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

*(Applicable to students admitted in the academic year 2024-25 and thereafter)*

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

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

For the MSc(Eng) degree, the major part of the curriculum must include courses offered in one of the following fields: building services engineering, civil engineering, electrical and electronic engineering, energy engineering, industrial engineering and logistics management, innovative design and technology, mechanical engineering, and microelectronic science and technology.

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

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## MSc 1    Admission requirements

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

- (a)   comply with the General Regulations;
- (b)   comply with the Regulations for Taught Postgraduate Curricula;
- (c)   hold
  - (i)    a Bachelor's degree of this University in a relevant field; or
  - (ii)   a relevant qualification of equivalent standard from this University or from another university or comparable institution accepted for this purpose; and
  - (iii)  in respect of the courses of study leading to the degree of Master of Science in Engineering in the fields of Innovative Design and Technology and Microelectronic Science and Technology, a Bachelor's degree in Engineering or related Science discipline;
  - (iv)   in respect of the courses of study leading to the degree of Master of Science in civil engineering, a Bachelor's degree in related disciplines, such as Environmental Engineering, Chemical Engineering, Mechanical Engineering, Environment-related Sciences, Computer Science, Mathematics or Statistics; and
- (d)   satisfy the examiners in a qualifying examination if required.

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**MSc 2    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.

**MSc 3    Period of Study**

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

**MSc 4    Curriculum Requirements**

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

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

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

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

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

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

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

**MSc 5    Dissertation or project report**

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

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

**MSc 6  Selection of Courses**

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

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

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

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

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

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

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**MSc 7  Assessment**

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

(b)  A candidate, who is unable to complete the requirements within the prescribed maximum period of registration specified in Regulation MSc 3 because of illness or circumstances beyond his/her control, may apply for permission to extend his/her period of studies.

(c)  A candidate who has failed to satisfy the examiners in any course(s) is required to make up for failed course(s) in the following manners:

(i)  undergoing re-assessment/re-examination in the failed course(s); or

(ii)  repeating the failed course(s) by undergoing instruction and satisfying the assessments; or

(iii)  taking another course in lieu and satisfying the assessment requirements.

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

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

## MSc 8  Grading system

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

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

## MSc 9  Discontinuation of Studies

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

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

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

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

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

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

## MSc 10  Advanced Standing

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

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

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

**MSc 11    Award of Degree**

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

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

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

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

**MSc 12    Assessment results**

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

## MSC(ENG) IN ELECTRICAL AND ELECTRONIC ENGINEERING
(Applicable to students admitted to the curriculum in the academic year 2024-2025 and thereafter)

Definition and Terminology

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

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

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

Curriculum Structure

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

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

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

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

The following is a list of discipline courses offered by the Department of Electrical and Electronic Engineering. The list below is not final and some courses may not be offered every year.

All courses are assessed through examination and / or coursework assessment, the weightings of which are subject to approval by the Board of Examiners.

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**Subject Groups**

**A.        General**
ELEC6008        Pattern recognition and machine learning
ELEC6027        Integrated circuit systems design
ELEC6036        High performance computer architecture

ELEC6049        Digital system design techniques
ELEC6063        Optoelectronics and lightwave technology
ELEC6067        Magnetic resonance imaging (MRI) technology and applications
ELEC6079        Biomedical ultrasound
ELEC6081        Biomedical signals and systems
ELEC6092        Green project management
ELEC6105        Magnetics engineering for data storage and emerging applications
ELEC6106        From AI software to hardware: an introduction of machine learning and EDA
ELEC6601        Industrial marketing
ELEC6602        Business venture in China
ELEC6603        Success in industrial entrepreneurship
ELEC6604        Neural networks, fuzzy systems and genetic algorithms
ELEC7029        Analog IC design computing and memories
ELEC7030        Advanced CMOS Analog/RF IC Design
ELEC7043        Digital image processing and computer vision
ELEC7075        Advanced topics on circuits and systems
ELEC7078        Advanced topics in electrical and electronic engineering
ELEC7079        Investment and trading for engineering students
ELEC7080        Algorithmic trading and high frequency trading
ELEC7081        Advanced topics in computational finance
ELEC7082        Artificial intelligence in finance
ELEC7083        Distributed systems
ELEC7084        Advanced database

**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**

ELEC6084        Power delivery management for metropolitan cities

| ELEC6085 | The role of a computerized SCADA system in power system operation |
| ELEC6095 | Smart grid |
| ELEC7011 | Energy Internet |
| ELEC7012 | Power systems practicum |
| ELEC7013 | Leadership in future energy industry |
| ELEC7014 | Building information modelling for E&M engineers |
| ELEC7055 | Power distribution systems |
| ELEC7402 | Advanced electric vehicle technology |
| ELEC7403 | Advanced power electronics |
| ELEC7404 | Advanced railway engineering |
| ELEC7405 | Advanced signaling systems for railway |
| ELEC7408 | Power, Control and Signalling Facilities for High-Speed Trains |
| ELEC7456 | Advanced power system operation |
| ELEC7466 | Advanced topics in power system engineering |
| MEBS6001 | Electrical installations |
| MEBS6019 | Extra-low-voltage electrical systems in buildings |

### D.        Professional Development

| ELEC7900 | Leadership training in engineering professionals (This course will not be counted for the fulfilment of the curriculum requirements and the classification of award of the degree.) |

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

All courses are assessed through examination and/or coursework assessment.

## ELEC6006.    Communications policy and regulations (6 credits)

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

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

## ELEC6008.    Pattern recognition and machine learning (6 credits)

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

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

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

Mutually exclusive with: COMP7504 Pattern recognition and applications

**ELEC6026.    Digital signal processing (6 credits)**

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

**ELEC6027.    Integrated circuit systems design (6 credits)**

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

**ELEC6036.    High-performance computer architecture (6 credits)**

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

**ELEC6049.    Digital system design techniques (6 credits)**

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

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

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

**ELEC6063.    Optoelectronics and lightwave technology (6 credits)**

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

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

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

## ELEC6065.    Data compression (6 credits)

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

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

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

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

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

Pre-requisite: Introductory course in physics or electromagnetism

## ELEC6079.    Biomedical ultrasound (6 credits)

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

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

## ELEC6080.    Telecommunications systems and management (6 credits)

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

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

## ELEC6081.    Biomedical signals and systems (6 credits)

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

## ELEC6084.    Power delivery management for metropolitan cities (6 credits)

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

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

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

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

## ELEC6092.    Green project management (6 credits)

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

management; environmental issues and risk management. The course shall be concluded by detailing project quality assurance; safety management.

Mutually exclusive with: EMEE6008

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**ELEC6095.     Smart grid (6 credits)**

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

Mutually exclusive with: ELEC6096, MEBS6018

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**ELEC6097.     IP Networks (6 credits)**

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

Mutually exclusive with: ELEC6007, ELEC7144

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**ELEC6098.     Electronic and mobile commerce (6 credits)**

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

Mutually exclusive with: ELEC6078, ELEC6086

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**ELEC6099.     Wireless communications and networking (6 credits)**

5G refers to the fifth generation wireless technologies for digital cellular networks that began wide deployment in 2019. This course aims at introducing the core principles and technologies for 5G communications and networking. The first half focuses on basic concepts and techniques including including radio propagation, digital modulation, Orthogonal Frequency Division Multiplexing (OFDM), Multiple-Input-Multiple-Output (MIMO) Communication. The second half provides a comprehensive introduction to 5G covering physical layer (PHY) technologies, millimetre wave (mmWave) communications, network virtualization and slicing, provides an introduction to different types of networks including cellular networks, satellite communication networks, narrow-band Internet-of-Things (NB-IoT).

Mutually exclusive with: ELEC6040, ELEC6071, ELEC6087

**ELEC6100.      Digital Communications (6 credits)**

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

Mutually exclusive with: ELEC6014 and ELEC6045

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**ELEC6103.      Satellite communications (6 credits)**

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

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

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

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**ELEC6105.      Magnetics engineering for data storage and emerging applications (6 credits)**

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

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

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

**ELEC6106.    From AI software to hardware: an introduction of machine learning and EDA (6 credits)**

This introductory course covers two topics: basic machine learning and basic Electronic Design Automation (EDA) for Very Large Scale Integration (VLSI). The first part starts from the basic concepts and fundamentals of deep learning, including machine learning basics, deep neural networks, back-propagation, activation functions, loss functions and regularizations. Then deep learning methods are applied to a few tasks in computer vision (handwritten digits recognition) and natural language processing (name generation). Finally, successful applications and hot research directions in deep learning are showcased. The second part starts with the VLSI realization of AI and EDA design flow. It then focuses on an important component in EDA, the SPICE circuit simulation. Various SPICE simulation concepts and models (netlist, MNA, compact models) are introduced. A series of numerical methods (linear system solution, Newton's method, backward Euler and matrix exponential method) to solve the linear and nonlinear SPICE problems are then investigated, followed by an introduction of future trends in the fields.

- Introduce the basic concepts and fundamentals of machine learning.
- Introduce a popular deep learning framework and some simple tasks that can be solved with deep learning.
- Introduce possible research directions of machine learning.
- Introduce fundamental knowledge of hardware realization of AI & EDA.
- Teach basic models and algorithms for circuit simulation.
- Introduce future topics in AI hardware & EDA.

**ELEC6601.    Industrial marketing (6 credits)**

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

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

**ELEC6602.    Business venture in China (6 credits)**

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

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

**ELEC6603.    Success in industrial entrepreneurship (6 credits)**

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

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

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

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

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**ELEC7011.    Energy Internet (6 credits)**

The aim of this course is to provide basic knowledge on the emerging energy technologies in Energy Internet, which offer innovative solutions to accommodate renewable energy and achieve carbon neutrality goals. This calls for an interdisciplinary understanding of aspects such as electrical engineering, thermal engineering, information technology, data science, management science, and economics. This course will showcase the advances by combining these aspects and introduce the layered structure of the Energy Internet with rich illustrative examples of the key concepts, components, and technologies. The latest technical developments and industrial demonstrations will be covered as well.

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**ELEC7012.    Power systems practicum (6 credits)**

Students in this module will acquire the required knowledge and soft-skill in providing a quality, stable and reliable power system with effective integration and execution of design, operation, control, protection, maintenance and communication.  A practicum approach involves understanding various power system problems, applying fundamental principles to derive the required solutions for implementation.  Past experiences sharing in dealing with incidents will be highlighted and some emerging technologies will also be discussed thus benefitting the students in their careers development in power systems industry.

Mutually exclusive with EMEE7012

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**ELEC7013.    Leadership in future energy industry (6 credits)**

Climate Change, together with other technical and non-technical factors, is reshaping the fossil fuel based energy industry in the last two decades and, for sure, in the foreseeable future.  Business as

usual is no longer a viable option for existing and emerging energy players. Visionary leadership and ability to embrace future energy technologies are two essential elements to stay competitive in the future energy sector. The course, by integrating the engineering knowledge on future energy technologies and business knowledge on leadership and management of utility of the future, shall enable the students to develop a holistic view on energy industry to date and tomorrow, understand major business trend and transition in the energy industry, and build up basic knowledge and skill to evaluate and analyze different emerging energy technologies that may become the mainstream energy in the future for achieving the net carbon zero target.

At the end of this course, students who fulfill the requirements of this course will be able to:

1. describe the challenges and trends in the energy industry
2. appreciate the role of leadership and management in the evolving energy industry
3. understand the working principle of the fossil fuel-based energy technologies and their impact on climate change and other environmental/sustainable issues.
4. understand the working principle of the emerging no/low carbon energy technologies and their contribution in mitigating climate change and other environmental/sustainable issues.

Mutually exclusive with EMEE7013

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**ELEC7014.     Building information modelling for E&M engineers (6 credits)**

This course provides training for electrical & mechanical (E&M) engineers to acquire the knowledge and ability in Building Information Modelling (BIM) viewing, editing, and commenting skills. The contents shall cover theory and practice of BIM application in the construction industry. The students shall perform professionalism in achieving optimal benefits.

At the end of this course, students who fulfil the requirements of this course will be able to:
1.      understand the operational principles of building information management workflow;
2.      application of BIM model in planning, coordinating, and managing installation of E&M systems for buildings;
3.      familiarise with the BIM software;
4.      analyse the trend and impacts of latest development in BIM regulations and standards.

Mutually exclusive with EMEE701

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**ELEC7021.     Dissertation (24 credits)**

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

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

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**ELEC7022.     Project (12 credits)**

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

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

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

## ELEC7023.    Capstone Workshop (0 credits)

Students are required to attend and satisfactorily complete a capstone workshop in his/her respective stream/programme.

## ELEC7029.    Analog IC Design, computing & memories (6 credits)

This course provides important circuit theories to analyse and design analog circuits, analyse small-signal operations of transistors. Design and apply basic analog design techniques in the field of analog IC design. Use of CAD tools to simulate and design analog circuits.

## ELEC7030.    Advanced CMOS Analog/RF IC Design (6 credits)

This course aims to train students with the fundamental knowledge of analog and RF integrated circuit design in the advanced CMOS process. The student will get hands-on experience to design and analyze analog and RF CMOS integrated circuits. The circuit design of several important amplifiers frequently used in the industry and fundamental RF transceiver will be introduced and extensively analyzed. The complete analog IC design flow including schematic design, simulation, layout design and parasitic extraction using EDA tools in the industry will be covered in the course.

## ELEC7043.    Digital image processing and computer vision (6 credits)

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

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

Mutually exclusive: ELEC6043 Digital image processing

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

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

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**ELEC7055.     Power distribution systems (6 credits)**

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

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

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**ELEC7075.     Advanced topics on circuits and systems (6 credits)**

The course covers core and selected timely topics in circuits and systems.

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

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

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

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

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**ELEC7079.     Investment and trading for engineering students (6 credits)**

This course is designed for engineering students who wish to start a career in the financial industry. This course helps students to develop the basic knowledge, skill sets, and vocabulary that can communicate with the practitioners in financial industry. Students are expected to learn how to develop market view by analyzing the driving factors to forecast the movement of financial assets like equities and foreign exchange.  Students will learn various financial instruments and quantitative

models to support the development of investment and trading strategies. The financial instruments will be covered in this course include: options, futures and other derivatives of equities, commodities, and foreign exchanges as well as their pricing models. Investment and trading strategies that will be discussed in this course include those that commonly used in the market, for example, VWAP, TWAP, Bollinger Band, and RSI.

Mutually exclusive with: COMP7802 Introduction to financial computing

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**ELEC7080.     Algorithmic trading and high frequency trading (6 credits)**

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

Pre-requisite: ELEC7079 Investment and trading for engineering students

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**ELEC7081.     Advanced topics in computational finance (6 credits)**

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

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

Mutually exclusive with: ELEC7082 Artificial intelligence in finance

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**ELEC7082.     Artificial intelligence in finance (6 credits)**

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

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

Mutually exclusive with: ELEC7081 Advanced topics in computational finance

**ELEC7083.    Distributed systems (6 credits)**

This course aims to provide students with in-depth knowledge of distributed systems. Distributed systems commonly consist of a group of hosts which provide services to their clients as a single computing system. Resource sharing, high scalability and fault tolerance are the common features of a distributed system. In order to achieve those features, numbers of challenges and constraints should be considered and overcome. This course covers the essential concepts in distributed systems like time synchronization, inter-process communication, distributed coordination, distributed file systems, fault tolerance and blockchain.

After finished this course, students should able to:

• Describe the characteristics and requirements of distributed systems

• Describe the essential principles of inter-process communication

• Demonstrate the working knowledge of various distributed algorithms on time synchronization, election and mutual exclusion and replication

• Solve problems in time synchronization, IPC, distributed coordination, fault tolerance and blockchain in distributed systems

• Evaluate the design of distributed systems or algorithms based on the system requirements and constraints

**ELEC7084.    Advanced database (6 credits)**

This course has three objectives. First, it aims to enhance students' understanding of relational databases, especially on relational algebra and SQL. Second, it introduces a number of advanced database topics including indexing techniques, query processing and optimization, transaction processing and concurrency control. These are important to the performance and correctness of contemporary commercial database systems. Last, it discusses important issues about data storage, query processing and transaction management for parallel, distributed and real-time databases. All these are important in supporting sophisticated systems or applications.

After finished this course, students should be able to:
• Develop in-depth understanding of relational databases and proficiency in using SQL/relational algebra for data retrieval.
• Design efficient evaluation plans by applying indexing techniques and query algorithms.
• Analyse issues specific to correct and efficient transaction execution.
• Apply data storage techniques, query and transaction processing algorithms to parallel, distributed and real-time databases.

**ELEC7402.    Advanced electric vehicle technology (6 credits)**

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

Specifically, the course covers the following topics: latest EV system concepts and designs, advanced electric machines and drives for EVs, advanced hybrid powertrains for hybrid EVs, advanced EV energy

sources and energy management systems, and EV-to-grid technology.

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### ELEC7403. Advanced power electronics (6 credits)

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

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### ELEC7404. Advanced railway engineering (6 credits)

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

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### ELEC7405. Advanced signaling systems for railway (6 credits)

The course aims at providing students with a sound understanding of various advanced signaling systems for railway lines as well as the latest signaling technologies in the market. The course covers 6 main areas – time table and headway, trackside signaling equipment (including train position detection and navigation systems), automatic train supervision and automatic train protection, interlocking principles, block concepts (moving block and fixed block systems), Communication-based train control systems and China and European Train control systems. Students enrolled in the module are expected to have knowledge and know-how of basic electrical engineering principles.

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### ELEC7408. Power, Control and Signalling Facilities for High-Speed Trains (6 credits)

Due to the rapid development of High-Speed Railway worldwide, there is a strong demand for railway professionals in the areas of railway planning, design, construction, maintenance and operations. The railway engineering professionals, in particular those with High-Speed knowledge and experience are scarce in supply. This course aims to provide students with specialized knowledges and practical skills on the key Electrical and Electronic Systems in a High-Speed Rail, including Rolling Stocks, Power System, Signalling and Control and Communications Systems. The course can also broaden the knowledge of those engineers who are already working in the railway industry and prepare them to take up more senior positions.

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### ELEC7456. Advanced power system operation (6 credits)

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

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

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

## ELEC7466.    Advanced topics in power system engineering (6 credits)

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

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

## ELEC7900.    Leadership training in engineering professionals (6 credits)

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

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

## MEBS6001.    Electrical installations (6 credits)

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

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

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