EMEE6009 Green facilities management
ELEC6094 Renewable energy
ELEC6095 Smart grid
ELEC7401 Advanced topics in electric drives and control
ELEC7402 Advanced electric vehicle technology
ELEC7403 Advanced power electronics
ELEC7456 Advanced power system operation
ELEC7466 Advanced topics in power system engineering

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

ELEC6006. Communications policy and regulations

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.

ELEC6007. Internet protocols and services
Fundamentals of computer networking; performance metrics; Internet backbone and access technologies; link-layer and LANs; bridge protocols; network layer and routing; IP addressing; transport layer and TCP; congestion control; UDP; application layer and WWW; HTTP; network services: SMTP and sendmail, DNS and BIND, network management and SNMP; introduction to secure protocols: IPSec, SSL, and TLS.

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**ELEC6008. Pattern recognition and machine learning**

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

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.

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**ELEC6014. Digital communications I**

Basics of stochastic processes; source coding; characterizations of signals; AWGN channels; channel capacity; modulation and demodulation; synchronization; equalization.

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**ELEC6021. Project (4 modules)**

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**ELEC6026. Digital signal processing**

This course provides an introduction to the fundamental concepts of digital signal processing 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.

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**ELEC6027. Integrated circuit systems design**

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.

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**ELEC6031. Numerical methods for computer applications**

General principles of computer application; accuracy and error analysis; series and functions; linear algebra; nonlinear equations; finite differences applied to interpolation, integration and differentiation; special topics in optimization, Monte Carlo method or Fourier methods.
ELEC6032.  Process and device design for VLSI circuits

Design of submicron MOS and bipolar devices; scaling schemes and their related problems; introduction to process and device simulation tools; capabilities and limitations; methodology in process and device developments; case study of a typical IC process; advanced IC technologies.

ELEC6036.  High-performance computer architecture

This course aims at providing an in-depth understanding of the principles, architectures and implementations of modern high performance processors which are designed and based on the aggressive use of instruction-level parallelism (ILP). Specifically, the course discusses with examples to investigate the high-performance computing models; pipelining and ILP; advanced pipelining design including the scoreboard and Tomasulo algorithm; speculative execution and advanced technologies for value prediction or instruction reuse; advanced computing model such as the quantum computing; low-power processor design; and case studies like the IA-64 architecture.

ELEC6040.  Mobile radio communications

Introduction to mobile radio communications; statistical communication theory; elements of mobile radio communication systems; error performance over radio links; cellular systems; elements of cellular systems design; the digital cellular systems and the future systems.

ELEC6043.  Digital image processing

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

ELEC6045.  Digital communications II

Introduction; direct sequence; frequency/time hopping and hybrid systems; characteristics, anti-jam, multiple access; generation and detection of spread spectrum signals; applications to secure communications, digital cellular mobile systems.

ELEC6049.  Digital system design techniques

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.

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**ELEC604. Power system dynamics**

Synchronous machine modelling; load models; small-signal stability; transient stability; voltage stability; subsynchronous resonance; mid-term and long-term stability; numerical methods, direct methods, methods of improving stability.

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**ELEC605. Power system distribution**

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.

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**ELEC607. Power system planning**

Optimal generation expansion; load forecasting; reliability evaluation; probabilistic production costing, Monte Carlo simulation; value of service; least cost planning; electricity pricing.

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**ELEC608. Power transmission**


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**ELEC606. Optoelectronics and lightwave technology**

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**

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**

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

**ELEC6069. Multimedia storage systems**

Basic characteristics of multimedia data, compression standards, storage organizations, disk scheduling, data migration, and cache replacement.

**ELEC6070. Cryptography and network security**

This course focuses on the mathematical concepts and techniques behind the state-of-the-art information encryption and network security technologies. Also covered are the security threats and their possible countermeasures, secure protocols, and other network security related schemes (authentication, key management, etc.).

Prerequisite: ELEC2701 Internet technologies and applications or CSIS0234 Computer and communication networks (for undergraduate students only)

**ELEC6071. Wireless networking**

Overview of existing wireless networking services and technologies; requirements and challenges for mobile data network design; access technologies; short-range wireless technologies: Bluetooth, IEEE
802.11x WLAN, and coexistence issues; mobility management; protocol adaptations for wireless networking: Mobile IP, WAP, TCP over wireless; wireless resources management: packet scheduling, power management, ad hoc routing; mobile data network security; emerging mobile data architectures and services; mobile data application issues: wireless cache invalidation, wireless video, location dependent services.

Prerequisite: ELEC2402 Computer communications or CSIS0234 Computer and communication networks (for undergraduate students only)

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**ELEC6077. CMOS analogue integrated circuit design**

CMOS device characteristics. Device modelling and operations. Small-signal analyses. Operational amplifier architecture, analysis, design and implementation. Functional blocks in analogue signal processing such as single-transistor amplifiers, differential pairs and multi-transistor amplifiers, and different types of current mirrors. Transistor circuits at high frequencies, operational amplifiers at high frequencies. Feedback and compensation techniques in amplifiers.

Prerequisite: Prior exposure to CMOS & VLSI design (e.g., ELEC1614, ELEC3612 or alike).

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**ELEC6078. Electronic commerce**

Introduction; business-to-consumer (B2C) model; business-to-business (B2B) model; internet marketing; e-commerce technologies; web-site design; mobile commerce; client-side security; communication channel security; server-side security; electronic payment; future directions.

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**ELEC6079. Biomedical ultrasound**

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.

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**ELEC6080. Telecommunications systems and management**

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.

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**ELEC6081. Biomedical signals and systems**
This course 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.

**ELEC6082. Convex programming and applications**

Introduction; Convex functions, convex sets, and convex problems; LP (linear programming); QP (quadratic programming); GP (geometric programming); LMI (linear matrix inequality); SDP (semidefinite programming); SOS (sum of squares); PP (polynomial programming); Applications in biology, control, finance, and transport; Matlab tools for convex optimization.

**ELEC6083. Computer vision and applications**

Introduction to computer vision, camera model and image formation, projective geometry, feature detection and correspondence, stereo vision, epipolar geometry, structure from motion, camera calibration, industrial applications.

**ELEC6084. Power delivery management for metropolitan cities**

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**

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.

**ELEC6086. Mobile commerce**
Introduction, subscriber applications, enterprise applications, development platforms for mobile applications, SMS and MMS technologies and applications, mobile connectivity, mobile security, mobile payment, TD-SCDMA and m-commerce development in China, development of WiFi and ubiquitous cities, industry case studies, ICT convergence and future development.

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**ELEC6087. Wireless data network standards**


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**ELEC6088. Flexible organic electronics**

Organic semiconductor materials, electrical and optical properties of organic materials, and organic devices such as light emitting devices, solar cells and transistors.

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**ELEC6089. Antennas**

Principles and characteristics of modern antennas: radiation pattern, polarization, directivity, gain, efficiency, impedance bandwidth and antenna transfer function.

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**ELEC6090. Energy saving lighting**

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.

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**ELEC6091. Energy saving installations**

Electrical energy distribution; types of distribution systems; installation design principles; energy load pattern, maximum demand and energy diversity; protective devices and safety interlocks; purposes of earthing; equipotential bonding arrangements. City main and alternative energy sources; energy loss and leakage; power quality study; power conditioning; electromagnetic interference; power factor correction and tariff scheme. Electrical energy saving development.

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**EMEE6008. Green project management**

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

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EMEE6009.  Green facilities management

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.

Calendar Entry (Proposed)
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

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EMEE6010.  Electricity quality and energy efficiency

The course shall enhance classmates’ 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.

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ELEC6094.  Renewable energy

Renewable energy sources: hydro power, pumped storage, wave, wind, solar, geothermal, biomass; biofuel, ethanol-fuel and recycle wastes; their nature; sustainability; operating principles and cleanliness; incentives and barriers; utilization, efficiency and effectiveness. Management of renewable energy and its sustainability. Energy storage: flywheel, batteries and fuel cell; hybrid system and integration; a.c. and d.c. electricity conversion; electricity quality regeneration; power conditioning and renewable energy to grid.

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ELEC6095.  Smart grid

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/applications and energy saving control are included.

Mutually exclusive with ELEC6096
ELEC6097. IP Networks

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

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 overview 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 communication and networking

This course aims at introducing the technologies on wireless communications and issues on wireless networking. The course will start with an introduction to wireless communication theories. Afterward, short-range wireless technologies and standards (bluetooth, IEEE 802.11) are discussed. This is followed by long-range wireless technologies and standards (cellular, UMTS, LTE/SAE). Important system issues in wireless networking such as mobility management (Mobile IP, location dependent services, power management) and security issues are then covered in detail. Finally, the course will introduce various state-of-the-art wireless networking frontier problems (ad hoc routing, packet scheduling, femtocell, white-space networking) and mobile data application issues.

Mutually exclusive with: ELEC6040, ELEC6071, ELEC6087

ELEC6100. Digital Communications

This course aims at enabling the fundamental understanding of the digital communication systems. After an overview, the course will cover the basic blocks of source coding and channel coding. Then, baseband transmission topics covering line codes, baseband reception and bandlimited transmission are examined. This is followed by bandpass transmission involving digital carrier modulation and demodulation. The course also covers advanced topics in digital communications such as CDMA, MIMO, and OFDM.

Mutually exclusive with: ELEC6014 and ELEC6045

ELEC6102. Reconfigurable computing systems

Introduction to fundamentals of reconfigurable computing; Field programmable gate array (FPGA) architectures; Advance computing system architectures; Hardware/Software co-design; Reconfigurable
computing operating systems; Energy-efficient high-performance computing and applications. Recent developments in the field will also be used as case studies.

Prerequisite: Knowledge in digital system design and high performance computer architectures.

**ELEC6103. Satellite communications**

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.

**ELEC6601. Industrial marketing**

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.

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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.

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**ELEC6604. Neural networks, fuzzy systems and genetic algorithms**

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.

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**ELEC7051. Advanced topics in communication theory and systems**

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.

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**ELEC7073. Digital communications III**

Introduction, adaptive modulation, channel coding, digital communications through fading multipath channels, ARQ.

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**ELEC7077. Advanced topics in multimedia signals and systems**

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

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**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.

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**ELEC7079. Investment and trading for engineering students**

This course is designed for engineering students who wish to start a career in the financial industry. The depth of this course will be at the master level but senior undergraduate students with good
technical skills are welcome to take. This course helps the students to integrate the technical skills, for example, programming and partial differential equation (PDE), they have learned in other engineering courses and to develop the basic knowledge, skill sets, and vocabulary that can communicate with the practitioners. The most important is that 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, which is extremely important when interviewing for a job in the financial industry. Then, students are expected to build up the basic knowledge on various financial instruments as well as quantitative models for investment management and development of trading strategies. The financial products or instruments include: equities, fixed income securities, options, futures and other derivatives. Also, we will discuss about their pricing models and investment/trading strategies, such as, VWAP, TWAP, Bollinger Band, RSI, etc.

**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 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.

**ELEC7101. Quantum computing**

Quantum states, operators and observables, time evolution, spin 1/2 particles; quantum gates; quantum adder; quantum algorithms: Deutsch-Jozsa algorithm, Grover's algorithm, Shor's algorithm; quantum cryptography, quantum key distribution; quantum teleportation.

Prerequisite: A good background in linear algebra

**ELEC7141. Advanced image processing**

2D and 3D image acquisition and optical systems; imaging with coherent and incoherent light; optical transfer functions, modulation transfer functions, and aberrations; image restoration, reconstruction, and super-resolution; holography; image feature extraction and inspection systems; denoising; image segmentation and mathematical morphology.

Prerequisite: ELEC3504 or ELEC6043 or the consent of the instructor.

**ELEC7144. Advanced Internet infrastructure technologies**

Web caching and load balancing; contents distribution networks (CDNs); Multimedia networking: streaming, RTSP, RTP, RTCP, H.323, session management and conference control; buffer design; traffic shaping; Internet QoS: IntServ, DiffServ, packet scheduling, RSVP, MPLS, GMPLS;
multicasting: addressing, multicast routing, reliable multicast transport; Peer-to-peer protocols; grid computing protocols.

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**ELEC7150. Advanced topics in computer engineering and networking**

This course aims at offering an in-depth view of some research topics of current interest in the field of computer engineering and networking.

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**ELEC7162. Scalable parallel computing**

Commodity microprocessors, high-performance networks, symmetric multi-processor, clusters of PC/workstations, massively parallel processors, scientific and commercial applications, distributed multi-media and scalable computing.

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**ELEC7252. Advanced topics in control theory and systems**

This course aims at offering an in-depth view of some research topics of current interest in the field of control theory and systems.

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**ELEC7364. Advanced topics in microelectronics**

This course aims at offering an in-depth view of some research topics of current interest in the field of microelectronics.

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**ELEC7401. Advanced topics in electric drives and control**

Selected topics from the latest development in the areas of electric drives and control.

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**ELEC7402. Advanced electric vehicle technology**

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.

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**ELEC7403. Advanced power electronics**

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.

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**ELEC7456. Advanced power system operation**

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.

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**ELEC7466. Advanced topics in power system engineering**

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.

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**ELEC7467. Sliding mode control applications in power electronics**

This course aims to provide students the fundamental knowledge of various sliding mode control applications in power electronics. Students will be guided towards the understanding of the sliding mode control theory, its application to power converters, and the practical realization of such controllers. The issues of implementing sliding mode control in various types of power converters in terms of achieving constant frequency, control coefficients design, practical implementation using analog devices, and the required sensing techniques, will be covered. Topics of hysteresis modulation, pulsewidth modulation, adaptive sliding mode control will be studied.

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**EMEE6003. Nuclear energy**

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.
MEBS6001.  Electrical installations

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; electromagnetic interference; lightning protection.

MEBS6019.  Extra-low-voltage electrical systems in buildings

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 programme in the academic year 2012-2013 and 2013-2014)

(The syllabus is subject to University’s approval.)

The Master of Science in Electrical and Electronic Engineering Programme has three different streams: General Stream, Communications Engineering, and Power Engineering. Each candidate is required to follow a prescribed course of study comprising 12 modules, out of which the candidate has to pass at least 8 modules selected from the modules listed below. To qualify as a graduate of the Communications Engineering Stream, the candidate must pass at least 6 modules in the Communications Engineering subject group. To qualify as a graduate of the Power Engineering Stream, the candidate must pass at least 6 modules in the Power Engineering subject group. For General Stream, the candidate can freely choose from the three subject groups below. Subject to approval, candidates can select to undertake a project (ELEC6021) and in which case, General Stream candidates are required to pass at least 5 modules selected from modules listed below, while candidates pursuing Communications Engineering and Power Engineering Streams are required to pass at least 4 modules in their respective subject groups.

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

Mutually exclusive with: ELEC6104
The list below is not final and some courses may not be offered every year.

**ELEC6006.  Communications policy and regulations**

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

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.

ELEC6021. Project (4 modules)

ELEC6026. Digital signal processing

This course provides an introduction to the fundamental concepts of digital signal processing 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

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

This course aims at providing an in-depth understanding of the principles, architectures and implementations of modern high performance processors which are designed and based on the aggressive use of instruction-level parallelism (ILP). Specifically, the course discusses with examples to investigate the high-performance computing models; pipelining and ILP; advanced pipelining design including the scoreboard and Tomasulo algorithm; speculative execution and advanced technologies for value prediction or instruction reuse; advanced computing model such as the quantum computing; low-power processor design; and case studies like the IA-64 architecture.

ELEC6043. Digital image processing

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

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

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

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

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

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

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

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

This course 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 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**

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**

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**

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/applications and energy saving control are included.

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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.

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The course 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 course is designed for engineering students who wish to start a career in the financial industry. The depth of this course will be at the master level but senior undergraduate students with good technical skills are welcome to take. This course helps the students to integrate the technical skills, for example, programming and partial differential equation (PDE), they have learned in other engineering courses and to develop the basic knowledge, skill sets, and vocabulary that can communicate with the practitioners. The most important is that 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, which is extremely important when interviewing for a job in the financial industry. Then, students are expected to build up the basic knowledge on various financial instruments as well as quantitative models for investment management and development of trading strategies. The financial products or instruments include: equities, fixed income securities, options, futures and other derivatives. Also, we will discuss about their pricing models and investment/trading strategies, such as, VWAP, TWAP, Bollinger Band, RSI, etc.

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 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.

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ELEC7402.  Advanced electric vehicle technology

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.

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ELEC7403.  Advanced power electronics

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.

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ELEC7456.  Advanced power system operation

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.

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ELEC7466.  Advanced topics in power system engineering

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.

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**ELEC7467. Sliding mode control applications in power electronics**

This course aims to provide students the fundamental knowledge of various sliding mode control
applications in power electronics. Students will be guided towards the understanding of the sliding mode
control theory, its application to power converters, and the practical realization of such controllers. The
issues of implementing sliding mode control in various types of power converters in terms of achieving
constant frequency, control coefficients design, practical implementation using analog devices, and the
required sensing techniques, will be covered. Topics of hysteresis modulation, pulsewidth modulation,
adaptive sliding mode control will be studied.

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**EMEE6003. Nuclear energy**

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

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**EMEE6010. Electricity quality and energy efficiency**

The course shall enhance classmates’ 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.

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**MEBS6001. Electrical installations**

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; electromagnetic
interference; lightning protection.

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**MEBS6019. Extra-low-voltage electrical systems in buildings**

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 ENERGY ENGINEERING
(applicable to students admitted to the programme before the academic year 2014-2015)

(The syllabus is subject to University’s approval.)

Each candidate is required to follow a prescribed course of study comprising 12 modules, out of which the candidate has to pass at least 8 core modules selected from the List of Core Modules. The candidate can select to undertake a project in lieu of 4 modules, and has to pass at least 5 core modules. The candidate can select elective MSc modules offered by other departments of the Faculty of Engineering.

List of Core Modules for MSc(Eng) in Energy Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ELEC6084</td>
<td>Power delivery management for metropolitan cities</td>
</tr>
<tr>
<td>ELEC6090</td>
<td>Energy saving lighting</td>
</tr>
<tr>
<td>ELEC6095</td>
<td>Smart grid</td>
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<tr>
<td>ELEC7402</td>
<td>Advanced electric vehicle technology</td>
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<tr>
<td>ELEC7403</td>
<td>Advanced power electronics</td>
</tr>
<tr>
<td>ELEC7466</td>
<td>Advanced topics in power system engineering</td>
</tr>
<tr>
<td>EMEE6001</td>
<td>Project (4 modules)</td>
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<tr>
<td>EMEE6002</td>
<td>Sustainability and climate change</td>
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<td>EMEE6003</td>
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<td>EMEE6004</td>
<td>Energy conservation and management</td>
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<tr>
<td>EMEE6005</td>
<td>Renewable energy technology I: Fundamental</td>
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<tr>
<td>EMEE6006</td>
<td>Renewable energy technology II: Advanced</td>
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<tr>
<td>EMEE6007</td>
<td>Energy and carbon audit</td>
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<td>EMEE6008</td>
<td>Green project management</td>
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<td>EMEE6009</td>
<td>Green facilities management</td>
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<td>EMEE6010</td>
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<td>MEBS6016</td>
<td>Energy performance of buildings</td>
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<tr>
<td>MECH6023</td>
<td>Power plant technology</td>
</tr>
</tbody>
</table>

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

ELEC6084. Power delivery management for metropolitan cities

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.

ELEC6090. Energy saving lighting

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.

ELEC6095. Smart grid

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

ELEC7402. Advanced electric vehicle technology

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

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.

ELEC7466. Advanced topics in power system engineering
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.

EMEE6001. Project (4 modules)

Students will undertake an assigned and supervised project which will be assessed. The project 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.

EMEE6002. Sustainability and climate change

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

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

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.
This course covers the following topics: energy sources and environmental impact; energy in buildings; energy-efficient industrial processes; waste heat recovery; energy storage; energy auditing; energy strategies and management.

Mutually exclusive with: MECH6033

EMEE6005. Renewable energy technology I: Fundamental

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.

This course covers the following topics: renewable energy in a big picture; hydro power; wind power; solar thermal; solar PV; bioenergy; energy storage: intermittancy and other issues; energy usage: solid state lighting.

Mutually exclusive with: MECH6042

EMEE6006. Renewable energy technology II: Advanced

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: (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.

This course covers the following topics: introduction: energy carriers in energy conversion cells; solar cells; fuel cells; electrochemical cells; photoelectrochemical (PEC) water splitting; thermoelectric cells.

Pre-requisite: MECH 6042 or EMEE6005 or MECH6009

Mutually exclusive with: MECH6043

EMEE6007. Energy and carbon audit

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.

This course covers the following topics: 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.

Mutually exclusive with: MECH6044

EMEE6008. Green project management

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

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

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.

MEBS6016. Energy performance of buildings
This course covers the following topics: 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.

**MECH6023. Power plant technology**

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 emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.

This course covers the following topics: sources of energy; 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.

**MSC(ENG) IN ENVIRONMENTAL ENGINEERING**

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 project report or dissertation of four modules, on a subject within his approved field of study. Courses are one-module courses unless otherwise specified. The list of courses below is not final and some courses 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 courses.

(A) **FIVE to EIGHT modules from the following list of courses or courses 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.

**CIVL6010. Coastal hydraulics and sedimentation**

Tides and tidal currents; basic numerical techniques in mathematical models of tidal hydraulics and solute transport; tidal flushing and mariculture management; coastal sedimentation; impact of man-made changes on the coastal environment.

Prerequisite: Undergraduate course in hydraulics/fluid mechanics or equivalent
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 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

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.

MECH6017. Noise and vibration

For course descriptions, see the syllabuses of the MSc(Eng) in Mechanical Engineering programme.

MECH6019. Sources and control of air pollution

For course descriptions, see the syllabuses of the MSc(Eng) in Mechanical Engineering programme.

MEBS6004. Built environment

For course descriptions, see the syllabuses of the MSc(Eng) in Building Services Engineering programme.

MEBS6010. Indoor air quality

For course descriptions, see the syllabuses of the MSc(Eng) in Building Services Engineering programme.

(B) Not more than THREE modules from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or courses offered by other Departments subject to the approval of the Head of the Department of Civil Engineering.
(C) CIVL6001. Project (4 modules)

On admission to the programme, 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 E 18 and E 19, the progress of the project work will be assessed for the purpose of General Regulations G 11 and G 12 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 G 11.

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.

MSC(ENG) IN GEOTECHNICAL ENGINEERING

The curriculum provides advanced education in the field of Geotechnical Engineering. Students are required to successfully complete twelve modules which must include a project report or dissertation of four modules, on a subject within his approved field of study. Courses are one-module courses unless otherwise specified. The list of courses below is not final and some courses 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 courses.

(A) FIVE to EIGHT modules from the following list of courses or courses 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 course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

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

A discussion of 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 will be given. The principles and design considerations will be discussed through worked examples and case studies. Techniques of obtaining relevant soil parameters for design and the verification methods will also be covered.

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 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

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

Soil and rock classification systems; field instrumentation techniques; in-situ tests; laboratory tests; stress-path and its applications; groundwater monitoring; stress measurements; GPS and laser scanning monitoring methods.
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.

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

(C) CIVL6001. Project (4 modules)

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

MSC(ENG) IN INDUSTRIAL ENGINEERING AND LOGISTICS MANAGEMENT

The curriculum extends over not less than two and not more than three calendar 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.

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5 for student intake in/after 2005-2006.
Candidates are permitted to select courses in accordance with regulations E16 and E17.

**IELM6001. Concurrent engineering**


**IELM6002. Operations management**

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 * **

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.

**IELM6027. Organisation theory and behavioural science**

Managing and managers; evolution of management theory. Planning- decision making; strategic management; strategy implementation. Organising- organisational design and structure; power and the distribution of authority; managing organisational change and innovation. Leading- motivation; leadership; teams and teamwork; communication and negotiation. Controlling- principles of effective control; operations control.

**IELM6028. Enterprise logistics and facilities design * **

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**

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

IELM6034. Operational research techniques


IELM6037. Costing and finance

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 *


IELM6043. Information technology management

Planning and management approaches in IT: IT strategies; alignment planning; IT evaluation and outsourcing; managing information resources; building information systems; project implementation. Contemporary IT topics: e-commerce; IS security; impacts of IT on organizations, individuals, and society; business process re-engineering. IT applications: supply chain management; enterprise resource planning; customer relationship management; and knowledge management.

IELM6044. Supply chain management *

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.

IELM6045. Global operations and logistics *


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.

IELM6046. Supply management *

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.

IELM6047. Digital enterprises

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; Application case studies in enterprise business processes: (product development, order taking and processing, online contract negotiation and bidding, rapid quotation and cost estimation, etc.)

IELM6048. Terminal and warehousing operations *

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.

IELM6049. Advanced manufacturing systems

Manufacturing strategies, process choice; types of advanced manufacturing systems: FMS, reconfigurable manufacturing systems, holonic manufacturing system; elements of advanced manufacturing systems: production, handling, storage, sensing and control; modelling and analysis of manufacturing systems, discrete-event simulation, queuing networks, effects of variability on system performance; manufacturing cells; modelling and design of advanced manufacturing systems; control architectures; agent-based planning and scheduling.

IELM6050. Industrial applications of radio frequency identification technologies *

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

The module 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.

IELM6052. Operational risk management practices


IELM6025. Project (4 modules)

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

MSC(ENG) IN INFRASTRUCTURE PROJECT MANAGEMENT

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 project report or dissertation of four modules, on a subject within his approved field of study. Courses are one-module courses unless otherwise specified. The list of courses below is not final and some courses 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 courses.

(A) FIVE to EIGHT modules from the following list of courses or courses 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 course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

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 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

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

This course will cover in detail the requirements and obligations of asset stewardship and railway asset management models and their relationships with the growing demands of regulatory and business environments.

CIVL7005. Sustainable construction technology: principles and practices

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.

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

(B) Not more than THREE modules from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or courses offered by other Departments subject to the approval of the Head of the Department of Civil Engineering.
MSC(ENG) IN MECHANICAL ENGINEERING

Programme Objectives

The aim of the programme 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. Classes will normally be arranged in the evening on weekdays and in the morning on Saturdays. For the full-time students, some courses may also be taught in the daytime on weekdays.

The full-time programme requires a student to satisfactorily complete 8 modules and a project within a study period of 1 to 2 years. For the students enrolled in the part-time programme, they may opt to either satisfactorily complete 12 modules or 8 modules plus a project within a study period of 2 to 3 years.

Study Modules

The following study modules are the core courses of the programme. A number of these core courses will be selected for offer to students in each academic year. A student who does not undertake a project must complete at least 8 core courses whereas a student who undertakes a project must complete at least 5 core courses. Optional courses are available from other MSc programmes in the Faculty of Engineering for selection by students.

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

MECH6007. Project (4 modules)

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

MECH6010. Service behaviour of materials

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.

**MECH6017. Noise and vibration**

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**

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**

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.

**MECH6023. Power plant technology**

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 emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.
Topics include: sources of energy; 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.

**MECH6024. Applied mathematics for engineers**

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.

**MECH6026. Computational fluid dynamics**

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.

**MECH6033. Energy conservation and management**

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.

**MECH6034. Computer-aided product development (CAPD)**

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.

**MECH6039. Biomaterials and tissue engineering**

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.

**MECH6042. Renewable energy technology I: Fundamental**

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.

**MECH6043. Renewable energy technology II: Advanced**

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: MECH 6042 or for students who have previously passed MECH6009 which is obsolete with effect from 2011-2012

**MECH6044. Energy and carbon audit**
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.

**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 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 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 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 module 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 MECH 6032 will not be allowed to take MECH6046.

**MECH6047. Finite element analysis in mechanics**

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; beam/plate analysis; dynamic analysis; geometric and material nonlinear analysis; contact analysis; hands-on experience of finite element analysis.

**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**

The curriculum provides advanced education in the field of Structural Engineering. Students are required to successfully complete twelve modules which must include a project report or dissertation of four modules, on a subject within his approved field of study.

The list of courses below is not final, and may be changed from time to time. Courses are one-module courses unless otherwise specified. Students who intend to complete the curriculum in one academic year should check with the Department of Civil Engineering for the availability of the courses.

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

**CIVL6002. Advanced finite elements**

For course descriptions, see the syllabuses of the MSc(Eng) in Geotechnical Engineering programme.
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 course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

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 course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

CIVL6026. Finite element method

For course descriptions, see the syllabuses of the MSc(Eng) in Geotechnical Engineering programme.

CIVL6027. Foundation engineering

For course descriptions, see the syllabuses of the MSc(Eng) in Geotechnical Engineering programme.

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 course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.
CIVL6060. Operation and maintenance of building and civil engineering works

For course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

CIVL6063. Special topic in structural engineering A

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

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

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 course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

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.

(B) Not more than THREE modules from the MSc(Eng) courses offered by the Department of Civil Engineering other than those listed in (A) above, or courses offered by other Departments subject to the approval of the Head of the Department of Civil Engineering.
MSC(ENG) IN TRANSPORTATION ENGINEERING

The curriculum provides advanced education in the field of Transportation Engineering. Students are required to successfully complete twelve modules which must include a project report or dissertation of four modules, on a subject within his approved field of study. Courses are one-module courses unless otherwise specified. The list below is not final and some courses 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 courses.

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

CIVL6007. Behavioural travel demand modelling *

This course will cover the basic as well as modern and advanced techniques in travel demand modelling. Topics will include demand theory, statistical models, survey methods in transport, land use transportation models, disaggregate choice models, and behavioural concepts in choice modelling. Software packages such as R, SPSS and SAS will be used to support the demonstration of practical applications of data analysis and model building in the course.

CIVL6025. Environmental impact assessment of engineering projects

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.

CIVL6035. Highway pavement engineering

For course descriptions, see the syllabuses of the MSc(Eng) in Geotechnical Engineering programme.

CIVL6037. Project management - human and organisational factors *

For course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

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.

CIVL6048. Planning of transport infrastructure systems *

Introduction to systems engineering, urban system models, network modelling concepts and techniques, trip assignment models.

CIVL6049. Urban development management by engineering approach

For course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

CIVL6054. Engineering for transport systems *

This course provides the students an engineering appreciation of the transport systems, including planning, policy formulation, design, implementation and operation. It covers both the theoretical frameworks and practical examples under various topics in transportation engineering. Key aspects of transport infrastructure development, choice of transportation systems, fixed track systems, road safety, application of technology in transport etc. will be presented.

CIVL6056. Special topic in transportation engineering A

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

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 *

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

This course will cover a wide variety of analytical tools used in transportation studies, from the fundamentals to modern and advanced techniques in data analysis. Topics will include basic tools for statistical model building, linear models, time series and forecasting, count and discrete dependent variables, duration models, and analysis of longitudinal data. Software packages such as R, SPSS and SAS will be used to support the demonstration of data analysis in the course.
CIVL7001. Railway asset management

For course descriptions, see the syllabuses of the MSc(Eng) in Infrastructure Project Management programme.

CIVL7004. Traffic impact assessment

This course focuses on Traffic Impact Assessments (TIA’s) for professional traffic engineers and transport planners, and aims to upgrade the capability and competency of students to conduct TIA’s independently, convincingly and satisfactorily in their professional career. It covers the essence for carrying out TIA’s for single isolated developments, TIA’s for developments such as extensive developments and reclamation areas, TIA’s for the commissioning of highway and public transport infrastructures, TIA’s for changes of transport policies, TIA’s for special traffic generators, and TIA’s encountered in Mainland China. This course also covers the development of technical, presentational and public relation skills for professional TIA report writing and presentation of study findings to public bodies or relevant authorities in a persuasive manner, the applications of the traffic engineering and transport planning techniques in TIA’s, as well as the development of skills required to obtain efficient and cost-effective solutions to problems identified in TIA’s.

CIVL7006. Optimization techniques for transportation applications

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

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

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

(C) CIVL6001. Project (4 modules)

For course descriptions, see the syllabuses of the MSc(Eng) in Environmental Engineering programme.