

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

(See also General Regulations)

The degree of Master of Science in Engineering (MSc[Eng]) is a postgraduate degree awarded for the satisfactory completion of a curriculum in the Faculty of Engineering. The major part of the curriculum must be formed from modules offered in one of the following fields: building services engineering, electrical and electronic engineering, energy engineering, environmental engineering, geotechnical engineering, industrial engineering and logistics management, infrastructure project management, mechanical engineering, structural engineering, and transportation engineering. The MSc[Eng] curriculum is offered in part-time and full-time modes.

E1 Admission requirements

To be eligible for admission to the curriculum leading to the degree of Master of Science in Engineering, a candidate shall

- (a) comply with the General Regulations;
 - (b) hold (1) a Bachelor's degree of this University in a relevant field; or
(2) any other relevant qualification of equivalent standard from this University or from another university or comparable institution accepted for this purpose; and
 - (c) satisfy the examiners in a qualifying examination if required.
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E2 Qualifying examination

- (a) A qualifying examination may be set to test the candidate's academic ability or his/her ability to follow the curriculum prescribed. It shall consist of one or more written papers or their equivalent and may include a dissertation.
 - (b) A candidate who is required to satisfy the examiners in a qualifying examination shall not be permitted to register until he/she has satisfied the examiners in the examination.
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E3 Award of degree

- (a) To be eligible for the award of the degree of Master of Science in Engineering, a candidate shall
 - (1) comply with the General Regulations; and
 - (2) complete the curriculum and satisfy the examiners in accordance with the regulations set out below.
 - (b) A candidate who has completed eight modules but has not satisfied the examiners for the award of the degree of Master of Science in Engineering may be awarded a Postgraduate Diploma in Engineering [PDipEng], subject to approval of the Faculty Board.
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E4 Length of curriculum

For the part-time mode of study, the curriculum shall extend over not less than two and not more than three academic years of study. For the full-time mode of study, the curriculum shall extend over not less than one and not more than two academic years of study. In both cases, a minimum of 300 hours of prescribed work are required.

E5 Completion of curriculum

To complete the curriculum a candidate shall, within the prescribed maximum period of study stipulated in Regulation E4 above:

- (a) follow courses of instruction and complete satisfactorily all prescribed practical / laboratory work; and
 - (b) satisfy the examiners in all forms of assessment as may be required in either
 - (1) twelve modules which may include a dissertation of four modules; *or*
 - (2) at least nine modules successfully completed at this University (which may include a dissertation of four modules) and not more than three modules successfully completed at this or another university before admission to the Master of Science in Engineering and approved by the Faculty Board.
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E6 Course selection

- (a) Selection of study patterns, as stipulated in the respective syllabus, shall be subject to the approval of the Head of the Department concerned.
 - (b) A candidate shall select modules according to the guidelines stipulated in the syllabuses for the degree of MSc[Eng].
 - (c) Subject to the approval of the Committee on Taught Postgraduate Curricula on the recommendation of the Head of the Department concerned, a candidate may in exceptional circumstances be permitted to select additional module(s).
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E7 Dissertation

- (a) A candidate who is permitted to select a dissertation is required to submit it by a date specified by the Board of Examiners.
 - (b) All candidates shall submit a statement that the dissertation represents his/her own work undertaken after the registration as a candidate for the degree.
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E8 Assessment and discontinuation

- (a) The written examination for each module shall be held after the completion of the prescribed course of study for that module, and not later than January, May or August immediately following the completion of the course of study for that module.
- (b) A candidate, who is unable to complete the requirements within the prescribed maximum period of study specified in Regulation E4 because of illness or circumstances beyond his/her control, may apply for permission to extend his/her period of studies. Any such application shall be made within two weeks of the day of examination for the paper in question.
- (c) A candidate who has failed to satisfy the examiners in a module or modules may be permitted to present him/herself either for re-examination in the module or modules of failure or for examination in the same number of new modules when the examination is next held. To proceed to the following year of the curriculum, a candidate must satisfy the examiners in a minimum of two modules in each academic year. A candidate who passes in less than two modules in an academic year may be recommended for discontinuation of studies under the provisions of General Regulation G12.
- (d) A candidate who has failed to satisfy the examiners in his/her dissertation may be required to submit or resubmit a dissertation on the same subject within a period specified by the Board of Examiners.
- (e) A candidate who has failed to satisfy the examiners at a second attempt in his/her

dissertation within the specified period shall be recommended for discontinuation of studies under the provisions of General Regulation G12.

- (f) A candidate who has failed to fulfill the requirements within the prescribed maximum period of study specified in Regulation E4, including any extension, shall be recommended for discontinuation of studies under the provisions of General Regulation G12.

E9 Assessment results

At the conclusion of the examination and after presentation of the dissertation, a pass list shall be published. A candidate who has shown exceptional merit or merit at the whole examination may be awarded distinction or credit, as appropriate, and this shall be recorded on the candidate's degree diploma.

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

MSC(ENG) IN BUILDING SERVICES ENGINEERING (Applicable to students admitted to the curriculum in 2014-2015 and thereafter)

Objectives

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

Study Modules

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

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

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

List A discipline modules

MEBS6000 Utility services

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

generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; electromagnetic interference; lightning protection.

MEBS6003 Project management

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

MEBS6006 Environmental services I

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

MEBS6008 Environmental services II

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

MEBS6021 Fire services design I

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

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

MEBS6022 Fire services design II

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

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

List B discipline modules

MEBS6002 Lighting engineering

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

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.

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 health effects of pollutants, concentration, individual and population exposure, dose-response relationships, measurement and monitoring methods, ventilation, filtration, indoor air quality assessment and control, operation and maintenance, legislation and public policy issues, energy and cost implications.

MEBS6011 Maintenance and management of building facilities

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

MEBS6013 Testing and commissioning

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

MEBS6014 Computer modelling and simulation

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

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

MEBS6015 Natural and hybrid ventilation of buildings

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

MEBS6016 Energy performance of buildings

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

MEBS6017 Building intelligence

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

MEBS6018 Clean electrical energy and smart-grids for buildings

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

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.

MEBS6020 Sustainable building design

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

MEBS6023 Dissertation (4 modules)

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

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

MSC(ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING

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

The Master of Science in Engineering in Electrical and Electronic Engineering curriculum, 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.

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 modules may not be offered every year.

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

ELEC6006 Communications policy and regulations

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

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

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.

ELEC6008 Pattern recognition and machine learning

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

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

Pre-requisite: A good background in linear algebra, programming experience.

ELEC6014 Digital communications I

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

ELEC6021 Project (4 modules)

ELEC6026 Digital signal processing

This module 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 module will also discuss in detail about other advanced topics in digital signal processing such as multidimensional signals and systems, random processes and applications, and adaptive signal processing.

ELEC6027 Integrated circuit systems design

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

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

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

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

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

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

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

ELEC6054 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.

ELEC6055 Power system distribution

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

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

ELEC6057 Power system planning

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

ELEC6058 Power transmission

High voltage a.c. transmission. Steady-state and transient performance of transmission lines. System simulation. Lightning performance. Overvoltages and insulation coordination. Reactive power control, SVC's, Field effects, corona, radio interference and noise. High voltage d.c. transmission. Thyristor valves, converter operation, harmonics and filters, protection and insulation coordination.

ELEC6063 Optoelectronics and lightwave technology

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

Optical communication system has almost become a “must” technique in data/signal transmission (i.e. fiber to home). Students will have the ability to address the issues:

- (i) what optoelectronic components are required in the system and the operation principles and device physics,
 - (ii) the issues that have been considered to build an optical network by using the optoelectronic components
 - (iii) to evaluate the performance of the optical network to meet the target/budget (technical) and to improve the performance (using advanced technology).
- All the issues will be discussed in this module.
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ELEC6065 Data compression

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

ELEC6067 Magnetic resonance imaging (MRI) technology and applications

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

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

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

Pre-requisite: Introductory module in physics or electromagnetism

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 module 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)

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).

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.

ELEC6079 Biomedical ultrasound

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

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

ELEC6080 Telecommunications systems and management

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

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

ELEC6081 Biomedical signals and systems

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

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

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

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

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

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.

ELEC6087 Wireless data network standards

Wireless network standards: Architecture, components, and protocols; Cellular technology, UMTS and Evolved packet core, LTE/SAE; WirelessLAN standards extensions, WiMAX standards. Wireless network technology: wireless applications, wireless links, IP standards, mobility in different wireless systems, ID-Locator split protocols, IETF standards for wireless data networks.

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.

ELEC6089 Antennas

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

ELEC6090 Energy saving lighting

This module 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 module, the candidate should be able to make a learned choice on energy-efficient light sources.

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.

EMEE6008 Green project management

This module aims at introducing Green Project Management. By giving a brief account on the environmental issues, the module will begin by explaining the scope and value of green projects. It will

illustrate the importance of clarity of mission and goals of green projects; and how these could be done by means of audit and feasibility study. It will also describe how green project planning and control can be implemented with proper system tools. The basic theory regarding contract management: project strategy, contract documents, tendering procedure and contingency shall be introduced. It will also give examples of site implementation: partnership collaboration; project quality assurance; safety management; environmental issues and risk management. The module shall be concluded by detailing project quality assurance; safety management.

Mutually exclusive with: ELEC6092

EMEE6009 Green facilities management

The module 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 module 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 module 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.

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.

ELEC6095 Smart grid

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

Mutually exclusive with ELEC6096

ELEC6097 IP Networks

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

Mutually exclusive with: ELEC6007, ELEC7144

ELEC6098 Electronic and mobile commerce

This module aims at introducing both technical, commercial and managerial knowledge on electronic commerce and mobile. The module will start with an introduction to the Business-to-Consumer (B2C) Model; Business-to- Business (B2B) model, followed by an 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 module, the research trend and the way forward of the industry will be discussed.

Mutually exclusive with: ELEC6078, ELEC6086

ELEC6099 Wireless communications and networking

This module aims at introducing the technologies on wireless communications and issues on wireless networking. The module 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 module 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 module aims at enabling the fundamental understanding of the digital communication systems. After an overview, the module 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 module 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 module is an introduction to satellite communications taught at a level appropriate for postgraduates reading for the MSc curriculum in electrical and electronic engineering. It is aimed at providing a general understanding and an overview on satellite communications, with emphasis on the recent applications and developments

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

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

ELEC6601 Industrial marketing

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

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

ELEC6602 Business venture in China

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

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

ELEC6603 Success in industrial entrepreneurship

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

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

ELEC6604 Neural networks, fuzzy systems and genetic algorithms

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

ELEC7051 Advanced topics in communication theory and systems

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

ELEC7073 Digital communications III

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

ELEC7077 Advanced topics in multimedia signals and systems

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

ELEC7078 Advanced topics in electrical and electronic engineering

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

ELEC7079 Investment and trading for engineering students

This module is designed for engineering students who wish to start a career in the financial industry. The depth of this module will be at the master level but senior undergraduate students with good technical skills are welcome to take. This module helps the students to integrate the technical skills, for example, programming and partial differential equation (PDE), they have learned in other engineering modules 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 module we will review the foundations of securities trading and discuss issues that related to the market microstructure. We will review important models in the microstructure and present mathematical tools in their structural and statistical representations. We will also discuss the costs associated with trading, how these costs are measured and strategies that minimize them, including the study of models for optimal splitting of the orders across time, to reduce transaction costs and control the temporary and permanent price adjustments that result from trades. "Is that possible to use HFT in China or Hong Kong equities, options, or futures markets?" was a question that constantly been asked by practitioners and we will search for the answer together.

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.

ELEC7150 Advanced topics in computer engineering and networking

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

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.

ELEC7252 Advanced topics in control theory and systems

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

ELEC7364 Advanced topics in microelectronics

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

ELEC7401 Advanced topics in electric drives and control

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

ELEC7402 Advanced electric vehicle technology

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

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

ELEC7403 Advanced power electronics

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

ELEC7456 Advanced power system operation

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

control, switching operation and operational safety, emergency preparedness and black start strategy, and power system deregulation and open market's impact to system operation.

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

ELEC7466 Advanced topics in power system engineering

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

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

ELEC7467 Sliding mode control applications in power electronics

This module 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.

EMEE6003 Nuclear energy

Students in this module 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

MEBS6001 Electrical installations

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

MEBS6019 Extra-low-voltage electrical systems in buildings

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

MSC (ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING

(applicable to students admitted to the curriculum in the academic year 2012-2013 and 2013-2014)

The Master of Science in Engineering in Electrical and Electronic Engineering curriculum has three different streams: General Stream, Communications Engineering, and Power Engineering. Each candidate is required to follow a prescribed 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
ELEC6067	Magnetic resonance imaging (MRI) technology and applications
ELEC6079	Biomedical ultrasound
ELEC6081	Biomedical signals and systems
ELEC6092	Green project management
ELEC6601	Industrial marketing
ELEC6602	Business venture in China
ELEC6603	Success in industrial entrepreneurship
ELEC6604	Neural networks, fuzzy systems and genetic algorithms
ELEC7078	Advanced topics in electrical and electronic engineering
ELEC7079	Investment and trading for engineering students
ELEC7080	Algorithmic trading and high frequency trading

B. Communications Engineering

ELEC6006	Communications policy and regulations
ELEC6026	Digital signal processing †
ELEC6065	Data compression
ELEC6080	Telecommunications systems and management

ELEC6097	IP networks
ELEC6098	Electronic and mobile commerce
ELEC6099	Wireless communications and networking
ELEC6100	Digital communications
ELEC6103	Satellite communications
ELEC7051	Advanced topics in communication theory and systems
ELEC7077	Advanced topics in multimedia signals and systems

C. Power Engineering

ELEC6055	Power system distribution
ELEC6084	Power delivery management for metropolitan cities
ELEC6085	The role of a computerized SCADA system in power system operation
ELEC6095	Smart grid
ELEC7402	Advanced electric vehicle technology
ELEC7403	Advanced power electronics
ELEC7456	Advanced power system operation
ELEC7466	Advanced topics in power system engineering
ELEC7467	Sliding mode control applications in power electronics
EMEE6003	Nuclear energy
EMEE6010	Electricity quality and energy efficiency
MEBS6001	Electrical installations
MEBS6019	Extra-low-voltage electrical systems in buildings

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

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

ELEC6006 Communications policy and regulations

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

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

ELEC6008 Pattern recognition and machine learning

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

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

Pre-requisite: A good background in linear algebra, programming experience.

ELEC6021 Project (4 modules)

ELEC6026 Digital signal processing

This module 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 module will also discuss in detail about other advanced topics in digital signal processing such as multidimensional signals and systems, random processes and applications, and adaptive signal processing.

ELEC6027 Integrated circuit systems design

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

ELEC6036 High-performance computer architecture

This module aims at providing an in-depth understanding of the principles, architectures and implementations of modern high performance processors which are designed and based on the aggressive use of instruction-level parallelism (ILP). Specifically, the module 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 module deals with the theory, techniques and applications of digital image processing, which includes characterization, enhancement, restoration, feature extraction, representation, description and classification, advance topics in image analysis, image motion, and application case studies.

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

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

ELEC6049 Digital system design techniques

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

The module begins with an overview of digital technologies, their evolution and the implication on design realization. Students are updated on fundamental theories and essential building blocks to prepare them for higher level systems design. A structured approach is used to quickly guide students from basic

combinational logic to more complex digital systems such as RTL or programmable processors. Design tradeoffs and optimizations are emphasized as an integral part of the design process.

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

ELEC6055 Power system distribution

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

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

ELEC6063 Optoelectronics and lightwave technology

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

Optical communication system has almost become a “must” technique in data/signal transmission (i.e. fiber to home). Students will have the ability to address the issues:

- (i) what optoelectronic components are required in the system and the operation principles and device physics,
- (ii) the issues that have been be considered to build a optical network by using the optoelectronic components
- (iii) to evaluate the performance of the optical network to meet the target/budget (technical) and to improve the performance (using advanced technology).

All the issues will be discussed in this module.

ELEC6065 Data compression

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

ELEC6067 Magnetic resonance imaging (MRI) technology and applications

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

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

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

Pre-requisite: Introductory module in physics or electromagnetism

ELEC6079 Biomedical ultrasound

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

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

ELEC6080 Telecommunications systems and management

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

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

ELEC6081 Biomedical signals and systems

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

ELEC6084 Power delivery management for metropolitan cities

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

effectiveness are also included. Strategies for loss prevention management, enhancement of supply reliability and power quality are also examined.

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

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

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

ELEC6092 Green project management

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

ELEC6095 Smart grid

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

Mutually exclusive with ELEC6096

ELEC6097 IP Networks

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

Mutually exclusive with: ELEC6007, ELEC7144

ELEC6098 Electronic and mobile commerce

This module aims at introducing both technical, commercial and managerial knowledge on electronic commerce and mobile. The module will start with an introduction to the Business-to-Consumer (B2C) Model; Business-to- Business (B2B) model, followed by an 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 module, the research trend and the way forward of the industry will be discussed.

Mutually exclusive with: ELEC6078, ELEC6086

ELEC6099 Wireless communications and networking

This module aims at introducing the technologies on wireless communications and issues on wireless networking. The module 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 module 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 module aims at enabling the fundamental understanding of the digital communication systems. After an overview, the module 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 module also covers advanced topics in digital communications such as CDMA, MIMO, and OFDM.

Mutually exclusive with: ELEC6014 and ELEC6045

ELEC6103 Satellite communications

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

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

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

ELEC6601 Industrial marketing

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

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

ELEC6602 Business venture in China

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

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

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

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ELEC6604 Neural networks, fuzzy systems and genetic algorithms

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

ELEC7051 Advanced topics in communication theory and systems

This module covers advanced topics in communication theory and systems. The first part of the module focuses on MIMO communication that is the major breakthrough in modern communication theory and

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

ELEC7077 Advanced topics in multimedia signals and systems

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

ELEC7078 Advanced topics in electrical and electronic engineering

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

ELEC7079 Investment and trading for engineering students

This module is designed for engineering students who wish to start a career in the financial industry. The depth of this module will be at the master level but senior undergraduate students with good technical skills are welcome to take. This module helps the students to integrate the technical skills, for example, programming and partial differential equation (PDE), they have learned in other engineering modules 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 module we will review the foundations of securities trading and discuss issues that related to the market microstructure. We will review important models in the microstructure and present mathematical tools in their structural and statistical representations. We will also discuss the costs associated with trading, how these costs are measured and strategies that minimize them, including the study of models for optimal splitting of the orders across time, to reduce transaction costs and control the temporary and permanent price adjustments that result from trades. "Is that possible to use HFT in China or Hong Kong equities, options, or futures markets?" was a question that constantly been asked by practitioners and we will search for the answer together.

ELEC7402 Advanced electric vehicle technology

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

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

ELEC7403 Advanced power electronics

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

ELEC7456 Advanced power system operation

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

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

ELEC7466 Advanced topics in power system engineering

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

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

ELEC7467 Sliding mode control applications in power electronics

This module 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.

EMEE6003 Nuclear energy

Students in this module 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

EMEE6010 Electricity quality and energy efficiency

The module 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.

MEBS6001 Electrical installations

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

MEBS6019 Extra-low-voltage electrical systems in buildings

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

MSC (ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING

(applicable to students admitted to the curriculum in the academic year 2014-2015 and thereafter)

The Master of Science in Engineering in Electrical and Electronic Engineering curriculum has three different streams: General Stream, Communications Engineering, and Power Engineering. Each candidate is required to follow a prescribed curriculum comprising 12 modules, out of which the candidate has to pass at least 9 discipline modules selected from the list below. To qualify as a graduate of the Communications Engineering Stream, the candidate must pass at least 6 discipline modules in the Communications Engineering subject group. To qualify as a graduate of the Power Engineering Stream, the candidate must pass at least 6 discipline modules in the Power Engineering subject group. For General Stream, the candidate can freely choose from the three subject groups below. Subject to approval, candidates can select to undertake a dissertation (ELEC7021) and in which case, General Stream candidates are required to pass at least 5 discipline modules selected from the list below, while candidates pursuing Communications Engineering and Power Engineering Streams are required to pass at least 5 discipline modules in their respective subject groups. The candidate can select Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives.

Subject Groups

A. General

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

B. Communications Engineering

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

C. Power Engineering

ELEC6055	Power system distribution
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ELEC6084	Power delivery management for metropolitan cities
ELEC6085	The role of a computerized SCADA system in power system operation
ELEC6095	Smart grid
ELEC7402	Advanced electric vehicle technology
ELEC7403	Advanced power electronics
ELEC7456	Advanced power system operation
ELEC7466	Advanced topics in power system engineering
ELEC7467	Sliding mode control applications in power electronics
EMEE6003	Nuclear energy
EMEE6010	Electricity quality and energy efficiency
MEBS6001	Electrical installations
MEBS6019	Extra-low-voltage electrical systems in buildings

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

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

ELEC6006 Communications policy and regulations

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

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

ELEC6008 Pattern recognition and machine learning

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

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

Pre-requisite: A good background in linear algebra, programming experience.

ELEC7021 Dissertation (4 modules)

ELEC6026 Digital signal processing

This module 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 module will also discuss in detail about other advanced topics in digital signal processing such as multidimensional signals and systems, random processes and applications, and adaptive signal processing.

ELEC6027 Integrated circuit systems design

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

ELEC6036 High-performance computer architecture

This module aims at providing an in-depth understanding of the principles, architectures and implementations of modern high performance processors which are designed and based on the aggressive use of instruction-level parallelism (ILP). Specifically, the module 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 module deals with the theory, techniques and applications of digital image processing, which includes characterization, enhancement, restoration, feature extraction, representation, description and classification, advance topics in image analysis, image motion, and application case studies.

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

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

ELEC6049 Digital system design techniques

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

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

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

ELEC6055 Power system distribution

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

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

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

ELEC6063 Optoelectronics and lightwave technology

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

Optical communication system has almost become a “must” technique in data/signal transmission (i.e. fiber to home). Students will have the ability to address the issues:

- (i) what optoelectronic components are required in the system and the operation principles and device physics,
- (ii) the issues that have been considered to build a optical network by using the optoelectronic components
- (iii) to evaluate the performance of the optical network to meet the target/budget (technical) and to improve the performance (using advanced technology).

All the issues will be discussed in this module.

ELEC6065 Data compression

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

ELEC6067 Magnetic resonance imaging (MRI) technology and applications

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

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

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

Pre-requisite: Introductory course in physics or electromagnetism

ELEC6079 Biomedical ultrasound

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

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

ELEC6080 Telecommunications systems and management

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

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

ELEC6081 Biomedical signals and systems

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

ELEC6084 Power delivery management for metropolitan cities

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

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

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

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

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

Mutually exclusive with: ELEC6096

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

Mutually exclusive with: ELEC6007, ELEC7144

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

Mutually exclusive with: ELEC6078, ELEC6086

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Mutually exclusive with: ELEC6040, ELEC6071, ELEC6087

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This module aims at enabling the fundamental understanding of the digital communication systems. After an overview, the module 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 module also covers advanced topics in digital communications such as CDMA, MIMO, and OFDM.

Mutually exclusive with: ELEC6014 and ELEC6045

ELEC6103 Satellite communications

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

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

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

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

ELEC6602 Business venture in China

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

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

ELEC6603 Success in industrial entrepreneurship

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

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

ELEC6604 Neural networks, fuzzy systems and genetic algorithms

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

ELEC7051 Advanced topics in communication theory and systems

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

ELEC7077 Advanced topics in multimedia signals and systems

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

ELEC7078 Advanced topics in electrical and electronic engineering

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

ELEC7079 Investment and trading for engineering students

This module is designed for engineering students who wish to start a career in the financial industry. The depth of this module will be at the master level but senior undergraduate students with good technical skills are welcome to take. This module helps the students to integrate the technical skills, for example, programming and partial differential equation (PDE), they have learned in other engineering modules 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 module we will review the foundations of securities trading and discuss issues that related to the market microstructure. We will review important models in the microstructure and present mathematical tools in their structural and statistical representations. We will also discuss the costs associated with trading, how these costs are measured and strategies that minimize them, including the study of models for optimal splitting of the orders across time, to reduce transaction costs and control the temporary and permanent price adjustments that result from trades. "Is that possible to use HFT in China or Hong Kong equities, options, or futures markets?" was a question that constantly been asked by practitioners and we will search for the answer together.

ELEC7402 Advanced electric vehicle technology

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

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

ELEC7403 Advanced power electronics

The aim of this module is to provide students with an understanding of advanced subject matters in power electronics, which include (i) high-frequency switching converters; (ii) dynamics and control of

switching converters; (iii) modeling of switching converters; (iv) components and devices; and (v) industrial requirements. Students enrolled in the module are expected to have prior understanding of basic power electronic principles and the operations of rectifier and phase controlled circuits, and DC/DC buck, boost, buck-boost, and Cuk converters, and knowledge of basic power devices such as power transistor, power MOSFET, and IGBT.

ELEC7456 Advanced power system operation

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

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

ELEC7466 Advanced topics in power system engineering

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

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

ELEC7467 Sliding mode control applications in power electronics

This module 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.

EMEE6003 Nuclear energy

Students in this module 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

EMEE6010 Electricity quality and energy efficiency

The module 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.

MEBS6001 Electrical installations

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

MEBS6019 Extra-low-voltage electrical systems in buildings

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

MSC(ENG) IN ENERGY ENGINEERING

(applicable to students admitted to the curriculum before the academic year 2014-2015)

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 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 Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives.

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

ELEC6084	Power delivery management for metropolitan cities
ELEC6090	Energy saving lighting
ELEC6095	Smart grid
ELEC7402	Advanced electric vehicle technology
ELEC7403	Advanced power electronics
ELEC7466	Advanced topics in power system engineering
EMEE6001	Project (4 modules)

EMEE6002	Sustainability and climate change
EMEE6003	Nuclear energy
EMEE6004	Energy conservation and management
EMEE6005	Renewable energy technology I: Fundamental
EMEE6006	Renewable energy technology II: Advanced
EMEE6007	Energy and carbon audit
EMEE6008	Green project management
EMEE6009	Green facilities management
EMEE6010	Electricity quality and energy efficiency
MEBS6016	Energy performance of buildings
MECH6023	Power plant technology

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

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

ELEC6084 Power delivery management for metropolitan cities

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

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

ELEC6090 Energy saving lighting

This module 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 module, the candidate should be able to make a learned choice on energy-efficient light sources.

ELEC6095 Smart grid

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

Mutually exclusive with ELEC6096

ELEC7402 Advanced electric vehicle technology

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

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

ELEC7403 Advanced power electronics

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

ELEC7466 Advanced topics in power system engineering

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

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

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

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

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

Mutually exclusive with: MECH6042

EMEE6006 Renewable energy technology II: Advanced

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

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

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

Mutually exclusive with: ELEC6092

EMEE6009 Green facilities management

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

This module 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 ENERGY ENGINEERING

(applicable to students admitted to the curriculum in the academic year 2014-2015 and thereafter)

Each candidate is required to follow a prescribed curriculum comprising 12 modules, out of which the candidate has to pass at least 9 modules selected from the List of Discipline Modules. The candidate can select to undertake a dissertation in lieu of 4 modules, and has to pass at least 5 Discipline Modules. The candidate can select Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives.

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

ELEC6084	Power delivery management for metropolitan cities
ELEC6090	Energy saving lighting
ELEC6095	Smart grid
ELEC7402	Advanced electric vehicle technology
ELEC7403	Advanced power electronics
ELEC7466	Advanced topics in power system engineering
EMEE7001	Dissertation (4 modules)
EMEE6002	Sustainability and climate change
EMEE6003	Nuclear energy
EMEE6004	Energy conservation and management
EMEE6005	Renewable energy technology I: Fundamental
EMEE6006	Renewable energy technology II: Advanced

EMEE6007	Energy and carbon audit
EMEE6008	Green project management
EMEE6009	Green facilities management
EMEE6010	Electricity quality and energy efficiency
MEBS6016	Energy performance of buildings
MECH6023	Power plant technology

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

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

ELEC6084 Power delivery management for metropolitan cities

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

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

ELEC6090 Energy saving lighting

This module 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 module, the candidate should be able to make a learned choice on energy-efficient light sources.

ELEC6095 Smart grid

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

Mutually exclusive with: ELEC6096

ELEC7402 Advanced electric vehicle technology

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

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

ELEC7403 Advanced power electronics

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

ELEC7466 Advanced topics in power system engineering

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

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

EMEE7001 Dissertation (4 modules)

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

EMEE6002 Sustainability and climate change

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

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

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

Mutually exclusive with: MECH6042

EMEE6006 Renewable energy technology II: Advanced

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

This module 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: MECH6042 or EMEE6005 or MECH6009

Mutually exclusive with: MECH6043

EMEE6007 Energy and carbon audit

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

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

Mutually exclusive with: ELEC6092

EMEE6009 Green facilities management

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

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

The syllabus is applicable to all current students of the curriculum and to candidates admitted in the academic year 2014-15 and thereafter.

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

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

CIVL6005 Data analysis in hydrology

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

CIVL6006 Advanced water and wastewater treatment

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

CIVL6023 Environmental chemistry

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

CIVL6024 Environmental hydraulics

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

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

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6029 Groundwater hydrology

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

CIVL6034 Municipal wastewater treatment

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

CIVL6040 Solid and hazardous waste management engineering

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

CIVL6050 Urban hydrology and hydraulics

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

CIVL6051 Water quality modelling

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

Prerequisite: Undergraduate course in environmental engineering or equivalent

CIVL6053 Wind engineering

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

CIVL6061 Special topic in environmental engineering A

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

CIVL6062 Special topic in environmental engineering B

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

CIVL6081 Recent advances in water and environmental engineering

The module aims to provide an opportunity for students to study in-depth areas of water and environmental engineering. Content will encompass the selected topics in environmental hydraulics, fluid mechanics, hydrology, environmental microbiology, water chemistry, water and wastewater treatment technologies.

MEBS6004 Built environment

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

MEBS6010 Indoor air quality

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

MECH6017 Noise and vibration

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

MECH6019 Sources and control of air pollution

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

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

(C) CIVL6001 Project (4 modules)

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

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

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

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

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in or after the academic year of 2014-2015.

On admission to the curriculum, students will undertake a supervised dissertation which will be assessed. The dissertation must relate to the subject matter and be agreed by the Department of Civil Engineering. In addition to satisfying MSc(Eng) Regulations E7 and E8, the progress of the dissertation work will be assessed for the purpose of General Regulations G11 and G12 according to a timeframe set by the Department of Civil Engineering for submission of the following:

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

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

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

MSC(ENG) IN GEOTECHNICAL ENGINEERING

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

The syllabus is applicable to all current students of the curriculum and to candidates admitted in the academic year 2014-15 and thereafter.

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

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

CIVL6002 Advanced finite elements

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

CIVL6004 Advanced soil mechanics

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

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6026 Finite element method

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

CIVL6027 Foundation engineering

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

CIVL6028 Ground improvement

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

CIVL6044 Special topic in geotechnical engineering B

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

CIVL6077 Ground investigation and soil testing

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; landslide 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) modules offered by the Department of Civil Engineering other than those listed in (A) above, or elective modules at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001 Project (4 modules)

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

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in or after the academic year of 2014-2015.

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

MSC(ENG) IN INDUSTRIAL ENGINEERING AND LOGISTICS MANAGEMENT

[This syllabus is applicable to students admitted to the curriculum in the academic year 2014-2015 and thereafter.]

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

Candidates are permitted to select modules in accordance with Regulations E5 and E6. Candidates must either select (a) 12 modules; or (b) 8 modules and a dissertation. In either case, he/she can select no more than three Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives. All selection will be subjected to approval by the Course Coordinator.

The following is a list of discipline modules offered by the Department of Industrial and Manufacturing Systems Engineering. The list below is not final and some modules may not be offered every year.

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

IELM6001 Concurrent engineering

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

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

IELM6002 Operations management

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 comfort. Noise; noise measurement, effects of noise, control of noise. Vibration and acceleration; human tolerance.

IELM6034 Operational research techniques

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

IELM6037 Costing and finance

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 *

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

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

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

IELM7035 Dissertation (4 modules)

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

MSC(ENG) IN INFRASTRUCTURE PROJECT MANAGEMENT

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

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

The syllabus is applicable to all current students of the curriculum and to candidates admitted in the academic year 2014-15 and thereafter.

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

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

CIVL6009 Building planning and control

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

CIVL6014 Construction dispute resolution

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

CIVL6015 Construction financial management *

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

CIVL6021 Infrastructure contracts management

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

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6037 Project management - human and organisational factors *

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

CIVL6049 Urban development management by engineering approach

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

CIVL6058 Management of infrastructure megaprojects

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

CIVL6059 Special topic in infrastructure project management

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

CIVL6060 Operation and maintenance of building and civil engineering works

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

CIVL6073 Professional practice in building development

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

CIVL6074 Rights, liabilities and claims in construction contracts

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

CIVL6075 Hong Kong, PRC and international construction law

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

CIVL7001 Railway asset management

This module 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 module provides in-depth knowledge of technology in the context of sustainable construction, with the syllabus covering concepts of sustainable construction; systems theories; technological innovation theories; types of technology and their applications; technology selection and management strategy.

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

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

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

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

(C) CIVL6001 Project (4 modules)

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

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in or after the academic year of 2014-2015.

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

MSC(ENG) IN MECHANICAL ENGINEERING

(Applicable to students admitted to the curriculum in 2014-2015 and thereafter)

Objectives

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

Modes of Study

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

Study Modules

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

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

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

List A discipline modules

MECH6010 Service behaviour of materials

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

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

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

MECH6017 Noise and vibration

This module aims to provide an integrated treatment for vibration system, noise radiation and the available control methods in engineering. Upon completing this module, the students are expected to: (1) explain the basic characteristics of a simple vibration system; (2) understand the mechanism of noise radiation by structural vibration or turbulent flow, and its impact on human hearing; and (3) offer solution to typical noise and vibration problems. The following are covered in the module: (i) fundamentals of vibration and its control, (ii) human hearing and environmental noise sources and their mitigation, (iii) noise control.

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

MECH6026 Computational fluid dynamics

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

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

MECH6034 Computer-aided product development (CAPD) *

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

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

MECH6047 Finite element analysis in mechanics

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

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

List B discipline modules

MECH6018 Atmospheric environment modelling

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

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

MECH6019 Sources and control of air pollution

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

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

MECH6023 Power plant technology

This module is focused on understanding the operating principles of power plants for the generation of electric power. The module objectives are to: (1) provide students with the working principles of various types of power plants, including fossil fuels, nuclear fuels and renewable energy; and (2) enable students to understand the 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 module aims to introduce some advanced knowledge of computational and statistical analysis and methods and provide the students with the ability to apply computational and statistical methods to solve engineering problems.

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

EMEE6004 Energy conservation and management

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

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

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

MECH6039 Biomaterials and tissue engineering

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

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

EMEE 6005 Renewable energy technology I: Fundamental

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

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

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

EMEE 6006 Renewable energy technology II: Advanced

This module is on the working principles of advanced energy conversion devices including solar cells, fuel cells, batteries, photoelectrochemical (PEC) water splitting cells, and thermoelectric cells. Also

covered are the energy carriers in different materials and the connection between different energy conversion devices. The specific module objectives are as: (1) to have a deep understanding of the energy carriers in different materials and their important roles in energy conversion; (2) to grasp the working principles of different energy conversion devices; (3) to be able to tell the differences and similarities between different energy conversion devices; and (4) to be able to design more efficient energy conversion devices.

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

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

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

EMEE6007 Energy and carbon audit

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

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

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

MECH6045 Nanotechnology: fundamentals and applications

Nanotechnology is a rapidly developing discipline which has emerged from foundations based in microtechnology built up during the past few decades. Many exciting engineering applications in nanotechnology have been proposed and some are already in use. The current intensive research activities world-wide make it highly likely that many more products and applications in nanotechnology will emerge in the next few decades. This module aims at: (1) to equip students with fundamental knowledge and concepts on micro- and nano-technology, and to enable the students to apply such knowledge in future careers in both industry and universities; (2) to enable students to understand the effects of material size on behaviour and properties, and from these to appreciate the new possibilities in both fundamental science and practical applications brought about by nanotechnology; and (3) to introduce students to promising and emerging applications of nanotechnology in energy storage/conversion, unconventional materials and optical metamaterials, and help students to further research and/or work in specific application areas.

Topics include: characteristic length scales, nanomaterials, nanostructures, physical properties of nanostructures, deposition techniques of nanofabrication, micro/nanolithography, high resolution analysis and characterization, scanning probe methods, nanoindentation, mechanical behaviours of bulk nanostructured materials, processing techniques for bulk nanostructured materials, ultrahigh strength of nanostructures, bio-nanotechnology, energy storage, energy conversion, nanophotonics, plasmonics, optical metamaterial.

Students who have taken and passed MECH 6040 will not be allowed to take MECH6045.

MECH6046 Microsystems for energy, biomedical and consumer electronics applications

Microelectromechanical systems (MEMS) and microfluidics have gradually found numerous applications in modern energy, mechanical engineering and biomedical engineering applications. This module aims to provide students with the necessary fundamental knowledge and experience in the working principles, design, materials, fabrication and packaging, and applications of MEMS and microfluidic systems. MEMS and microfluidic devices are emerging platforms for modern engineering applications in biomedicine, chemistry, material sciences and micro-machines. This is the module that will introduce graduate students and practicing engineers into the growing field of microsystem engineering. Practical examples will be given when delivering each major topic. Teaching of the module is also strengthened with case studies on carefully chosen topics. At the end of this module, students who fulfill the requirements of this module will be able to: (1) demonstrate ability to understand the fundamental principles behind MEMS and microfluidic; (2) differentiate different MEMS and microfluidic techniques and understand their importance in modern engineering; (3) apply concepts of micro-systems for industrial applications, particularly in energy, mechanical engineering and biomedical engineering.

Topics include: MEMS and microsystem products; microsensors; microactuators; microfluidic devices; multidisciplinary nature of microsystem design and manufacture; fluid mechanics in microscaled flows; materials for MEMS and microfluidic devices; fluid mechanics in microscaled flows; fabrication techniques of MEMS and microfluidic devices; flow characterization techniques; flow control with microfluidics; microfluidics for life sciences and chemistry.

Students who have taken and passed MECH 6032 will not be allowed to take MECH6046.

MECH6048 Dissertation (4 modules)

It involves undertaking a dissertation or report on a topic consisting of design, experimental or analytical investigation by individual students. The objectives are to: (1) simulate a realistic working experience for students; (2) provide them an experience of applying engineering principles, engineering economics, business or management skills; and (3) train students to work independently to obtain an effective and acceptable solution to industry-related or research-type problems.

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 dissertation of four modules, on a subject within his/her approved field of study.

The list of modules below is not final, and may be changed from time to time. Students who intend to complete the curriculum in one academic year should check with the Department of Civil Engineering for the availability of the modules.

The syllabus is applicable to all current students of the curriculum and to candidates admitted in the academic year 2014-15 and thereafter.

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

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

CIVL6002 Advanced finite elements

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

CIVL6003 Advanced reinforced concrete structure design

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

CIVL6008 Bridge engineering

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

CIVL6009 Building planning and control

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6013 Concrete technology

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

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6026 Finite element method

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

CIVL6027 Foundation engineering

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

CIVL6045 Tall building structures

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

CIVL6053 Wind engineering

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

CIVL6060 Operation and maintenance of building and civil engineering works

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6063 Special topic in structural engineering A

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

CIVL6064 Special topic in structural engineering B

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

CIVL6072 Design of cold-formed steel structures

Cold-formed steel structures; concepts of local buckling; effective width design method; shift of effective centroid; new design approach using direct strength method; design of structural steel building.

CIVL6073 Professional practice in building development

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6080 Fire engineering design of structures

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

CIVL7003 Space structures

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

CIVL7008 Seismic analysis for building structures

This module aims to provide students with knowledge and understanding in dynamic behaviour and seismic analysis methods for buildings. Students will be exposed to fundamental concepts of structural dynamics; vibration of single-degree-of-freedom systems; vibration of multiple-degree-of-freedom systems; base-shear method; response spectrum analysis; coefficient-based method; estimation of seismic drift demand and capacity.

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

(C) CIVL6001 Project (4 modules)

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

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in or after the academic year of 2014-2015.

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

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

The syllabus is applicable to all current students of the curriculum and to candidates admitted in the academic year 2014-15 and thereafter.

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

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

CIVL6007 Behavioural travel demand modelling *

This module 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 module.

CIVL6025 Environmental impact assessment of engineering projects

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

CIVL6035 Highway pavement engineering

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

CIVL6037 Project management - human and organisational factors *

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6046 Theory of traffic flow *

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

CIVL6047 Traffic management and control *

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

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 descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL6054 Engineering for transport systems *

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

CIVL6057 Special topic in transportation engineering B

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

CIVL6070 Logistics and transportation *

The logistics supply chain, evolution of logistics and the supply chain as management disciplines; the customer service dimensions; transportation fundamentals, transportation decisions; inventory concepts, inventory management; facility location decisions, the network planning process; logistics organization, best practice and benchmarking; discussion on contemporary issues in logistics.

CIVL6084 Statistical methods for transportation

This module 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 module.

CIVL7001 Railway asset management

For descriptions, see the syllabus of the MSc(Eng) in Infrastructure Project Management curriculum.

CIVL7004 Traffic impact assessment

This module 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 module 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) modules offered by the Department of Civil Engineering other than those listed in (A) above, or elective modules at Taught Postgraduate level offered by other Departments of the Faculty of Engineering subject to the approval of the Head of the Department of Civil Engineering.

(C) CIVL6001 Project (4 modules)

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

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

CIVL7009 Dissertation (4 modules)

For MSc(Eng) students admitted in or after the academic year of 2014-2015.

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