**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.

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**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.

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**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.

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**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.

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**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.

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**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 |

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**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.*

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**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.

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**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.

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**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.

Subject to the University's approval

# MSC(ENG) IN MICROELECTRONICS SCIENCE AND TECHNOLOGY

(Applicable to students admitted to the curriculum in the academic year 2024-25 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 Microelectronics Science and Technology that are not classified as discipline courses.

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

## Curriculum Structure

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

| Course Category | No. of Credits |
|---|---|
| Discipline Courses | Not less than 42 |
| Elective Courses | Not more than 6 |
| Capstone Experience | 24 |
| Total | 72 |

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete i) 8 courses, including at least 3 courses from List A and 4 from List B, and ii) a dissertation. They may select no more than 1 course offered by other taught postgraduate curricula in the Faculty of Engineering as electives. All course selection will be subject to approval by the Programme Director(s).

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List of Discipline Courses for MSc(Eng) in Microelectronics Science and Technology. The list below is not final and some courses may not be offered every year.

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

**COURSE DESCRIPTION**

The following is a list of discipline courses. The list of courses 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 Faculty Board.

## List-A Discipline courses

**MEST7411. Characterization techniques for materials and devices (6 credits)**

This course will focus on introducing a number of characterization techniques for the electronic devices and materials. Different physical parameters of the materials as electrical, optical, thermal, and etc will be examined and measured. Various tools and equipment such as atomic force microscope, scanning electron microscope, tunneling electron microscope, semiconductor parameter analyzer, UV-visible spectrometer, solar simulator and etc, will be introduced in the course. Their working principles and the areas of practical applications will also be covered. The specific course objectives are: (1) Encourage students to explore latest material and device performance characterization tools; (2) To develop creative, analytical and critical thinking abilities in the material and electronic device characterizations; (3) Able to apply the state-of-art characterization tools onto their research.

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**MEST7412. Solid-state materials and physics (6 credits)**

This course will focus on the fundamental principles of solid-state materials and physics, including crystal structures and binding, point defects, dislocations, alloys, reciprocal lattice, lattice vibration, thermal transport, electronic structure, and electrical transport. The specific course objectives are: (1) To provide students fundamental knowledge that is critical for in-depth understanding of material behaviors in modern microelectronics; (2) To encourage students building connections between basic physical principles and transport properties that are important to technological applications.

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**MEST7413. Semiconductor devices (6 credits)**

This course starts with the overview of the electronic properties of materials. There is an emphasis in fundamental physical models to understand the crystal structure and bonding, band structure of semiconductors, electron and hole carrier properties, electrical current and p-n junctions. With the basis, the course will further discuss on various semiconductor devices including diodes, bipolar junction transistors and field-effect transistors. This course will also introduce the applications of devices including light emission and detection.

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**MEST7419. Safety Training and Microelectronics Process (6 credits)**

Safety is of top importance throughout the entire microelectronics fabrication process. Not only does it protect operators, but it also guarantees the reliability, repeatability, and quality of electronic devices by adhering to proper operation procedures.

This course aims to provide comprehensive training on various aspects of the semiconductor process and its safety. Topics covered will include the use of Personal Protective Equipment (PPE), proper

handling and storage of chemicals and samples, standard operation procedures in fabrication processes, and special rules specific to the cleanroom environment. Furthermore, students will have the opportunity to gain hands-on experience in operating equipment related to key semiconductor processes such as dielectric deposition, metal formulation, lithography, and etching.

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**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.

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**MECH6045. Nanotechnology: fundamentals and applications (6 credits)**

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

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

Students who have taken and passed MECH6040 will not be allowed to take MECH6045.

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## List-B Discipline courses

**MEST7414. Advanced micro/nanofabrication (6 credits)**

Deterministic fabrication of devices and structures at the micro- and nanoscale is critically important for microelectronics manufacturing and many emerging devices in photonics, biomedical sensing, etc. This course will help students to understand the fundamental physics and engineering applications of key processing techniques that are commonly used in the micro- and nanoscale fabrication. The covered topics include 1) fundamental properties of common materials in microelectronics; 2) fundamental science on optics, vacuum, and plasma; 3) working principle, development history, and applications of various lithographic patterning technologies; 4) physics and applications of thin film deposition; 5) physics and applications of plasma etching; 6) other important processing steps in microelectronic fabrication and other emerging advanced micro/nanofabrication.

**MEST7415. Advanced semiconductor devices (6 credits)**

The course is to understand the technical challenges of scaled bulk MOSFETs and learn about the advanced transistor structures adapted to overcome the issues and continue Moore's Law in a general sense. The topics include the following: 1.Overview of basic CMOS (Threshold voltage and MOSFET theory); 2.Advanced MOSFET Physics (Scaled MOSFET, Hot carrier effect, advanced gate stacking); 3.Advanced transistor structure and their fabrication (FinFET and gate-all-around FET); 4. Emerging materials and device structure (Low-dimensional materials and potential device structures).

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**MEST7416. Advanced topics in microelectronics technologies A (6 credits)**

The course covers new research topics in microelectronics technologies. The topic will be announced in the beginning of the semester when the course is offered.

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**MEST7417. Advanced topics in microelectronics technologies B (6 credits)**

The course covers new research topics in microelectronics technologies. The topic will be announced in the beginning of the semester when the course is offered.

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**MEST7418. Nanophotonics (6 credits)**

The recent advances in semiconductor technology and optical sciences allow the unprecedented control of light flows and light-matter interactions at the nanometer precision, a length scale that is much smaller than the wavelength of light. This opens immense opportunities for technological renovations including faster internet, more sensitive immuno-sensors, more powerful but less energy-intense computing using photons instead of heating generating electrons, smart cameras and 3D virtual displays that is flexible and thinner than a piece of paper. The class introduces the principles of optics at the small scale where conventional ray optics starts failing, teaches methods and tools of nanophotonics designs through case studies, and stimulates critical thinking on the future of photonics and optoelectronics through team projects.

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**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.

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**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.

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**ELEC7029. Analog IC design, computing & memories (6 credits)**

This course aims to provide important circuit theories to analyze and design analog circuits and analyze 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.

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**MECH6046. Microsystems for energy, biomedical and consumer electronics applications (6 credits)**

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

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

Students who have taken and passed MECH6032. will not be allowed to take MECH6046.

**MEST7401. Dissertation (24 credits)**

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