

## **REGULATIONS FOR THE DEGREE OF BACHELOR OF ENGINEERING (BENG)**

These regulations apply to students admitted to the four-year BEng curriculum in the academic year 2014-15 and thereafter.

*(See also General Regulations and Regulations for First Degree Curricula)*

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### **EN 1 Admission to the Degree**

To be eligible for admission to the Bachelor of Engineering (BEng) degree, a candidate shall

- (a) comply with the General Regulations;
  - (b) comply with the Regulations for First Degree Curricula;
  - (c) satisfy all the requirements of the curriculum in accordance with these regulations and the syllabuses.
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### **EN 2 Period of Study**

The curriculum for the BEng degree shall normally require eight semesters of full-time study, extending over not fewer than four academic years, and shall include any assessment to be held during and/or at the end of each semester. Candidates shall not in any case be permitted to extend their studies beyond the maximum period of registration of six academic years.

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### **EN 3 Curriculum Requirements**

To complete the curriculum, a candidate shall

- (a) satisfy the requirements prescribed in UG 5 of the Regulations for the First Degree Curricula; and
  - (b) take not fewer than 240 credits of courses, in the manner specified in these regulations and syllabuses; candidates are also required to pass all courses as specified in the syllabuses.
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**EN 4** Candidates shall normally select not fewer than 24 and not more than 30 credits of courses in any one semester (except the summer semester), unless otherwise permitted or required by the Board of the Faculty, or except in the last semester of study when the number of credits required to satisfy the outstanding curriculum requirements is fewer than 24 credits. Candidates may, of their own volition, take additional credits not exceeding 6 credits in each semester, and/or further credits during the summer semester, accumulating up to a maximum of 72 credits in one academic year. Candidates may, with the approval of the Board of the Faculty, exceed 72 credits in an academic year provided that the total number of credits taken shall not exceed 288 credits. Students making up for failed credits can be permitted by the Faculty to take up to 432 credits.

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**EN 5** Candidates with unsatisfactory academic progress may be required by the Board of the Faculty to take a reduced study load.

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### **EN 6 Selection of Courses**

Candidates shall select their courses in accordance with these regulations and the guidelines specified in the syllabuses before the beginning of each academic year. 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. Requests for changes after the designated add/drop period of the semester shall be subject to the approval of the Board of the Faculty. Withdrawal from courses beyond the designated add/drop period will be subject to the approval of the Board of the Faculty.

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#### **EN 7      Assessment and Grades**

Candidates shall be assessed for each of the courses for which they have registered, and assessment may be conducted in any one or any combination of the following manners: written examinations or tests, continuous assessment, laboratory work, field work, project reports, or in any other manner as specified in the syllabuses. Grades shall be awarded in accordance with UG8 of the Regulations for the First Degree Curricula.

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**EN 8**      Written examinations or tests shall normally be held at the end of each semester unless otherwise specified in the syllabuses.

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**EN 9**      Candidates are required to make up for failed courses in the following manner:

- i) undergoing re-assessment/re-examination in the failed course to be held no later than the end of the following semester (not including the summer semester); or
  - ii) re-submitting failed coursework, without having to repeat the same course of instruction; or
  - iii) repeating the failed course by undergoing instruction and satisfying the assessments; or
  - iv) for elective courses, taking another course in lieu and satisfying the assessment requirements.
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**EN 10**      Candidates shall not be permitted to repeat a course for which they have received a grade D or above for the purpose of upgrading.

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**EN 11**      There shall be no appeal against the results of examinations and all other forms of assessment.

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**EN 12**      Unless otherwise permitted by the Board of the Faculty, a candidate will be recommended for discontinuation of their studies if

- (a) he/she fails to complete successfully 36 or more credits in two consecutive semesters (not including the summer semester), except where they are not required to take 36 credits in the two given semesters;
  - (b) he/she fails to achieve an average Semester GPA of 1.0 or higher for two consecutive semesters (not including the summer semester); or
  - (c) he/she has exceeded the maximum period of registration specified in EN2.
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#### **EN 13      Absence from Examination**

Candidates who are unable, because of illness, to be present at the written examination of any course may apply for permission to present themselves at a supplementary examination of the same course to be held before the beginning of the First Semester of the following academic year. Any such application shall be made on the form prescribed within two weeks of the first day of the candidate's

absence from any examination. Any supplementary examination shall be part of that academic year's examinations, and the provisions made in the regulations for failure at the first attempt shall apply accordingly.

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#### **EN 14      Advanced Standing**

Advanced standing may be granted to candidates in recognition of studies completed successfully in an approved institution of higher education elsewhere in accordance with UG2 of the Regulations for First Degree Curricula. The amount of advanced credits to be granted shall be determined by the Board of the Faculty, in accordance with the following principles:

- (a) a minimum of two years of study at this University shall be required before the candidate is considered for the award of the degree; and
- (b) a minimum of 120 credits shall be accumulated through study in this University, or from transfer of credits for courses completed at other institutions in accordance with UG4(d) of the Regulations for the First Degree Curricula.

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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#### **EN 15      Degree Classification**

To be eligible for the award of the BEng degree, candidates shall have:

- a) satisfied all the requirements in the UG5 of the Regulations for First Degree Curricula;
  - b) passed not fewer than 240 credits, comprising
    - i) introductory courses, including General Engineering courses;
    - ii) advanced courses;
    - iii) capstone experience;
    - iv) a Chinese language enhancement course<sup>1</sup>;
    - v) two English language enhancement courses, including Core University English<sup>2</sup> and English in the Discipline;
    - vi) Common Core Curriculum courses;
    - vii) all required courses as prescribed in respective syllabuses; and
    - viii) elective courses.
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**EN 16**      The degree of Bachelor of Engineering shall be awarded in five divisions: First Class Honours, Second Class Honours Division One, Second Class Honours Division Two, Third Class Honours, and Pass. The classification of honours shall be determined by the Board of Examiners for the degree of BEng with the following Cumulative GPA (CGPA) scores, with all courses taken (including failed courses) carrying equal weighting:

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<sup>1</sup> Students who have not studied Chinese language during their secondary education / who have not attained the requisite level of competence in the Chinese language to take CENG9001 can apply (i) to take credit-bearing Cantonese or Putonghua language courses offered by the School of Chinese especially for international and exchange students; OR (ii) to be exempted from the Chinese language requirement and take an elective course in lieu.

<sup>2</sup> Candidates who have achieved Level 5\*\* in English Language in the HKDSE or equivalent are exempted from this requirement but must take an elective in lieu.

| <i>Class of honours</i> | <i>CGPA range</i> |
|-------------------------|-------------------|
| First Class             | 3.60 – 4.30       |
| Second Class            | (2.40 – 3.59)     |
| Division One            | 3.00 – 3.59       |
| Division Two            | 2.40 – 2.99       |
| Third Class             | 1.70 – 2.39       |
| Pass                    | 1.00 – 1.69       |

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**EN 17** Honours classification may not be determined solely on the basis of a candidate's Cumulative GPA and the Board of Examiners for the BEng degree may, at its absolute discretion and with justification, award a higher class of honours to a candidate deemed to have demonstrated meritorious academic achievement but whose Cumulative GPA falls below the range stipulated in EN16 of the higher classification by not more than 0.05 of a Grade Point.

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**EN 18** A list of candidates who have successfully completed all degree requirements shall be posted on Faculty notice boards.

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## **SYLLABUSES FOR THE DEGREE OF BACHELOR OF ENGINEERING (BENG)**

General Engineering courses (applicable to candidates admitted to the four-year curriculum in the academic year 2014-15 and thereafter)

General Engineering courses include:

### Computer Programming Courses

|          |   |
|----------|---|
| ENGG1111 | Computer programming and applications (6 credits)   |
| ENGG1112 | Computer programming and applications I (6 credits) |

### Mathematics and Physics Courses

|          |   |
|----------|---|
| MATH1011 | University Mathematics I (6 credits)                                |
| MATH1851 | Calculus and ordinary differential equations (6 credits)            |
| MATH1853 | Linear algebra, probability and statistics (6 credits)              |
| MECH2407 | Multivariable calculus & partial differential equations (6 credits) |
| PHYS1050 | Physics for Engineering Students (6 credits)                        |

### Disciplinary Specific Courses

|          |   |
|----------|---|
| ENGG1201 | Engineering for sustainable development (6 credits)               |
| ENGG1202 | Introduction to computer science (6 credits)                      |
| ENGG1203 | Introduction to electrical and electronic engineering (6 credits) |
| ENGG1204 | Industrial management and logistics (6 credits)                   |
| ENGG1205 | Introduction to mechanical engineering (6 credits)                |
| ENGG1206 | Introduction to biomedical engineering (6 credits)                |
| ENGG1207 | Foundations of biochemistry for medical engineering (6 credits)   |

Candidates are required to satisfactorily complete General Engineering courses as specified in the syllabus of the programme concerned.

The course descriptions of the General Engineering courses are as follows:

### **ENGG1111 Computer programming and applications (6 credits)**

This course covers both the basic and advanced features of the C/C++ programming languages, including syntax, identifiers, data types, control statements, functions, arrays, file access, objects and classes, class string, structures and pointers. It introduces programming techniques such as recursion, linked lists and dynamic data structures. The concept and skills of program design, implementation and debugging, with emphasis on problem-solving, will also be covered.

Target students are those who wish to complete the programming course in a more intensive mode in 1 semester. Students with some programming knowledge are encouraged to take this course.

Assessment: 50% continuous assessment, 50% examination

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### **ENGG1112 Computer programming and applications I (6 credits)**

This course covers both the basic and advanced features of the C/C++ programming languages, including syntax, identifiers, data types, control statements, functions, arrays, file access, objects and classes, class string, structures and pointers. It introduces programming techniques such as recursion, linked lists and dynamic data structures. The concept and skills of program design, implementation and debugging, with emphasis on problem-solving, will also be covered.

Target students are those who wish to complete the programming course in a slower pace covering 2 semesters.

Assessment: 50% continuous assessment, 50% examination

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### **MATH1011    University Mathematics I (6 credits)**

This course aims at students with only HKDSE Mathematics (or equivalent) background and provides them with basic knowledge of mathematics that serves as essential foundation in various disciplines. It is expected to be followed by MATH1013 University mathematics II.

Assessment: 50% continuous assessment, 50% examination

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### **MATH1851    Calculus and ordinary differential equations (6 credits)**

In this course, students will be introduced to some important topics of mathematics commonly used in many engineering fields. A concrete foundation of engineering mathematics that underpins the various engineering subjects will be built. Mathematical concepts and principles, as well as some typical engineering applications, would be emphasized so that students could enhance their mathematical skills in solving engineering problems, and be well prepared in learning a higher level of applied mathematics required in different engineering disciplines.

This course is exclusively for Engineering students.

Pre-requisite: Mathematics (Extended Part Module 1 or 2) of the HKDSE Examination or equivalent, or a pass in “MATH1011 University Mathematics I”

Assessment: 20% continuous assessment, 80% examination

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### **MATH1853    Linear algebra, probability and statistics (6 credits)**

As the consecutive course of MATH1851, students will be introduced to more topics of mathematics commonly applied in engineering so that students could be further enhanced with a concrete skill in mathematics underpinned for different engineering subjects. The course emphasizes mathematical concepts, principles, analysis, and their relationship to the modelling of engineering systems. Students could be furnished with the essential mathematical skill to analytically tackle some typical engineering problems to prepare for all the engineering subjects.

This course is exclusively for Engineering students.

Pre-requisite: Mathematics (Extended Part Module 1 or 2) of the HKDSE Examination or equivalent, or a pass in “MATH1011 University Mathematics I”

Assessment: 20% continuous assessment, 80% examination

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### **MECH2407.    Multivariable calculus & partial differential equations (6 credits)**

This course aims to further develop the foundation of mathematics used in engineering discipline. Students will be introduced and explored to: (1) the ideas of periodic functions and their Fourier series representations; (2) the concepts of differentiation and integration of multivariable functions, and their extensions to vector analysis; and (3) the methods for solving elementary partial differential equations. Through the development of solution methods, students will enrich their experience in critical analysis and problem solving.

Topics include: Fourier series; advanced calculus; vector analysis; elementary partial differential equations.

Assessment: 20% continuous assessment, 80% examination

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**PHYS1050     Physics for Engineering Students (6 credits)**

This one-semester course offers a comprehensive training of physics for engineering students. It covers the major physical laws on mechanics, electricity and magnetism. Specifically, it will introduce and discuss the motion of a particle in one and higher dimensions, Newton's laws of motion, friction, curvilinear and circular motion on a plane, forces, impulse and momentum, force polygon and static equilibrium, work and energy, system of particles, moment of inertia and rotation of a rigid body, angular momentum, simple harmonic motion and pendulum; electrostatic fields and potential, Gauss's law, DC circuits, magnetic field due to moving charges, force on a moving charge in magnetic field, Biot-Savart law, Ampere's law, electromagnetic induction, Faraday's law, Eddy currents, AC circuits, phases in capacitive and inductive circuits, power, DC and AC generators, and transformer.

Assessment: 30% continuous assessment, 70% examination

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**ENGG1201     Engineering for sustainable development (6 credits)**

This course is an introduction to the broad disciplines of civil, environmental and mechanical engineering and is presented in the context of sustainable development of the built environment. At the end of this course, students should gain an informed understanding of the central issues associated with sustainable development of the built environment. They should also gain an understanding of the roles engineering professionals have played, as well as the ethical and professional responsibilities of engineers, in response to these issues throughout history and the present day. Students will also develop the ability to formulate clear strategies by drawing upon relevant best practices and technologies.

Assessment: 50% continuous assessment, 50% examination

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**ENGG1202     Introduction to computer science (6 credits)**

This course introduces a number of real-world computational problems taken from different areas of computer science (e.g. security and cryptography, artificial intelligence, database, web and networking). Through these problems and some hands-on exercises, students are exposed to the mathematics, data structures and algorithms that form the foundations of computer science and see how these elements integrated together to solve those problems.

Assessment: 100% continuous assessment

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**ENGG1203     Introduction to electrical and electronic engineering (6 credits)**

This course provides an overview of the field of electrical and electronic engineering and its role in the modern world. The function of different electronic engineering disciplines in modern electronic system designs will be introduced, including signal processing, system-level design, digital logic design, circuits design, as well as electronic devices design. The role of electrical systems and their impact on the environment will also be discussed. The design and implementation of an open-ended group project bring these topics into practice.

Assessment: 30% practical work, 30% continuous assessment, 40% examination

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**ENGG1204     Industrial management and logistics (6 credits)**

The fundamental role of logistics and supply chain management in the economy and organisation; contribution of logistics and supply chain management to value creation; introduction to logistics industry in Hong Kong; contemporary topics in logistics and supply chain management.

Essential management and business skills for engineers; introduction to project management; global manufacturing; applications of industrial engineering principles in different sectors and industries; quality functions; performance improvement; basics of problem solving and decision making.

Assessment: 50% continuous assessment, 50% examination

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### **ENGG1205 Introduction to Mechanical Engineering (6 credits)**

This is one of the common engineering courses offered to BEng students in their first year of study. Students who choose to study BEng in Mechanical Engineering must study this course either in their first year or second year. This course aims to provide students with a comprehensive knowledge in the nature of mechanical engineering by studying some important applications including robots, aircrafts and strong materials.

Topics include: modelling of mechanical systems; working principles of robots; mechanics and propulsion of aircrafts; strong materials; hands-on projects.

Assessment: 30% practical work, 20% continuous assessment, 50% examination

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### **ENGG1206 Introduction to biomedical engineering (6 credits)**

This course is an overview of the essential areas in biomedical engineering, including technologies and applications in life sciences and medicine. The course is broadly divided into 4 areas: biomechanics and biomaterial; cell and tissue engineering; biomedical instrumentations and signals, and medical imaging. The global development and other issues, such as safety, ethics and industry will also be addressed. The course has a laboratory component to provide the students with some hands-on experience in the subject.

Assessment: 60% continuous assessment, 40% examination

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### **ENGG1207 Foundations of biochemistry for medical engineering (6 credits)**

The course is comprised of four areas of fundamentals, namely:

#### **A. Chemistry for Biochemistry**

The elements and bonding (from carbon to Coenzyme A); Resonance and orbital theory (a focus on the electron); Structure and conformation (thinking in 3 dimensions); Isomerism (from mirrors to thalidomide); Water (the universal biochemical solvent) & buffer; Quantitation in chemistry (who was Avogadro anyway?)

#### **B. Biology for Biochemistry**

The basic building blocks of life (proteins, DNA, lipids, carbohydrate); The Central Dogma of Molecular Biology; Evolution (considering molecular evolution); Origins of life (the chicken-egg paradox of proteins and DNA)

#### **C. Physics and Mathematics for Biochemistry**

Thermodynamics from a Biological Perspective; Introduction to molecular recognition and binding



(DNA melting); Statistics for biochemistry (applied statistics for what you really need to know); Thinking numbers (exponentials, logs and the limits of life).

#### D. Inspiring Biochemistry

The protein (from Perutz to the frontier of proteomics); The gene (from the double helix to the human genome project and how it failed to live up to its expectations); Vitamins and disease (stories of scientific discovery motivated by human suffering); Synthetic biology (a cure to the world's energy problems or misplaced trust in dangerous technology); The challenges of modern-day genetics (will we ever really understand individuality); Drugs-successes, failures, and perhaps the most challenging business on earth.

Assessment: 70% continuous assessment, 30% examination

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### **University Language Enhancement Courses**

All the students admitted to the Bachelor of Engineering curriculum under common code admission are required to take two English language enhancement courses and one Chinese language enhancement course in the study year as specified in the syllabuses of respective BEng curriculum:

|                 |  |
|-----------------|--|
| <b>CAES1000</b> | <b>Core University English</b>   |
| <b>CAES95##</b> | <b>English in the Discipline course for respective BEng curriculum</b> |
| <b>CENG9001</b> | <b>Practical Chinese for engineering students<sup>1</sup></b>          |

#### **COURSE DESCRIPTIONS**

##### **CAES1000      Core University English (6 credits)**

The Core University English (CUE) aims to enhance first-year students' academic English language proficiency in the university context. CUE focuses on developing students' academic English language skills for the Common Core Curriculum. These include the language skills needed to understand and produce spoken and written academic texts, express academic ideas and concepts clearly and in a well-structured manner and search for and use academic sources of information in their writing and speaking. Students will also complete our online-learning modules through the Moodle platform on academic grammar, academic vocabulary, citation and referencing skills and understanding and avoiding plagiarism. This course will help students to participate more effectively in their first-year university studies in English, thereby enriching their first-year experience.

Assessment: 65% continuous assessment, 35% examination.

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##### **CENG9001      Practical Chinese for engineering students (6 credits) (normally to be taken at the first semester of third year of study)**

The course is designed to enable students to gain a mastery of the varieties of the Chinese language as used in the field of Engineering. It introduces students to various techniques for the effective use of practical Chinese. The course will familiarize students with traditional Chinese characters, simplified Chinese characters, modern Chinese grammar and rhetoric through outcomes-based assignments. Special training that is intended to sharpen students' presentation skills in Cantonese and Putonghua will also be provided.

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<sup>1</sup> Putonghua-speaking students should take CUND9002 or CUND9003. Students who have not studied Chinese language during their secondary education / who have not attained the requisite level of competence in the Chinese language to take CENG9001 can apply (i) to take credit-bearing Cantonese or Putonghua language courses offered by the School of Chinese especially for international and exchange students; OR (ii) to be exempted from the Chinese language requirement and take an elective course in lieu.

Assessment: 50% continuous assessment, 50% examination.

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**CAES95## English in the Discipline course for respective BEng curriculum (6 credits)**  
**[to be taken in the study year as specified in the syllabuses of respective BEng curriculum]**

Apart from “CAES1000 Core University English”, BEng students must complete a 6-credit English in the Discipline (ED) course as specified in the syllabuses of respective BEng curriculum, with the summary of the list of ED courses as follows:

| Course Code | Course Title   | BEng Curriculum                     | Year/Semester (normally to be taken) |
|-------------|--|-------------------------------------|--------------------------------------|
| CAES9520    | Technical English for Industrial and Manufacturing Systems Engineering | BEng(IETM)<br>BEng(LESCM)           | Semester 2, Year 2                   |
| CAES9543    | Technical English for Mechanical and Building Services Engineering     | BEng(ME)<br>BEng(ME-BSE)            | Semester 2, Year 4                   |
| CAES9531    | Technical English for Medical Engineering                              | BEng(MedE)                          | Semester 1, Year 3                   |
| CAES9540    | Technical English for Civil Engineering                                | BEng(CivE)<br>BEng(Civ-EnvE)        | Semester 1, Year 4                   |
| CAES9541    | Technical English for Electrical and Electronic Engineering            | BEng(CE)<br>BEng(ElecE)<br>BEng(EE) | Semester 2, Year 4                   |
| CAES9542    | Technical English for Computer Science                                 | BEng(CompSc)                        | Semester 1, Year 4                   |

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**Minor Option**

Candidates are given an option to pursue a minor in a discipline outside their own degree curriculum. Candidates who wish to have their minor recorded on the transcript must take and pass all the required courses in the selected minor as specified by the offering Department/Faculty in addition to the graduation requirements of their own degree curriculum. For the descriptions of the course under minor options, candidates should refer to the syllabuses of the relevant degree.

Courses taken to fulfil the Minor Option requirements may also be considered as equivalent courses that satisfy the elective requirements of the BEng curriculum, subject to the approval of the Board of the Faculty of Engineering.

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**Double-Degrees in BEng/BBA Option**

Candidates are given an option to pursue the double-degrees in BEng/BBA, subject to the approval of the Boards of the Faculty of Engineering and Faculty of Business and Economics upon their meeting the prescribed admission requirements as laid down by both the Faculty of Engineering and the Faculty of Business and Economics.

Courses taken to fulfil the double-degrees curriculum requirements may also be considered as equivalent courses that satisfy the elective requirements of the BEng curriculum, subject to the approval of the Board of the Faculty of Engineering.

Candidates who have satisfied all the requirements of the BEng curriculum will be awarded the degree of Bachelor of Engineering. To be eligible for proceeding to the BBA programme in the 5<sup>th</sup> year, candidates must:

- (1) fulfil the requirements of the BEng curriculum;
- (2) hold a degree of BEng with Second Class Honours from The University of Hong Kong; and
- (3) pass the 54 credits of courses, as listed below, as required by the Faculty of Business and Economics during their study for BEng:

| Course Code | Course  | Credits   |
|-------------|---|-----------|
| ACCT1101    | Introduction to financial accounting  | 6         |
| IIMT2601    | Management information systems  | 6         |
| MKGT2501    | Introduction to marketing   | 6         |
| MGMT2401    | Principles of management  | 6         |
| ECON1210    | Introduction to economics I   | 6         |
| FINA1310    | Corporate finance   | 6         |
| ACCT2105    | Introduction to management accounting   | 6         |
|             | Electives (Any 2 courses in HRM, Marketing or Wealth Management major as specified below) | 12        |
|             | <b>Total</b>  | <b>54</b> |

Elective courses for BEng/BBA (Human Resource Management, HRM)

| Course Code | Course  | Credits |
|-------------|---|---------|
| MGMT3403    | Leadership                                      | 6       |
| MGMT3405    | Organizational behaviour                        | 6       |
| MGMT3415    | Principles of entrepreneurship                  | 6       |
| MGMT3429    | Human resource management and business strategy | 6       |
| MGMT3434    | Human resource: theory and practice             | 6       |
| MGMT3475    | Current topics in human resource management     | 6       |

Elective courses for BEng/BBA (Marketing)

| Course Code | Course                         | Credits |
|-------------|--------------------------------|---------|
| MKTG3501    | Consumer behaviour             | 6       |
| MKTG3502    | Marketing research             | 6       |
| MKTG3525    | Services marketing             | 6       |
| MKTG3531    | Strategic marketing management | 6       |

Elective courses for BEng/BBA (Wealth Management)

| Course Code | Course                            | Credits |
|-------------|-----------------------------------|---------|
| ACCT3107    | Hong Kong taxation                | 6       |
| FINA2320    | Investment and portfolio analysis | 6       |
| FINA2322    | Derivatives                       | 6       |
| FINA2325    | Alternative investments           | 6       |
| FINA2342    | Insurance: theory and practice    | 6       |

Subject to approval of the Board of the Faculty of Engineering, candidates who have completed the requirements of BEng and decide not to proceed to the study for BBA may be awarded with a minor as specified by the Faculty of Business and Economics, if they have completed not less than 36 to 48 credits of courses in compliance with the syllabuses for the minor programme.

To obtain the degree of BBA, candidates must satisfactorily complete 114 credits of courses, 54 of which shall be completed during the study for BEng and 60 of which shall be completed during the 5<sup>th</sup>

year in accordance with the Regulations and Syllabuses for the Degree of BBA in Conjunction with the Degree of BEng.

*Note: Candidates may refer to the Regulations for the Degree of Bachelor of Business Administration (BBA) in conjunction with the Degree of Bachelor of Engineering (BEng)"and Syllabuses for the Degree of Bachelor of Business Administration (BBA) in conjunction with the Degree of Bachelor of Engineering (BEng)"for the regulations, length and contents of courses for the double-degrees in BEng/BBA option.*

# **CIVIL ENGINEERING**

## **SYLLABUS**

The syllabus applies to students admitted in the academic year 2014-15 under the four-year curriculum.

### Definition and Terminology

Each course offered by the Department of Civil Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Civil Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Civil Engineering that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (78 credits), comprising 24 credits of introductory core courses and 54 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 36 credits of advanced discipline elective courses offered by the Department of Civil Engineering.

#### Elective Courses

Students are required to complete 18 credits of elective course(s) offered by either the Department of Civil Engineering, or other departments within or outside of the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9540 Technical English for Civil Engineering”;
- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for Engineering Students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from the same Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### Capstone Experience

Students are required to complete the 12-credit “CIVL4102 Project” to fulfill the capstone experience requirement for the degree of BEng in Civil Engineering.

### Internship

Students are required to complete the 6-credit internship “CIVL2109 Internship”, which normally takes place after their third year of study.

### **Degree Classification**

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

### **The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Civil Engineering) comprises 240 credits of courses with the following structure:

#### **UG 5 Requirements (54 credits)**

| Course Code                       | Course                                     | No. of credits |
|-----------------------------------|--|----------------|
| CAES1000                          | Core University English                    | 6              |
| CAES9540                          | Technical English for Civil Engineering    | 6              |
| CENG9001                          | Practical Chinese for Engineering Students | 6              |
| CC##XXXX                          | University Common Core Course (6 courses)* | 36             |
| <b>Total for UG5 Requirements</b> |  | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one and no more than two courses from each Area of Inquiry during the whole period of study.

#### **General Engineering Courses (36 credits)**

| Course Code                                  | Course  | No. of credits |
|--|---|----------------|
| MATH1851                                     | Calculus and ordinary differential equations  | 6              |
| MATH1853                                     | Linear algebra, probability & statistics  | 6              |
| ENGG1111/<br>ENGG1112                        | Computer programming and applications/<br>Computer programming and applications I                         | 6              |
| PHYS1050                                     | Physics for engineering students  | 6              |
| ENGG1201                                     | Engineering for sustainable development   | 6              |
| ENGG120#X                                    | Any one of the General Engineering Courses offered by other<br>Departments of the Faculty of Engineering* | 6              |
| <b>Total for General Engineering Courses</b> |   | <b>36</b>      |

\* Choose one General Engineering Course from the following list:

|          |   |
|----------|---|
| ENGG1202 | Introduction to computer science                      |
| ENGG1203 | Introduction to electrical and electronic engineering |
| ENGG1204 | Industrial management and logistics                   |
| ENGG1205 | Introduction to mechanical engineering                |
| ENGG1206 | Introduction to biomedical engineering                |
| ENGG1207 | Foundation of biochemistry for medical engineering    |

#### **Discipline Core Courses (78 credits)**

**Introductory Courses (24 credits)**

| Course Code   | Course  | No. of credits |
|---|---|----------------|
| CIVL1105  | Environmental engineering                               | 6              |
| CIVL1113  | Engineering mechanics & materials                       | 6              |
| CIVL1114  | Surveying & drawing                                     | 6              |
| MECH2407  | Multivariable calculus & partial differential equations | 6              |
| <b>Total for Introductory Discipline Core Courses</b> |   | <b>24</b>      |

**Advanced Courses (54 credits)**

| Course Code                                       | Course                                     | No. of credits |
|---|--|----------------|
| CIVL2102  | Engineering geology and rock mechanics     | 6              |
| CIVL2103  | Fluid mechanics                            | 6              |
| CIVL2104  | Hydraulics and hydrology                   | 6              |
| CIVL2105  | Theory and design of structures I          | 6              |
| CIVL2106  | Soil mechanics                             | 6              |
| CIVL2107  | Theory and design of structures II         | 6              |
| CIVL2108  | Principles of civil engineering management | 6              |
| CIVL2111  | Transportation engineering                 | 6              |
| CIVL4101  | Capstone design project                    | 6              |
| <b>Total for Advanced Discipline Core Courses</b> |  | <b>54</b>      |

**Capstone Experience and Internship (18 credits)**

| Course Code   | Course               | No. of credits |
|---|----------------------|----------------|
| CIVL2109  | Internship*          | 6              |
| CIVL4102  | Project <sup>+</sup> | 12             |
| <b>Total for Capstone Experience and Internship Courses</b> |                      | <b>18</b>      |

+Capstone Experience

\*Internship

**Discipline Elective Courses (36 credits)**

| Course Code | Course  | No. of credits |
|-------------|---|----------------|
| CIVL2110    | Experiential learning   | 6              |
| CIVL3101    | Advanced engineering mechanics                                | 6              |
| CIVL3103    | Construction project management                               | 6              |
| CIVL3106    | Engineering hydraulics  | 6              |
| CIVL3107    | Environmental impact assessment of civil engineering projects | 6              |
| CIVL3108    | Foundation engineering  | 6              |
| CIVL3111    | Wastewater treatment  | 6              |
| CIVL3112    | Prestressed concrete structures                               | 6              |
| CIVL3114    | Slope engineering   | 6              |
| CIVL3115    | Solid and hazardous waste management                          | 6              |
| CIVL3116    | Steel structures  | 6              |
| CIVL3118    | Theory and design of structures III                           | 6              |



|   |   |           |
|---|---|-----------|
| CIVL3119  | Traffic engineering                                 | 6         |
| CIVL3120  | Transportation infrastructure engineering           | 6         |
| CIVL3121  | Water resources engineering                         | 6         |
| CIVL3122  | Wind engineering                                    | 6         |
| CIVL3125  | Law for civil engineers                             | 6         |
| CIVL3126  | Engineering practice in Mainland China              | 6         |
| CIVL3127  | Building practice in the built environment          | 6         |
| CIVL3128  | Structural dynamics and earthquake engineering      | 6         |
| CIVL3129  | Numerical analysis in geotechnical engineering      | 6         |
| CIVL3130  | Structural fire engineering                         | 6         |
| CIVL3131  | Earth retaining system                              | 6         |
| CIVL3132  | Geotechnical testing instrumentation and monitoring | 6         |
| CIVL3133  | Ground improvement                                  | 6         |
| CIVL3134  | Environmental geotechnology                         | 6         |
| <b>Complete six discipline elective courses for a total of 36 credits</b> |   | <b>36</b> |

### **Elective Courses (18 credits)**

At least 18 credits of courses offered by either the Department of Civil Engineering, or other departments within or outside of the Faculty of Engineering.

### **Summary of curriculum structure of BEng (Civil Engineering)**

| <b>Course Categories</b>               | <b>No. of credits</b> |
|--|-----------------------|
| UG5 Requirements                       | 54                    |
| General Engineering Courses            | 36                    |
| Discipline Core Courses (Introductory) | 24                    |
| Discipline Core Courses (Advanced)     | 54                    |
| Capstone Experience and Internship     | 18                    |
| Discipline Elective Courses            | 36                    |
| Elective Courses                       | 18                    |
| <b>Total</b>                           | <b>240</b>            |

A suggested study plan is given as follows:

### **FIRST YEAR**

#### **General Engineering Courses (36 credits)**

|           |   |
|-----------|---|
| MATH1851  | Calculus and ordinary differential equations  |
| MATH1853  | Linear algebra, probability & statistics  |
| ENGG1111/ | Computer programming and applications/  |
| ENGG1112  | Computer programming and applications I   |
| PHYS1050  | Physics for engineering students  |
| ENGG1201  | Engineering for sustainable development   |
| ENGG120X  | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering |

**University Requirements (UG5) (24 credits)**

CAES1000      Core University English  
CC##XXXX      Three Common Core Courses

**SECOND AND THIRD YEARS****Introductory Discipline Core Courses (24 credits)**

CIVL1105      Environmental engineering  
CIVL1113      Engineering mechanics & materials  
CIVL1114      Surveying & drawing  
MECH2407      Multivariable calculus & partial differential equations

**Advanced Discipline Core Courses (48 credits)**

CIVL2102      Engineering geology and rock mechanics  
CIVL2103      Fluid mechanics  
CIVL2104      Hydraulics and hydrology (pre-requisite: CIVL2103)  
CIVL2105      Theory and design of structures I (pre-requisite: CIVL1113)  
CIVL2106      Soil mechanics  
CIVL2107      Theory and design of structures II (pre-requisite: CIVL2105)  
CIVL2108      Principles of civil engineering management  
CIVL2111      Transportation engineering

**Discipline Elective Courses (18 Credits)**

(Note that pre-requisite is required for some courses. Please refer to the course description for individual courses)

**University Requirements (UG5) (24 credits)**

CC##XXXX      Three Common Core Courses  
CENG9001      Practical Chinese for Engineering Students (This course should be enrolled in the third year)

**Internship (6 credits)**

CIVL2109      Internship (This course must be enrolled in the Summer semester of the third year)

**FOURTH YEAR****Advanced Discipline Core Courses (6 credits)**

CIVL4101      Capstone design project (This course must be enrolled in the fourth year)

**Discipline Elective Courses (18 credits)**

(Note that pre-requisite is required for some courses. Please refer to the course descriptions for individual courses)

**Capstone Experience (12 credits)**

CIVL4102      Project (This course must be enrolled in the fourth year)

**University Requirements (UG5) (6 credits)**

CAES9540      Technical English for Civil Engineering (This course should be enrolled in the fourth year)

**Elective Courses (18 credits)**

(Note that pre-requisite is required for some courses. Please refer to the course descriptions for individual courses)

## **COURSE DESCRIPTIONS**

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

### **General Engineering Courses**

|          |   |
|----------|---|
| ENGG1111 | Computer programming (6 credits)                                  |
| ENGG1112 | Computer programming I (6 credits)                                |
| MATH1851 | Calculus and ordinary differential equations (6 credits)          |
| MATH1853 | Linear algebra, probability & statistics (6 credits)              |
| PHYS1050 | Physics for engineering students (6 credits)                      |
| ENGG1201 | Engineering for sustainable development (6 credits)               |
| ENGG1202 | Introduction of computer science (6 credits)                      |
| ENGG1203 | Introduction to electrical and electronic engineering (6 credits) |
| ENGG1204 | Industrial management and logistics (6 credits)                   |
| ENGG1205 | Introduction to mechanical engineering (6 credits)                |
| ENGG1206 | Introduction to biomedical engineering (6 credits)                |
| ENGG1207 | Foundations of biochemistry for medical engineering (6 credits)   |

Please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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### **University Requirements on Language Enhancement Courses**

|                  |   |
|------------------|---|
| <b>CAES1000.</b> | <b>Core University English (6 credits)</b>                    |
| <b>CENG9001.</b> | <b>Practical Chinese for engineering students (6 credits)</b> |

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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### **CAES9540. Technical English for Civil Engineering (6 credits)**

This one semester 6-credit English course will be offered to final year Civil Engineering and BEng(EngSc) Environmental Engineering students. It will run alongside Civil Engineering core project course. The main course objective is to provide students with training on report writing and oral presentation skills. Students will learn to write a technical report in a professional and effective manner through drafting and revision of their work. They will also be trained to give a technical presentation that focuses on explaining technical information to the general audience, handling over in a group presentation and designing appropriate visual aids to both professional and non-expert audiences. Assessment is by coursework and a final test.

Co-requisite: CIVL4102 Project

CIVL4101 Capstone design project (for BEng(EngSc) Environmental Engineering students only)

Assessment: 100% continuous assessment.

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## **University Common Core Curriculum**

36 credits of courses in the University Common Core Curriculum, in which students can select not more than one course from the same Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study:

- Scientific and Technology Literacy
  - Humanities
  - Global Issues
  - China: Culture, State and Society
- 

## **Introductory Discipline Core Courses**

### **CIVL1105. Environmental engineering (6 credits)**

This is an introductory course on environmental engineering. Students are taught in 31 hours of lecture plus 8 hours of interactive problem-based tutorial (IPBT). The IPBT is designed to train students in small groups for using the knowledge and engineering principles learned from the course to solve practical environmental engineering related problems.

Assessment: 20% continuous assessment, 80% examination

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### **CIVL1113. Engineering mechanics and materials (6 credits)**

The Engineering Mechanics part of this course aims to provide students with a firm foundation of engineering mechanics, which is needed for their later studies in structural engineering and geotechnical engineering. This part covers equilibrium of forces; bending moment, shear and axial forces; beam theory for bending and shear; torsion of circular sections; shear centre; analysis of stress and strain; and column buckling.

The Materials part of this course aims to provide students with a general knowledge of common construction materials and some background knowledge of material science. This part covers major applications and required properties of construction materials; structural steel; concrete; masonry; timber; bituminous materials; crystalline structure; elastic and plastic deformation; phase diagram; alloying; material forming and heat treatment; and corrosion.

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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### **CIVL1114. Surveying and drawing (6 credits)**

The Surveying part of this course aims to provide students with an overview on the surveying principles in determination of the differences in levelling between stations and of the coordinates of stations. Students will be introduced to basic surveying instruments and techniques through lectures and field work. The aim of the Drawing part of this course is to familiarize the students with the techniques for reading and production of both hand drawings and computer aided drafting (CAD) drawings. Students are expected to understand and appreciate the importance of surveying and drawing in the construction industry in order to prepare them for an engineering career.

Assessment: 35% practical work, 65% continuous assessment

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### **MECH2407. Multi-variables calculus & partial differential equations (6 credits)**

This course aims to further develop the foundation of mathematics used in engineering discipline. Students will be explored to Fourier series representations, multivariable functions, vector analysis and elementary partial differential equations. Through the development of solution methods, students will enrich their experience in critical analysis and problem solving.

Assessment: 20% Continuous assessment, 80% examination

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### **Advanced Discipline Core Courses**

#### **CIVL2102. Engineering geology and rock mechanics (6 credits)**

This course provides an introduction to engineering geology, acquainting the students with the fundamental aspects of rock mechanics, and developing the students' capability of applying the concepts and knowledge to solve practical problems in rock engineering.

Assessment: 20% practical work, 10% continuous assessment, 70% examination

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#### **CIVL2103. Fluid mechanics (6 credits)**

The course introduces the fundamental concepts of fluid flow, and examples of engineering fluid mechanics.

The course helps students to develop a sound understanding of control volume analysis, and its use with mass, momentum, and energy conservation principles. The course prepares students for dimensional analysis for the use of scale models in wind tunnel and hydraulic model testing.

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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#### **CIVL2104. Hydraulics and hydrology (6 credits)**

This course is to consolidate the principles of fluid mechanics learnt in CIVL2103, to apply them to civil engineering hydraulic problems, and to provide an understanding of the basic concepts of the hydrological cycle including its relevance and application to civil engineering field.

Pre-requisite: CIVL2103 Fluid mechanics

Assessment: 15% practical work, 15% continuous assessment; 70% examination

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#### **CIVL2105. Theory and design of structures I (6 credits)**

This is the first of three consecutive courses on Theory and Design of Structures. This course provides students with the basic knowledge in structural theory and design. Apart from introducing students to

statically determinate structures, it also provides the background for future study of statically indeterminate structures.

Pre-requisite: CIVL1113 Engineering mechanics and materials

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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### **CIVL2106. Soil mechanics (6 credits)**

Soil mechanics is a branch of engineering mechanics that describes the behaviour of soils. It differs from fluid mechanics and solid mechanics in the sense that soils consist of a heterogeneous mixture of fluids (usually air and water) and particles (usually clay, silt, sand and gravel) but soil may also contain organic solids, liquids, and gasses and other matter. Along with rock mechanics, soil mechanics provides the theoretical basis for analysis in geotechnical engineering. Soil mechanics is used to analyze the deformations of and flow of fluids within natural and man-made structures that are supported on or made of soil, or structures that are buried in soils. Examples applications are building and bridge foundations, retaining walls, dams, and buried pipeline systems.

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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### **CIVL2107. Theory and design of structures II (6 credits)**

This course is the second of three consecutive courses on Theory and Design of Structures. This course aims to provide students with knowledge and understanding in behaviour, analysis and design of statically indeterminate structures.

Prerequisite: CIVL2105 Theory and design of structures I

Assessment: 30% continuous assessment, 70% examination

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### **CIVL2108. Principles of civil engineering management (6 credits)\***

Civil engineering projects are characterised by their uniqueness, complexity and uncertainty, and these have posed immense challenges to our industry. To satisfy the client and project requirements, a good management skill and knowledge is of paramount importance. While engineers play a key role in relevant government departments, client organisations, design offices and contracting firms, they have the responsibilities of improving the efficiency, safety and quality of civil engineering projects and maximising the chance of project success and discharging their duties ethically. Therefore, the aims of this course are to introduce the basic concepts of various aspects of management and to explain how to apply these management principles to plan, organise and control a civil engineering project.

Assessment: 30% continuous assessment, 70% examination

\* For the double-degree in BEng/BBA, students who have completed the business course of 'Principles of management' are exempted from taking this core course under the BEng curriculum.

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**CIVL2111.      Transportation engineering (6 credits)**

This course is an introductory course of Transportation Engineering, and covers the causes and motivations of the movements of people and goods, the basic characteristics of different transportation modes, land use and transportation planning, equilibrium analysis, cost-benefit analysis, travel demand modeling and forecasting, highway alignment and geometric design, transportation surveys, and traffic impact assessment. Hong Kong examples will be used if possible.

Assessment: 20% continuous assessment, 80% examination

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**CIVL4101.      Capstone Design Project (6 credits)**

All modern engineering projects required substantial design and communication skills from engineers. With the demand for quality infrastructural projects, many professional engineers are required to participate in interdisciplinary teams throughout various project stages. Therefore, this course aims to train future civil engineers to handle civil engineering projects through synergetic teamwork within a multi-disciplinary working environment. The course will start by introducing the importance of engineering design and communication skills, and then will equip students with the general knowledge of project designing across different disciplines by a series of guest lectures. Student will be divided into small project groups. Each group will be allocated a real-life project and supervised by one of the departmental teaching staff (staff tutor) and an industrial tutor. The students will work closely with their staff tutor and industrial tutor throughout the project period, together with the specific technical advisors, to carry out feasibility study, preliminary design and detail design of their project. The project will be assessed by a series of oral presentations and written reports from the project team.

Assessment: 100% continuous assessment

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**Capstone Experience and Internship****CIVL2109.      Internship (6 credits)**

The course is to provide industrial training to engineering students. The students will have an opportunity to gain practical experience in civil engineering and related professions.

The course requires students to complete a period of full time approved internship in industry, of not less than 4 weeks normally after the end of the second semester of the student's third academic year of study. The students are required to complete the internship to the satisfaction of an engineering professional, who will act as the students' supervisors during the internship.

During the course of their internship, sometimes students will be asked to visit construction sites. To comply with the legal requirements and for safety reasons, all students must complete the Mandatory Basic Safety Training Course (MBST). Through the MBST course, students will gain an understanding on the relevant safety legislation; potential hazards and preventive strategies; use of the protective equipment and the accident reporting mechanism.

Assessment: 100% continuous assessment

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**CIVL4102. Project (12 credits)**

The primary aim of the project is to give each individual student an opportunity to handle a practical engineering problem and to present the findings in a precise and concise report. An important part of the project lies in the way in which the students plan and carry out the task, and apply their engineering knowledge sensibly and diligently to solve the problem. The way in which the students present their findings is equally important.

Assessment: 100% continuous assessment

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**Discipline Elective Courses****CIVL2110 Experiential learning (6 credits)**

To complete a period of training in industry, workshop training, study tour, or leadership programme, approved by the Head of Department, not less than a total of four weeks during the summer semester, subject to satisfactory performance in these activities and the submission of a satisfactory completion report.

Assessment: 100% continuous assessment

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**CIVL3101. Advanced engineering mechanics (6 credits)**

CIVL3101 Advanced Engineering Mechanics aims to introduce to the fundamentals of engineering mechanics and how this is linked to engineering solutions by advanced computation techniques based on the finite element method. Equilibrium in elasticity problems and continuity equation for steady-state field problems are discussed, and by means of the virtual work principle, finite element formulation will be systematically established. Using simple 3-node triangular element as an example, engineering problems in structural mechanics and fluid flow are analysed. A computer demonstration will be presented to show students how complex practical engineering problems are tackled, and allow them to develop the ability to analyse realistic engineering problems by themselves and appreciate the capability and limitations of modern computational tools for engineering solutions.

Assessment: 30% continuous assessment, 70% examination

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**CIVL3103. Construction project management (6 credits)**

This course conveys knowledge of the fundamentals of construction project management, including core principles and their basic applications, which can be further built upon during career development. Topics span both the management of civil engineering designs and the management of construction projects. The course imparts important basics of the planning and control of time and money, and links these to achieving better value for stakeholders, including quality and life cycle considerations.

The course is designed to enable civil engineering undergraduates to appreciate and assimilate key principles and good practices for the effective, efficient and ethical management of construction projects. It also aims to equip young civil engineers with the basic knowledge that will enable them to perform well and contribute meaningfully in multi-disciplinary project teams that may include financial and legal professionals, apart from those from other core construction industry disciplines



Assessment: 30% continuous assessment, 70% examination

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**CIVL3106. Engineering hydraulics (6 credits)**

The course Engineering Hydraulics covers three major parts: Open Channel Flow, Storm Drainage Design and Environmental Hydraulics.

In Open Channel Flow, emphasis will be placed on the ‘gradually varied’ open channel flow (GVF), which deals with the classification of GVF profiles and different methods of computation of flow profiles. Some examples of ‘rapidly varied’ flow, such as energy dissipators and vertical drop structures, will also be given.

In Storm Drainage Design, the classification of drainage and sewerage systems will be introduced. Students will learn the design of urban stormwater drainage system.

In Environmental Hydraulics, students will appreciate the assimilative capacity (self purification) of the natural environment, through the study of basic concepts of turbulent mixing and dispersion of pollutants in water. Examples will be given to demonstrate the use of advective diffusion equation to solve actual environmental problems.

Pre-requisite: CIVL2104 Hydraulics and hydrology

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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**CIVL3107. Environmental impact assessment of civil engineering projects (6 credits)**

This course will introduce concepts on environmental protection legislation, environmental impact assessment process, environmental impacts during construction and operation of projects, mitigation measures, modelling, environmental monitoring and audit, and case studies.

Pre-requisite: CIVL1105 Environmental engineering and CIVL2103 Fluid mechanics

Assessment: 30% continuous assessment, 70% examination

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**CIVL3108. Foundation engineering (6 credits)**

Foundation engineering deals with the investigation, design and construction of the foundations of engineering structures, which is of prime importance. This course addresses the site investigation of a geotechnical project, follows by the design and construction of shallow and deep foundations in accordance with both ultimate and serviceability criteria. In particular the design and construction practices in Hong Kong will be addressed. A site visit will be arranged to offer students an opportunity to observe the construction practice in Hong Kong.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 30% continuous assessment, 70% examination

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**CIVL3111. Wastewater treatment (6 credits)**

This course focuses on the theory, design and operation of wastewater treatment. Emphasis will be placed upon a fundamental understanding of commonly used treatment technologies. Major sections of the course cover the generation and characteristics of municipal wastewater, sewerage systems, preliminary treatment, primary sedimentation, secondary biological treatment, nutrient removal, disinfection, sludge treatment and disposal, unit process selection and treatment plant design, characteristics of industrial wastewater, and physical, chemical and biological processes used in industrial wastewater treatment.

The course aims to introduce to students the basic concept of wastewater treatment engineering and the knowledge of unit treatment operations and processes. At the end of this course, students who fulfill the requirement of the course will be able to present the principles and theories behind the common wastewater treatment technologies and to conduct preliminary design of sewerage systems and typical physical, chemical and biological units used in conventional wastewater treatment.

Pre-requisite: CIVL1105 Environmental engineering and CIVL2103 Fluid mechanics

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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**CIVL3112. Prestressed concrete structures (6 credits)**

This is an elective course to provide students with the basic knowledge for the design of Prestressed Concrete Structures. Apart from introducing students to the fundamental principles of prestressing and application to design of long-span concrete structures, it also provides the background for future study of bridge engineering. Each student is required to submit a comprehensive design of prestressed concrete structure. Students must have taken the pre-requisite CIVL2107 Theory and Design of Structures II before taking this course.

Pre-requisite: CIVL2107 Theory and design of structures II

Assessment: 30% continuous assessment, 70% examination

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**CIVL3114. Slope engineering (6 credits)**

This course is to provide our students with basic knowledge of slope stability analysis and design. It covers slope stability analyses, cases of landslide hazards, landslide investigation, uncertainties in slope stability analysis, landslip preventive measures and design, many case studies and actual examples, a Slope/w software workshop and one field technical trip.

Pre-requisite: CIVL2102 Engineering geology and rock mechanics and CIVL2106 Soil mechanics

Assessment: 20% continuous assessment, 80% examination

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**CIVL3115. Solid and hazardous waste management (6 credits)**

Human activities generate solid waste materials that are often discarded because they are considered useless. However, the disposal of these unwanted waste materials has created a heavy burden to our environment and sometimes even threatened the human health due to its hazardous properties. Waste management has become one of the most significant problems of our time because the current ways of life in Hong Kong and in many areas of the world produce enormous amounts of waste, and most people want to preserve their

lifestyle, while also protecting the environment and public health. Furthermore, if managed properly, many of these waste materials can be reused or recovered for becoming a resource for industrial production or energy generation. This course is an introduction to the key managing concepts and processing technologies of solid waste. It aims to train future engineers capable of conducting solid waste project planning for industries, businesses, communities and governmental sectors. The discussion of context will stem from solid waste materials generated from municipal sources, and then include selected examples from industrial sources and/or of hazardous properties with local relevance. After the training provided by this course, students are expected to be capable of using different planning tools to manage the reduction of solid waste generation, the reuse and recovery of waste materials, or the safe and economical disposal strategies.

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3116. Steel structures (6 credits)**

This course aims to provide students with knowledge and understanding in behaviour and design of steel structures. Students will be exposed to plastic analysis, residual stress, slender sections, plate girders, steel frames, connections and composite structures. Students must have fulfilled the pre-requisite CIVL2107 Theory and Design of Structures II requirement before taking this course.

Pre-requisite: CIVL2107 Theory and design of structures II

Assessment: 20% continuous assessment, 80% examination

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### **CIVL3118. Theory and design of structures III (6 credits)**

The theory part of the course introduces the theory and applications of the matrix method for static and stability analyses of two-dimensional structures together with the elastic and plastic torsional analyses of thin-walled sections. The design part of the course introduces the concept and principles of inelastic design of reinforced concrete structures with emphasis on plastic hinge formation and moment redistribution. On practical design aspects, ultimate limit state design as per Hong Kong Concrete Code of special structural members such as two-way slabs, flat slabs, torsion members and slender columns will be discussed and explained. The course also includes a section of serviceability limit state design of large civil water-retaining reinforced concrete structures, such as underground box culverts, open channels, manholes, inspection chambers and water/sewage treatment tanks.

Pre-requisite: CIVL2107 Theory and design of structures II

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3119. Traffic engineering (6 credits)**

This course is an introduction to the broad disciplines of traffic engineering and its applications to the management and control of traffic flows in highways and the planning and design of highway junctions and interchanges. This course covers the characteristics of traffic flow, mathematical models of traffic flow, traffic management schemes, traffic surveys, traffic design for safety, and the planning and design of different types of road junctions, including priority junctions, roundabouts, traffic signal controlled junctions and grade-separated junctions and interchanges. Hong Kong examples will be used if possible.

Assessment: 30% continuous assessment, 70% examination

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**CIVL3120.    Transportation infrastructure engineering (6 credits)**

This course is an introduction to the theory and practice of transportation infrastructure planning, design and maintenance. Emphasis is placed on facility operational requirements, facility location, demand estimation, capacity assessment, properties of construction materials, design codes and their underlying theories. The different stages of project development, including system planning, feasibility studies, public consultation, project appraisal, detailed design and construction are discussed and illustrated by case studies. Students are required to complete three exercises on infrastructure planning and design.

Pre-requisite: CIVL2111 Transportation engineering

Assessment: 30% continuous assessment, 70% examination

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**CIVL3121.    Water resources engineering (6 credits)**

CIVL3121 is a course that focuses on the concept, theory, design and operation of urban water supply systems. Emphasis will be placed upon a fundamental understanding of commonly used water collection and treatment technologies. Major sections of the course cover water cycle, water consumption and demand, water collection, storage and transportation, drinking water quality, conventional surface water treatment unit operations and processes, advanced water treatment technologies, water stabilisation and corrosion control, urban water distribution and transmission, water reclamation and total water management.

The course aims to introduce to students the basic concept of water resources engineering and the knowledge of urban water supply. At the end of this course, students who fulfill the requirement of the course will be able to present the principles and theories behind the common water collection and treatment technologies and to conduct conceptual design of freshwater collection systems, common surface water treatment processes and urban water distribution systems.

Pre-requisite: CIVL1105 Environmental engineering and CIVL2103 Fluid mechanics

Assessment: 20% practical work, 80% examination

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**CIVL3122.    Wind engineering (6 credits)**

The course introduces the effects of wind on buildings, structures and the environment, with emphasis on wind loading of buildings and structures.

The course provides students with the basic scientific knowledge of the engineering description of wind and the engineering phenomena of wind flow around bluff bodies, buildings, bridges and civil engineering structures. The basics of flow-structure interaction and wind-induced vibration of structures are also presented. The course then continues to describe the format and features of a wind loading code and how the code should be interpreted with the knowledge of wind engineering. The course also introduces the effects of wind on pedestrian comfort and pollutant dispersion.

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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**CIVL3125. Law for civil engineers (6 credits)**

With the changing demands and expectations of civil engineers, law has become an essential part of the body of knowledge important to the discharge of daily tasks of civil engineers. Whether working for sub-contractors, contractors, consultants, governments or private developers, a core competence for the planning, design, construction and maintenance of projects is the ability to apply principles of laws to their works. These enable the proper management of projects and the areas of disputes arising thereunder.

This course aims at introducing the basic principles of laws with particular emphasis on those, which are relevant to the construction industry.

Assessment: 30% continuous assessment, 70% examination

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**CIVL3126. Engineering practice in Mainland China (6 credits)**

To enable students to gain basic understanding of engineering design and construction practice in Mainland China. By introducing some commonly used codes of practice, work procedures, quality control system, engineering requirements, practical design case study, design principles and procedure of foundation, building structures with and without seismic design requirement and bridges/highway structures, students will be better equipped to engage in Mainland engineering projects. At the end of this course, students should be able to understand the work procedure in Mainland China. In design, students should be capable of carrying out correct design of foundations and buildings as per various GB Codes and understand the principle of respective design clauses stipulated in the Codes.

Pre-requisite: CIVL2107 Theory and design of structures II

Assessment: 30% continuous assessment, 70% examination

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**CIVL3127. Professional practice in the built environment (6 credits)**

Building construction is one of the major sectors of the construction industry in Hong Kong. Many high-rise buildings were built in the last three decades, calling for sophisticated designs in building layout, structure and foundation. At the same time it demands high technique in construction skill and management. There are government departments ensuring compliance with statutory standards of safety, health and environment of buildings and building works. Civil engineers would join relevant government departments, client organizations, consultant and contracting firms playing a key role in planning, design and construction of buildings. Therefore, the aims of this course are to introduce the basic knowledge and idea of statutory control on building planning, construction and site supervision.

Assessment: 30% continuous assessment, 70% examination

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**CIVL3128. Structural dynamics and earthquake engineering (6 credits)**

Earthquake disaster is increasingly of global concern as it threatens the world's population, economy, and sustainable development. It is the responsibility of civil engineers to design and build earthquake-resistant structures, in order to minimize the earthquake risk. By reducing losses of lives and properties, socio-economical sustainability can be achieved.

In this course, students will be introduced to the basic science of earthquakes and its effects on the natural and built environment.

Pre-requisite: CIVL2107 Theory and design of structures II

Assessment: 30% continuous assessment, 70% examination

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### **CIVL3129. Numerical analysis in geotechnical engineering (6 credits)**

Advances in computer technology greatly enhance the application of numerical methods in geotechnical engineering. The importance of numerical modelling in geotechnical practice has been increased tremendously over the past decade. In this course, the students will be introduced a proper understanding of the subject, covering from fundamentals of the numerical techniques to geotechnical practical considerations. This course first provides students a basic knowledge of numerical techniques including the finite difference and finite element method. The second part of the course focuses on practical considerations required for applying these techniques to geotechnical problems. It will be concluded by a number of geotechnical applications and case histories.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 35% continuous assessment, 65% examination

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### **CIVL3130. Structural fire engineering (6 credits)**

The major aims of this course are to introduce to the students the concept of fire safety engineering and design of fire resistant structures. Students will be given opportunities to learn Eurocode for the design of steel and concrete structures under elevated temperature. At the end of this course, students will be able to understand the fire development and predict gas temperature of fire compartment and temperature of structural members in fire condition. With respect to structural design, students will appreciate the special structural actions that occur under elevated temperature and capable of carrying out fire resistance design of simple steel and reinforced concrete members.

Pre-requisite: CIVL2107 Theory and design of structures II

Assessment: 30% continuous assessment, 70% examination

---

### **CIVL3131. Earth retaining system (6 credits)**

Development in urban areas is often limited by the space available, and efficient use of that space requires building underground or near slopes. Earth retaining systems are the engineering solution to this problem. This course introduces civil engineering students to different types of earth retaining systems, and gives them the means of designing earth retaining walls from first principles. At the end of the course, the students will have a good understanding of the forces exerted by the ground on retaining structures, for different cases (e.g. inclined ground, inclined wall, embedded wall, wall friction/adhesion), the different stabilizing methods that can be used (e.g. anchors, nails), and be able to use these calculations to design safe retaining walls.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 30% continuous assessment, 70% examination

---

**CIVL3132. Geotechnical testing, instrumentation and monitoring (6 credits)**

Geotechnical testing aims at understanding the behaviour of geomaterials that engineers are dealing with. A proper instrumentation and monitoring scheme provides crucial information for engineers to judge the effectiveness and safety of the engineering design and construction. This course first provides students advanced knowledge on geotechnical testing from both experimental and theoretical perspectives. Students are required to have hands-on experience on a common geotechnical test – multi-stage triaxial test. Then both practical and theoretical aspects of geotechnical instrumentation and monitoring are addressed.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 15% practical work, 15% continuous assessment, 70% examination

---

**CIVL3133. Ground improvement (6 credits)**

Construction is sometimes needed in ground that has poor strength and stiffness qualities. Improving the ground by reinforcing it or by modifying it can prevent excessive deformations or even failure. This course introduces civil engineering students to ground improvement by modification or reinforcement. At the end of the course, the students will have a good understanding of the different techniques used for ground improvement, and be able to use some of the theory for design.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 30% continuous assessment, 70% examination

---

**CIVL3134. Environmental Geotechnology (6 credits)**

Environmental geotechnology can be defined as an interdisciplinary science which covers soil and rock and their interactions with various environmental cycles, including the atmosphere, biosphere, hydrosphere, and lithosphere, as well as the geo-microbiosphere, and human activities, which includes characteristics of tree and vegetation roots and bacterial activities in the subsurface and subsequent response to the engineering behavior of the soil-water system.

The objective of the course is to provide the students with exposure to the geotechnical nature of environmental problems through discussions of contaminant transport in porous media and relationship with remediation technologies for hazardous waste sites and discussions of soil properties relative to waste containment systems, soil stability, and permeability. At the end of the course, the students who fulfill the requirements of this course should be able to understand the importance of Geotechnical Engineering related to environmental issues, to perform preliminary designs of different components of a municipal landfill, and to select appropriate remediation technologies for a contaminated site of a given contaminated site.

Pre-requisite: CIVL2106 Soil mechanics

Assessment: 30% continuous assessment, 70% examination

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## Minor in Environmental Engineering

Candidates are required to complete a total of 48 credits of courses comprising:

(a) Introductory Courses (18 credits)

| Course Code                                    | Course  | No. of credits |
|--|---|----------------|
| ENGG1201                                       | Engineering for sustainable development*        | 6              |
| CIVL1105                                       | Environmental engineering                       | 6              |
| CIVL2103                                       | Fluid mechanics <b>OR</b>                       | 6              |
| CIME2101                                       | Water and air quality: concepts and measurement | 6              |
| Total for Introductory Discipline Core Courses |   | 18             |

\* Students opting for the Minor cannot use the course ENGG1201 Engineering for sustainable development as satisfying the requirements of the General Engineering Course.

(b) Discipline Elective Courses (30 credits)

Students must complete 30 credits of discipline elective courses to be chosen from the following list:

| Course Code                           | Course  | No. of credits |
|---------------------------------------|---|----------------|
| CIME2101                              | Water and air quality: concepts and measurement               | 6              |
| CIVL2111                              | Transportation engineering                                    | 6              |
| CIVL2104                              | Hydraulics and hydrology                                      | 6              |
| CIVL3106                              | Engineering hydraulics  | 6              |
| CIVL3107                              | Environmental impact assessment of civil engineering projects | 6              |
| CIVL3111                              | Municipal and industrial wastewater treatment                 | 6              |
| CIVL3115                              | Solid and hazardous waste management                          | 6              |
| CIVL3121                              | Water resources engineering                                   | 6              |
| CIVL3122                              | Wind engineering  | 6              |
| CIVL3134                              | Environmental Geotechnology                                   | 6              |
| MECH3420                              | Air pollution control   | 6              |
| Total for Discipline Elective Courses |   | 30             |

## COURSE DESCRIPTIONS

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

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## Minor in Geotechnical Engineering

Candidates are required to complete a total of 48 credits of courses comprising:

(a) Introductory courses (18 credits)

| Course Code                                    | Course                                       | No. of credits |
|--|--|----------------|
| MATH1851                                       | Calculus and ordinary differential equations | 6              |
| MATH1853                                       | Linear algebra, probability & statistics     | 6              |
| CIVL2106                                       | Soil mechanics                               | 6              |
| Total for Introductory Discipline Core Courses |  | 18             |

(b) Discipline Elective Courses (30 credits)

Students must complete 30 credits of discipline elective courses to be chosen from the following list:

| Course Code                           | Course   | No. of credits |
|---------------------------------------|--|----------------|
| CIVL2102                              | Engineering geology and rock mechanics               | 6              |
| CIVL3108                              | Foundation engineering                               | 6              |
| CIVL3114                              | Slope engineering                                    | 6              |
| CIVL3129                              | Numerical analysis in geotechnical engineering       | 6              |
| CIVL3131                              | Earth retaining system                               | 6              |
| CIVL3132                              | Geotechnical testing, instrumentation and monitoring | 6              |
| CIVL3133                              | Ground improvement                                   | 6              |
| CIVL3134                              | Environmental geotechnology                          | 6              |
| Total for Discipline Elective Courses |  | 30             |

## COURSE DESCRIPTIONS

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

## **CIVIL ENGINEERING (Environmental Engineering)**

### **SYLLABUS**

The syllabus applies to students admitted in the academic year 2014-15 under the four-year curriculum.

#### Definition and Terminology

Each course offered by the Department of Civil Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Civil Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Civil Engineering-Environmental Engineering that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (84 credits), comprising 24 credits of introductory core courses and 60 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 36 credits of advanced discipline elective courses offered by the Department of Civil Engineering.

#### Elective Courses

Students are required to complete 12 credits of elective course(s) offered by either the Department of Civil Engineering, or other departments within or outside of the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9540 Technical English for Civil Engineering”;
- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for Engineering Students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from the same Area of Inquiry within one academic year and at least one and no more than two courses from each Area of Inquiry during the whole period of study.

#### Capstone Experience

Students are required to complete the 12-credit “CIVL4102 Project” to fulfill the capstone experience requirement for the degree of BEng in Civil Engineering-Environmental Engineering.

#### Internship

Students are required to complete the 6-credit internship “CIVL2109 Internship”, which normally takes place after their third year of study.

## Degree Classification

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

**The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Civil Engineering-Environmental Engineering) comprises 240 credits of courses with the following structure:

### UG 5 Requirements (54 credits)

| Course Code                       | Course                                     | No. of credits |
|-----------------------------------|--|----------------|
| CAES1000                          | Core University English                    | 6              |
| CAES9540                          | Technical English for Civil Engineering    | 6              |
| CENG9001                          | Practical Chinese for Engineering Students | 6              |
| CC##XXXX                          | University Common Core Course (6 courses)* | 36             |
| <b>Total for UG5 Requirements</b> |  | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one and no more than two courses from each Area of Inquiry during the whole period of study.

### General Engineering Courses (36 credits)

| Course Code                                  | Course   | No. of credits |
|--|--|----------------|
| MATH1851                                     | Calculus and ordinary differential equations   | 6              |
| MATH1853                                     | Linear algebra, probability & statistics   | 6              |
| ENGG1111/<br>ENGG1112                        | Computer programming and applications/<br>Computer programming and applications I                      | 6              |
| PHYS1050                                     | Physics for engineering students   | 6              |
| ENGG1201                                     | Engineering for sustainable development  | 6              |
| ENGG120X                                     | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering* | 6              |
| <b>Total for General Engineering Courses</b> |  | <b>36</b>      |

\*Choose one General Engineering Course from the following list:

|          |   |
|----------|---|
| ENGG1202 | Introduction of computer science                      |
| ENGG1203 | Introduction to electrical and electronic engineering |
| ENGG1204 | Industrial management and logistics                   |
| ENGG1205 | Introduction to mechanical engineering                |
| ENGG1206 | Introduction to biomedical engineering                |
| ENGG1207 | Introduction to biochemistry for medical engineering  |

### Discipline Core Courses (84 credits)

#### *Introductory Courses (24 credits)*

| Course Code | Course  | No. of credits |
|-------------|---|----------------|
| CIVL1105    | Environmental engineering                               | 6              |
| CIVL1113    | Engineering mechanics & materials                       | 6              |
| CIVL1114    | Surveying & drawing                                     | 6              |
| MECH2407    | Multivariable calculus & partial differential equations | 6              |

|   |    |
|---|----|
| <b>Total for Introductory Discipline Core Courses</b> | 24 |
|---|----|

#### **Advanced Courses (60 credits)**

| <b>Course Code</b>                                | <b>Course</b>                                   | <b>No. of credits</b> |
|---|---|-----------------------|
| CIME2101  | Water and air quality: concepts and measurement | 6                     |
| CIVL2102  | Engineering geology and rock mechanics          | 6                     |
| CIVL2103  | Fluid mechanics                                 | 6                     |
| CIVL2104  | Hydraulics and hydrology                        | 6                     |
| CIVL2105  | Theory and design of structures I               | 6                     |
| CIVL2106  | Soil mechanics                                  | 6                     |
| CIVL2107  | Theory and design of structures II              | 6                     |
| CIVL2108  | Principles of civil engineering management      | 6                     |
| CIVL2111  | Transportation engineering                      | 6                     |
| CIVL4101  | Capstone design project                         | 6                     |
| <b>Total for Advanced Discipline Core Courses</b> |   | 60                    |

#### **Capstone Experience and Internship (18 credits)**

| <b>Course Code</b>                                  | <b>Course</b>                   | <b>No. of credits</b> |
|---|---------------------------------|-----------------------|
| CIVL2109  | Internship*                     | 6                     |
| CIVL4102  | Final Year Project <sup>+</sup> | 12                    |
| <b>Total for Capstone Experience and Internship</b> |                                 | 18                    |

+Capstone Experience

\*Internship

#### **Discipline Elective Courses (36 credits)**

| <b>Course Code</b>  | <b>Course</b>   | <b>No. of credits</b> |
|---|---|-----------------------|
| CIVL2110  | Experiential learning   | 6                     |
| CIVL3103  | Construction project management                               | 6                     |
| CIVL3106  | Engineering hydraulics  | 6                     |
| CIVL3107  | Environmental impact assessment of civil engineering projects | 6                     |
| CIVL3108  | Foundation engineering  | 6                     |
| CIVL3111  | Wastewater treatment  | 6                     |
| CIVL3115  | Solid and hazardous waste management                          | 6                     |
| CIVL3118  | Theory and design of structures III                           | 6                     |
| CIVL3121  | Water resources engineering                                   | 6                     |
| CIVL3122  | Wind engineering  | 6                     |
| <b>Complete six discipline elective courses for a total of 36 credits</b> |   | 36                    |

#### **Elective Courses (12 credits)**

At least 12 credits of courses offered by either the Department of Civil Engineering, or other departments within or outside of the Faculty of Engineering.

| <b>Course Code</b> | <b>Course</b>                   | <b>No. of credits</b> |
|--------------------|---------------------------------|-----------------------|
| CIVL3101           | Advanced engineering mechanics  | 6                     |
| CIVL3112           | Prestressed concrete structures | 6                     |
| CIVL3114           | Slope engineering               | 6                     |
| CIVL3116           | Steel structures                | 6                     |

|          |   |   |
|----------|---|---|
| CIVL3119 | Traffic engineering                                 | 6 |
| CIVL3120 | Transportation infrastructure engineering           | 6 |
| CIVL3125 | Law for civil engineers                             | 6 |
| CIVL3126 | Engineering practice in Mainland China              | 6 |
| CIVL3127 | Building practice in the built environment          | 6 |
| CIVL3128 | Structural dynamics and earthquake engineering      | 6 |
| CIVL3129 | Numerical analysis in geotechnical engineering      | 6 |
| CIVL3130 | Structural fire engineering                         | 6 |
| CIVL3131 | Earth retaining systems                             | 6 |
| CIVL3132 | Geotechnical testing instrumentation and monitoring | 6 |
| CIVL3133 | Ground improvement                                  | 6 |
| CIVL3134 | Environmental geotechnology                         | 6 |

### Summary of curriculum structure of BEng (Civil Engineering-Environmental Engineering)

| Course Categories                      | No. of credits |
|--|----------------|
| UG5 Requirements                       | 54             |
| General Engineering Courses            | 36             |
| Discipline Core Courses (Introductory) | 24             |
| Discipline Core Courses (Advanced)     | 60             |
| Capstone Experience and Internship     | 18             |
| Discipline Elective Courses            | 36             |
| Elective Courses                       | 12             |
| <b>Total</b>                           | <b>240</b>     |

A suggested study plan is as follows:

### FIRST YEAR

#### General Engineering Courses (36 credits)

|           |   |
|-----------|---|
| MATH1851  | Calculus and ordinary differential equations  |
| MATH1853  | Linear algebra, probability & statistics  |
| ENGG1111/ | Computer programming and applications/  |
| ENGG1112  | Computer programming and applications I   |
| PHYS1050  | Physics for engineering students  |
| ENGG1201  | Engineering for sustainable development   |
| ENGG120X  | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering |

#### University Requirements (UG5) (24 credits)

|          |                           |
|----------|---------------------------|
| CAES1000 | Core University English   |
| CC##XXXX | Three Common Core Courses |

### SECOND AND THIRD YEARS

#### Introductory Discipline Core Courses (24 credits)

|          |   |
|----------|---|
| CIVL1105 | Environmental engineering                               |
| CIVL1113 | Engineering mechanics & materials                       |
| CIVL1114 | Surveying & drawing                                     |
| MECH2407 | Multivariable calculus & partial differential equations |

**Advanced Discipline Core Courses (54 credits)**

|          |  |
|----------|--|
| CIME2101 | Water and air quality: concepts and measurement              |
| CIVL2102 | Engineering geology and rock mechanics                       |
| CIVL2103 | Fluid mechanics  |
| CIVL2104 | Hydraulics and hydrology (pre-requisite: CIVL2103)           |
| CIVL2105 | Theory and design of structures I (pre-requisite: CIVL2113)  |
| CIVL2106 | Soil mechanics   |
| CIVL2107 | Theory and design of structures II (pre-requisite: CIVL2105) |
| CIVL2108 | Principles of civil engineering management                   |
| CIVL2111 | Transportation engineering                                   |

**Discipline Elective Courses (12 credits)**

(Note that pre-requisite is required for some courses. Please refer to the course description for individual courses)

**University Requirements (UG5) (24 credits)**

|          |  |
|----------|--|
| CC##XXXX | Three Common Core Courses                  |
| CENG9001 | Practical Chinese for Engineering Students |

**Internship (6 credits)**

|          |  |
|----------|--|
| CIVL2109 | Internship (This course must be enrolled in the Summer semester of the third year) |
|----------|--|

**FOURTH YEAR****Advanced Discipline Core Courses (6 credits)**

|          |   |
|----------|---|
| CIVL4101 | Capstone design project (This course must be enrolled in the fourth year) |
|----------|---|

**Discipline Elective Courses (24 credits)**

(Note that pre-requisite is required for some courses. Please refer to the course descriptions for individual courses)

**Capstone Experience (12 credits)**

|          |   |
|----------|---|
| CIVL4102 | Project (This course must be enrolled in the fourth year) |
|----------|---|

**University Requirements (UG5) (6 credits)**

|          |   |
|----------|---|
| CAES9540 | Technical English for Civil Engineering (This course should be enrolled in the fourth year) |
|----------|---|

**Elective Courses (12 credits)**

(Note that pre-requisite is required for some courses. Please refer to the course descriptions for individual courses)

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## **COURSE DESCRIPTIONS**

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

### **General Engineering Courses**

|          |   |
|----------|---|
| ENGG1111 | Computer programming (6 credits)                                  |
| ENGG1112 | Computer programming I (6 credits)                                |
| MATH1851 | Calculus and ordinary differential equations (6 credits)          |
| MATH1853 | Linear algebra, probability & statistics (6 credits)              |
| PHYS1050 | Physics for engineering students (6 credits)                      |
| ENGG1201 | Engineering for sustainable development (6 credits)               |
| ENGG1202 | Foundation of computer science (6 credits)                        |
| ENGG1203 | Introduction to electrical and electronic engineering (6 credits) |
| ENGG1204 | Industrial management and logistics (6 credits)                   |
| ENGG1205 | Introduction to mechanical engineering (6 credits)                |
| ENGG1206 | Introduction to biomedical engineering (6 credits)                |
| ENGG1207 | Foundation of biochemistry for medical engineering (6 credits)    |

Please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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### **University Requirements on Language Enhancement Courses**

|                  |   |
|------------------|---|
| <b>CAES1000.</b> | <b>Core University English (6 credits)</b>                    |
| <b>CENG9001.</b> | <b>Practical Chinese for Engineering Students (6 credits)</b> |

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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### **CAES9540.     Technical English for Civil Engineering (6 credits)**

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

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### **University Common Core Curriculum**

36 credits of courses in the University Common Core Curriculum, in which students can select not more than one course from the same Area of Inquiry within one academic year and at least one and no more than two courses from each Area of Inquiry during the whole period of study:

- Scientific and Technology Literacy
  - Humanities
  - Global Issues
  - China: Culture, State and Society
- 

### **Introductory Discipline Core Courses**

|                  |  |
|------------------|--|
| <b>CIVL1105.</b> | <b>Environmental engineering (6 credits)</b>           |
| <b>CIVL1113.</b> | <b>Engineering mechanics and materials (6 credits)</b> |
| <b>CIVL1114.</b> | <b>Surveying and drawing (6 credits)</b>               |

**MECH2407. Multivariable calculus & partial differential equations (6 credits)**

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

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**Advanced Discipline Core Courses**

|                  |   |
|------------------|---|
| <b>CIVL2102.</b> | <b>Engineering geology and rock mechanics (6 credits)</b>     |
| <b>CIVL2103.</b> | <b>Fluid mechanics (6 credits)</b>                            |
| <b>CIVL2104.</b> | <b>Hydraulics and hydrology (6 credits)</b>                   |
| <b>CIVL2105.</b> | <b>Theory and design of structures I (6 credits)</b>          |
| <b>CIVL2106.</b> | <b>Soil mechanics (6 credits)</b>                             |
| <b>CIVL2107.</b> | <b>Theory and design of structures II (6 credits)</b>         |
| <b>CIVL2108.</b> | <b>Principles of civil engineering management (6 credits)</b> |
| <b>CIVL2111.</b> | <b>Transportation engineering (6 credits)</b>                 |
| <b>CIVL4101.</b> | <b>Capstone Design Project (6 credits)</b>                    |

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

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**CIME2101. Water and air quality: concepts and measurement (6 credits)**

This course will introduce concepts on water/air quality and pollution, the standard methods of water and wastewater examination, air pollution control principles, and measurement techniques for common air pollutants.

Pre-requisite: CIVL1105 Environmental engineering

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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**Capstone Experience and Internship**

|                  |                               |
|------------------|-------------------------------|
| <b>CIVL2109.</b> | <b>Internship (6 credits)</b> |
| <b>CIVL4102.</b> | <b>Project (12 credits)</b>   |

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

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**Discipline Elective Courses**

|                  |  |
|------------------|--|
| <b>CIVL2110.</b> | <b>Experiential learning (6 credits)</b>   |
| <b>CIVL3103.</b> | <b>Construction project management (6 credits)</b>                               |
| <b>CIVL3106.</b> | <b>Engineering hydraulics (6 credits)</b>  |
| <b>CIVL3107.</b> | <b>Environmental impact assessment of civil engineering projects (6 credits)</b> |
| <b>CIVL3108.</b> | <b>Foundation engineering (6 credits)</b>  |
| <b>CIVL3111.</b> | <b>Wastewater treatment (6 credits)</b>  |
| <b>CIVL3115.</b> | <b>Solid and hazardous waste management (6 credits)</b>                          |
| <b>CIVL3118.</b> | <b>Theory and design of structures III (6 credits)</b>                           |
| <b>CIVL3121.</b> | <b>Water resources engineering (6 credits)</b>                                   |
| <b>CIVL3122.</b> | <b>Wind engineering (6 credits)</b>  |

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

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## Minor in Environmental Engineering

Candidates are required to complete a total of 48 credits of courses comprising:

(a) Introductory Courses (18 credits)

| Course Code                                    | Course  | No. of credits |
|--|---|----------------|
| ENGG1201                                       | Engineering for sustainable development*        | 6              |
| CIVL1105                                       | Environmental engineering                       | 6              |
| CIVL2103                                       | Fluid mechanics <b>OR</b>                       | 6              |
| CIME2101                                       | Water and air quality: concepts and measurement | 6              |
| Total for Introductory Discipline Core Courses |   | 18             |

\* Students opting for the Minor cannot use the course ENGG1201 Engineering for sustainable development as satisfying the requirements of the General Engineering Course.

(b) Discipline Elective Courses (30 credits)

Students must complete 30 credits of discipline elective courses to be chosen from the following list:

| Course Code                           | Course  | No. of credits |
|---------------------------------------|---|----------------|
| CIME2101                              | Water and air quality: concepts and measurement               | 6              |
| CIVL2111                              | Transportation engineering                                    | 6              |
| CIVL2104                              | Hydraulics and hydrology                                      | 6              |
| CIVL3106                              | Engineering hydraulics  | 6              |
| CIVL3107                              | Environmental impact assessment of civil engineering projects | 6              |
| CIVL3111                              | Wastewater treatment  | 6              |
| CIVL3115                              | Solid and hazardous waste management                          | 6              |
| CIVL3121                              | Water resources engineering                                   | 6              |
| CIVL3122                              | Wind engineering  | 6              |
| CIVL3134                              | Environmental Geotechnology                                   | 6              |
| MECH3420                              | Air pollution control   | 6              |
| Total for Discipline Elective Courses |   | 30             |

## COURSE DESCRIPTIONS

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

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### Minor in Geotechnical Engineering

Candidates are required to complete a total of 48 credits of courses comprising:

(a) Introductory courses (18 credits)

| Course Code  | Course                                       | No. of credits |
|--|--|----------------|
| MATH1851   | Calculus and ordinary differential equations | 6              |
| MATH1853   | Linear algebra, probability & statistics     | 6              |
| CIVL2106   | Soil mechanics                               | 6              |
| Total for Introductory Discipline Core Engineering Courses |  | 18             |

(b) Discipline Elective Courses (30 credits)

Students must complete 30 credits of discipline elective courses to be chosen from the following list:

| Course Code                           | Course   | No. of credits |
|---------------------------------------|--|----------------|
| CIVL2102                              | Engineering geology and rock mechanics               | 6              |
| CIVL3108                              | Foundation engineering                               | 6              |
| CIVL3114                              | Slope engineering                                    | 6              |
| CIVL3129                              | Numerical analysis in geotechnical engineering       | 6              |
| CIVL3131                              | Earth retaining system                               | 6              |
| CIVL3132                              | Geotechnical testing, instrumentation and monitoring | 6              |
| CIVL3133                              | Ground improvement                                   | 6              |
| CIVL3134                              | Environmental geotechnology                          | 6              |
| Total for Discipline Elective Courses |  | 30             |

### COURSE DESCRIPTIONS

For course descriptions, please refer to the syllabuses of the Civil Engineering programme.

# COMPUTER SCIENCE

## SYLLABUS

The syllabus applies to students admitted in the academic year 2014-15 under the four-year curriculum.

### Definition and Terminology

Each course offered by the Department of Computer Science shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline elective course refers to any technical course offered by the Department of Computer Science for the fulfillment of the curriculum requirements of the degree of BEng in Computer Science that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (60 credits), comprising 24 credits of introductory core courses and 36 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 30 credits of discipline elective courses offered by the Department of Computer Science.

#### Elective Courses

Students are required to complete 42 credits of elective course(s) offered by either the Department of Computer Science, or other departments within or outside of the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9542 Technical English for computer science”;
- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for engineering students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### Capstone Experience

Students are required to complete the 12-credit “COMP4801 Final year project” to fulfill the capstone experience requirement for the degree of BEng in Computer Science.

#### Internship

Students are required to complete the 6-credit internship “COMP3412 Internship”, which normally takes place after their third year of study.

## Degree Classification

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

**The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Computer Science) comprises 240 credits of courses with the following structure:

### UG 5 Requirements (54 credits)

| Course Code                       | Course                                     | No. of credits |
|-----------------------------------|--|----------------|
| CAES1000                          | Core University English                    | 6              |
| CAES9542                          | Technical English for computer science     | 6              |
| CENG9001                          | Practical Chinese for engineering students | 6              |
| CC##XXXX                          | University Common Core Course (6 courses)* | 36             |
| <b>Total for UG5 Requirements</b> |  | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

### General Engineering Courses (36 credits)

| Course Code                                  | Course   | No. of credits |
|--|--|----------------|
| MATH1851                                     | Calculus and ordinary differential equations   | 6              |
| MATH1853                                     | Linear algebra, probability and statistics   | 6              |
| ENGG1111                                     | Computer programming and applications  | 6              |
| PHYS1050                                     | Physics for engineering students   | 6              |
| ENGG1202                                     | Introduction to computer science   | 6              |
| ENGG120X                                     | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering* | 6              |
| <b>Total for General Engineering Courses</b> |  | <b>36</b>      |

\*Choose one General Engineering Course from the following list:

|          |   |
|----------|---|
| ENGG1201 | Engineering for sustainable development               |
| ENGG1203 | Introduction to electrical and electronic engineering |
| ENGG1204 | Industrial management and logistics                   |
| ENGG1205 | Introduction to mechanical engineering                |
| ENGG1206 | Introduction to biomedical engineering                |
| ENGG1207 | Foundation of biochemistry for medical engineering    |

### Discipline Core Courses (60 credits)

#### *Introductory Courses (24 credits)*

| Course Code   | Course   | No. of credits |
|---|--|----------------|
| COMP2119  | Introduction to data structures and algorithms | 6              |
| COMP2120  | Computer organization                          | 6              |
| COMP2121  | Discrete mathematics                           | 6              |
| COMP2123  | Programming technologies and tools             | 6              |
| <b>Total for Introductory Discipline Core Courses</b> |  | <b>24</b>      |

**Advanced Courses (36 credits)**

| <b>Course Code</b>                                | <b>Course</b>                               | <b>No. of credits</b> |
|---|---|-----------------------|
| COMP3230  | Principles of operation systems             | 6                     |
| COMP3234  | Computer and communication networks         | 6                     |
| COMP3250  | Design and analysis of algorithms           | 6                     |
| COMP3278  | Introduction to database management systems | 6                     |
| COMP3297  | Introduction to software engineering        | 6                     |
| COMP3311  | Legal aspects of computing                  | 6                     |
| <b>Total for Advanced Discipline Core Courses</b> |   | <b>36</b>             |

**Capstone Experience and Internship (18 credits)**

| <b>Course Code</b>                                  | <b>Course</b>                   | <b>No. of credits</b> |
|---|---------------------------------|-----------------------|
| COMP4801  | Final year project <sup>+</sup> | 12                    |
| COMP3412  | Internship*                     | 6                     |
| <b>Total for Capstone Experience and Internship</b> |                                 | <b>18</b>             |

+Capstone Experience

\*Training

\*Students who are selected to participate in the Undergraduate Research Fellowship Programme are required to complete COMP3413 Research internship and are not required to complete COMP3412 Internship.

**Discipline Elective Courses (30 credits)**

| <b>Course Code</b>  | <b>Course</b>   | <b>No. of credits</b> |
|---|---|-----------------------|
| COMP2396  | Object-oriented programming and Java                        | 6                     |
| COMP3231  | Computer architecture                                       | 6                     |
| COMP3235  | Compiling techniques  | 6                     |
| COMP3258  | Functional programming                                      | 6                     |
| COMP3259  | Principles of programming languages                         | 6                     |
| COMP3270  | Artificial intelligence                                     | 6                     |
| COMP3271  | Computer graphics   | 6                     |
| COMP3314  | Machine learning  | 6                     |
| COMP3315  | Multimedia computing and applications                       | 6                     |
| COMP3317  | Computer vision   | 6                     |
| COMP3320  | Electronic commerce technology                              | 6                     |
| COMP3322  | Modern technologies on World Wide Web                       | 6                     |
| COMP3323  | Advanced database systems                                   | 6                     |
| COMP3327  | Computer and network security                               | 6                     |
| COMP3328  | Wireless and mobile communication                           | 6                     |
| COMP3329  | Computer game design and programming                        | 6                     |
| COMP3330  | Interactive mobile application design and programming       | 6                     |
| COMP3351  | Advanced algorithm analysis                                 | 6                     |
| COMP3402  | System architecture and distributed computing               | 6                     |
| COMP3403  | Implementation, testing and maintenance of software systems | 6                     |
| COMP3404  | Software quality and project management                     | 6                     |
| COMP3407  | Scientific computing  | 6                     |
| COMP3413  | Research internship   | 6                     |
| <b>Complete at least five discipline elective courses for a total of 30 credits</b> |   | <b>30</b>             |

### Elective Courses (42 credits)

At least 42 credits of courses offered by either the Department of Computer Science, or other departments within or outside of the Faculty of Engineering.

### Summary of curriculum structure of BEng (Computer Science)

| Course Categories                      | No. of credits |
|--|----------------|
| UG5 Requirements                       | 54             |
| General Engineering Courses            | 36             |
| Discipline Core Courses (Introductory) | 24             |
| Discipline Core Courses (Advanced)     | 36             |
| Capstone Experience and Internship     | 18             |
| Discipline elective Courses            | 30             |
| Elective Courses                       | 42             |
| <b>Total</b>                           | <b>240</b>     |

The proposed syllabus by study year is as follows:

### FIRST YEAR

#### General Engineering Courses (36 credits)

|          |   |
|----------|---|
| MATH1851 | Calculus and ordinary differential equations  |
| MATH1853 | Linear algebra, probability and statistics  |
| ENGG1111 | Computer programming and applications   |
| PHYS1050 | Physics for engineering students  |
| ENGG1202 | Introduction to computer science  |
| ENGG120X | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering |

#### University Requirements (UG5) (24 credits)

|          |                           |
|----------|---------------------------|
| CAES1000 | Core University English   |
| CC##XXXX | Three Common Core Courses |

### SECOND YEAR

#### Introductory Core Courses (24 credits)

|          |  |
|----------|--|
| COMP2119 | Introduction to data structures and algorithms |
| COMP2120 | Computer organization                          |
| COMP2121 | Discrete mathematics                           |
| COMP2123 | Programming technologies and tools             |

#### Discipline Elective Courses (6 credits)

#### Elective Courses (12 credits)

#### University Requirements (UG5) (18 credits)

|          |                           |
|----------|---------------------------|
| CC##XXXX | Three Common Core Courses |
|----------|---------------------------|

## **THIRD YEAR**

### **Advanced Core Courses (36 credits)**

|          |   |
|----------|---|
| COMP3230 | Principles of operation systems             |
| COMP3234 | Computer and communication networks         |
| COMP3250 | Design and analysis of algorithms           |
| COMP3278 | Introduction to database management systems |
| COMP3297 | Introduction to software engineering        |
| COMP3311 | Legal aspects of computing                  |

### **Internship (6 credits)**

|          |            |
|----------|------------|
| COMP3412 | Internship |
|----------|------------|

### **University Requirements (UG5) (6 credits)**

|          |  |
|----------|--|
| CENG9001 | Practical Chinese for engineering students |
|----------|--|

### **Discipline Elective Courses (12 credits)**

### **Elective Courses (6 credits)**

## **FOURTH YEAR**

### **Discipline Elective Courses (12 credits)**

### **Capstone Experience (12 credits)**

|          |                    |
|----------|--------------------|
| COMP4801 | Final year project |
|----------|--------------------|

### **University Requirements (UG5) (6 credits in total)**

|          |  |
|----------|--|
| CAES9542 | Technical English for computer science |
|----------|--|

### **Elective Courses (24 credits)**

**MAJOR IN COMPUTER SCIENCE**  
(for non-BEng(CompSc) students)

The curriculum comprises 84 credits of courses with the following structure:

**Prerequisite:** Level 3 or above in Mathematics in the Hong Kong Diploma of Secondary Education (HKDSE) Examination

**Introductory Courses (30 credits)**

| Course Code                           | Course   | No. of credits |
|---------------------------------------|--|----------------|
| COMP1117                              | Computer programming                           | 6              |
| COMP2119                              | Introduction to data structures and algorithms | 6              |
| COMP2120                              | Computer organization                          | 6              |
| COMP2121                              | Discrete mathematics                           | 6              |
| COMP2123                              | Programming technologies and tools             | 6              |
| <b>Total for Introductory Courses</b> |  | <b>30</b>      |

**Advanced Courses (48 credits)**

| Course Code | Course   | No. of credits |
|-------------|--|----------------|
|             | 12 credits of courses to be chosen from the following list:          | 12             |
| COMP3230    | Principles of operating systems                                      | 6              |
| COMP3234    | Computer and communication networks                                  | 6              |
| COMP3278    | Introduction to database management systems                          | 6              |
| COMP3297    | Introduction to software engineering                                 | 6              |
|             | 36 credits of elective courses to be chosen from the following list: | 36             |
| COMP3230    | Principles of operating systems                                      | 6              |
| COMP3234    | Computer and communication networks                                  | 6              |
| COMP3278    | Introduction to database management systems                          | 6              |
| COMP3297    | Introduction to software engineering                                 | 6              |
| COMP2396    | Object-oriented programming and Java                                 | 6              |
| COMP3231    | Computer architecture  | 6              |
| COMP3235    | Compiling techniques   | 6              |
| COMP3250    | Design and analysis of algorithms                                    | 6              |
| COMP3258    | Functional programming   | 6              |
| COMP3259    | Principles of programming languages                                  | 6              |
| COMP3270    | Artificial intelligence  | 6              |
| COMP3271    | Computer graphics  | 6              |
| COMP3311    | Legal aspects of computing   | 6              |
| COMP3314    | Machine learning   | 6              |
| COMP3315    | Multimedia computing and applications                                | 6              |
| COMP3317    | Computer vision  | 6              |
| COMP3320    | Electronic commerce technology                                       | 6              |
| COMP3322    | Modern technologies on World Wide Web                                | 6              |
| COMP3323    | Advanced database systems  | 6              |
| COMP3327    | Computer and network security  | 6              |
| COMP3328    | Wireless and mobile communication                                    | 6              |
| COMP3329    | Computer game design and programming                                 | 6              |
| COMP3330    | Interactive mobile application design and programming                | 6              |



|                                   |   |           |
|-----------------------------------|---|-----------|
| COMP3351                          | Advanced algorithm analysis                                 | 6         |
| COMP3402                          | System architecture and distributed computing               | 6         |
| COMP3403                          | Implementation, testing and maintenance of software systems | 6         |
| COMP3404                          | Software quality and project management                     | 6         |
| COMP3407                          | Scientific computing  | 6         |
| <b>Total for Advanced Courses</b> |   | <b>48</b> |

### Capstone Experience (6 credits)

| Course Code                          | Course  | No. of credits |
|--------------------------------------|---------|----------------|
| COMP4805                             | Project | 6              |
| <b>Total for Capstone Experience</b> |         | <b>6</b>       |

Note 1 Students whose first major is Mathematics may be granted waiver of COMP2121, upon application, on the condition that students are required to complete one more elective in Computer Science as replacement. Students who have completed MATH2600 Discrete mathematics are deemed to have completed COMP2121, they are not permitted to take COMP2121 and are required to complete one more elective in Computer Science.

Note 2 Course enrollment in elective courses is subject to the approval of the Department of Computer Science, in consideration of class quota and other academic issues.

## MINOR IN COMPUTER SCIENCE

(This minor option is not available for BEng(CE) and BEng(CompSc) students)

The curriculum comprises 42 credits of courses with the following structure:

**Prerequisite:** Level 3 or above in Mathematics in the Hong Kong Diploma of Secondary Education (HKDSE) Examination

### Introductory Courses (18 credits)

| Course Code                           | Course   | No. of credits |
|---------------------------------------|--|----------------|
| COMP1117                              | Computer programming                           | 6              |
| COMP2119                              | Introduction to data structures and algorithms | 6              |
| COMP2123                              | Programming technologies and tools             | 6              |
| <b>Total for Introductory Courses</b> |  | <b>18</b>      |

### Advanced Courses (24 credits)

| Course Code | Course  | No. of credits |
|-------------|---|----------------|
|             | 24 credits of courses to be chosen from the following list: | 24             |
| COMP2120    | Computer organization                                       | 6              |
| COMP2121    | Discrete mathematics  | 6              |
| COMP2396    | Object-oriented programming and Java                        | 6              |
| COMP3230    | Principles of operation systems                             | 6              |
| COMP3231    | Computer architecture                                       | 6              |
| COMP3234    | Computer and communication networks                         | 6              |
| COMP3235    | Compiling techniques  | 6              |
| COMP3250    | Design and analysis of algorithms                           | 6              |
| COMP3258    | Functional programming                                      | 6              |

|                                   |   |           |
|-----------------------------------|---|-----------|
| COMP3259                          | Principles of programming languages                         | 6         |
| COMP3270                          | Artificial intelligence                                     | 6         |
| COMP3271                          | Computer graphics   | 6         |
| COMP3278                          | Introduction to database management systems                 | 6         |
| COMP3297                          | Introduction to software engineering                        | 6         |
| COMP3311                          | Legal aspects of computing                                  | 6         |
| COMP3314                          | Machine learning  | 6         |
| COMP3315                          | Multimedia computing and applications                       | 6         |
| COMP3317                          | Computer vision   | 6         |
| COMP3320                          | Electronic commerce technology                              | 6         |
| COMP3322                          | Modern technologies on World Wide Web                       | 6         |
| COMP3323                          | Advanced database systems                                   | 6         |
| COMP3327                          | Computer and network security                               | 6         |
| COMP3328                          | Wireless and mobile communication                           | 6         |
| COMP3329                          | Computer game design and programming                        | 6         |
| COMP3330                          | Interactive mobile application design and programming       | 6         |
| COMP3351                          | Advanced algorithm analysis                                 | 6         |
| COMP3402                          | System architecture and distributed computing               | 6         |
| COMP3403                          | Implementation, testing and maintenance of software systems | 6         |
| COMP3404                          | Software quality and project management                     | 6         |
| COMP3407                          | Scientific computing  | 6         |
| <b>Total for Advanced Courses</b> |   | <b>24</b> |

Note 1      BEng students who have completed ENGG1111 Computer programming and applications are deemed to have completed COMP1117 Computer programming, and they are required to complete one more elective in Computer Science as replacement (i.e. a total of 30 credits).

Note 2      Course enrollment in elective courses is subject to the approval of the Department of Computer Science, in consideration of class quota and other academic issues.

## COURSE DESCRIPTIONS

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

### General Engineering Courses

|          |   |
|----------|---|
| ENGG1111 | Computer programming (6 credits) or                               |
| ENGG1112 | Computer programming I (6 credits)                                |
| MATH1851 | Calculus and ordinary differential equations (6 credits)          |
| MATH1853 | Linear algebra, probability and statistics (6 credits)            |
| PHYS1050 | Physics for engineering students (6 credits)                      |
| ENGG1201 | Engineering for sustainable development (6 credits)               |
| ENGG1202 | Foundation of computer science (6 credits)                        |
| ENGG1203 | Introduction to electrical and electronic engineering (6 credits) |
| ENGG1204 | Industrial management and logistics (6 credits)                   |
| ENGG1205 | Introduction to mechanical engineering (6 credits)                |
| ENGG1206 | Introduction to biomedical engineering (6 credits)                |
| ENGG1207 | Foundation of biochemistry for medical engineering                |

Please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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### **University Requirements on Language Enhancement Courses**

**CAES1000. Core University English (6 credits)**

**CENG9001. Practical Chinese for engineering students (6 credits)**

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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**CAES9542. Technical English for computer science (6 credits)**

Running alongside Computer Science project based courses, this one semester, 6-credit course will build and consolidate final year CS and Computing and data analytics students' ability to compose technical reports, and make technical oral presentations. The focus of this course is on helping students to report on the progress of their Final Year Project in an effective, professional manner in both written and oral communication. Topics include accessing, abstracting, analyzing, organizing and summarizing information; making effective grammatical and lexical choices; technical report writing; and technical presentations. Assessment is wholly by coursework.

Co-requisite: COMP4801 or COMP4804

Assessment: 100% continuous assessment.

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### **University Common Core Curriculum**

36 credits of courses in the University Common Core Curriculum, in which students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study:

- Scientific and Technology Literacy
  - Humanities
  - Global Issues
  - China: Culture, State and Society
- 

*Courses with prefix CSISxxxx are offered to students admitted to the 3-year curriculum in 2012/13 and before, courses with prefix COMPxxxx are offered to students admitted to the 4-year curriculum in 2012/13 and thereafter.*

**COMP1117 Computer programming (6 credits)**

This course covers both the basic and advanced features of the C/C++ programming languages, including syntax, identifiers, data types, control statements, functions, arrays, file access, objects and classes, class string, structures and pointers. It introduces programming techniques such as recursion, linked lists and dynamic data structures. The concept and skills of program design, implementation and debugging, with emphasis on problem-solving, will also be covered.

Assessment: 50% continuous assessment, 50% examination

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### **COMP2121. Discrete mathematics (6 credits)**

This course provides students a solid background on discrete mathematics and structures pertinent to computer science. Topics include logic; set theory; mathematical reasoning; counting techniques; discrete probability; trees, graphs, and related algorithms; modeling computation.

Assessment: 50% continuous assessment, 50% examination

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### **COMP2119. Introduction to data structures and algorithms (6 credits)**

Arrays, linked lists, trees and graphs; stacks and queues; symbol tables; priority queues, balanced trees; sorting algorithms; complexity analysis.

Prerequisite: CSIS1117 or COMP1117 or ENGG1002 or ENGG1111 or ENGG1112

Pre-/Co-requisite: CSIS1122 or CSIS1123 or COMP2123

Assessment: 40% continuous assessment, 60% examination

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### **COMP2120. Computer organization (6 credits)**

Introduction to computer organization and architecture; data representations; instruction sets; machine and assembly languages; basic logic design and integrated devices; the central processing unit and its control; memory and caches; I/O and storage systems; computer arithmetic.

Co-requisite: CSIS1117 or COMP1117 or ENGG1002 or ENGG1111 or ENGG1112

Assessment: 50% continuous assessment, 50% examination

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### **COMP2123. Programming technologies and tools (6 credits)**

This course introduces various technologies and tools that are useful for software development, including Linux, C++ STL, the C language, shell scripts, python and xml. Learning materials will be provided but there will be no lecture. This strengthens the self-learning ability of the students.

Prerequisite: CSIS1117 or COMP1117 or ENGG1002 or ENGG1111 or ENGG1112

Assessment: 50% continuous assessment, 50% examination

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### **COMP2396. Object-oriented programming and Java (6 credits)**

Introduction to object-oriented programming; abstract data types and classes; inheritance and polymorphism; object-oriented program design; Java language and its program development environment; user interfaces and GUI programming; collection class and iteration protocol; program documentation.

Prerequisite: CSIS1117 or COMP1117 or ENGG1002 or ENGG1111 or ENGG1112

Assessment: 50% continuous assessment, 50% examination

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### **COMP3230. Principles of operating systems (6 credits)**

Operating system structures, process and thread, CPU scheduling, process synchronization, deadlocks, memory management, file systems, I/O systems and device driver, mass-storage structure and disk

scheduling, case studies.

Prerequisites: CSIS1122 or CSIS1123 or COMP2123 and CSIS1120 or COMP2120 or ELEC1401 or ELEC2441

Assessment: 50% continuous assessment, 50% examination

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### **COMP3231. Computer architecture (6 credits)**

Introduction to computer design process; performance and cost analysis; instruction set design; data-path and controller design; pipelining; memory system; I/O design; introduction to advanced topics.

Prerequisite: CSIS1120 or COMP2120

Assessment: 40% continuous assessment, 60% examination

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### **COMP3234. Computer and communication networks (6 credits)**

Network structure and architecture; reference models; stop and wait protocol; sliding window protocols; character and bit oriented protocols; virtual circuits and datagrams; routing; flow control; congestion control; local area networks; issues and principles of network interconnection; transport protocols and application layer; and examples of network protocols.

Prerequisite: CSIS1120 or COMP2120 or ELEC1401 or ELEC2441

Assessment: 50% continuous assessment, 50% examination

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### **COMP3235. Compiling techniques (6 credits)**

Lexical analysis; symbol table management; parsing techniques; error detection; error recovery; error diagnostics; run-time memory management; optimization; code generation.

Prerequisite: CSIS1119 or COMP2119; and CSIS1122 or CSIS1123 or COMP2123

Assessment: 50% continuous assessment, 50% examination

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### **COMP3250. Design and analysis of algorithms (6 credits)**

The course studies various algorithm design techniques, such as divide and conquer, and dynamic programming. These techniques are applied to design highly non-trivial algorithms from various areas of computer science. Topics include: advanced data structures; graph algorithms; searching algorithms; geometric algorithms; overview of NP-complete problems.

Prerequisite: CSIS1119 or COMP2119 or ELEC1502 or ELEC1503 or ELEC2543

Assessment: 50% continuous assessment, 50% examination

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### **COMP3258. Functional programming (6 credits)**

The course teaches the basics of functional programming using the language Haskell. The main goal is introduce students to fundamental programming concepts such as recursion, abstraction, lambda expressions and higher-order functions and data types. The course will also study the mathematical reasoning involved in the design of functional programs and techniques for proving properties about functions so defined. With the adoption of lambda expressions recent versions of Java, C++ or C#,

functional programming and related programming techniques are becoming increasingly more relevant even for programmers of languages that are not traditionally viewed as functional. This course is important to introduce students to such techniques.

Prerequisite: CSIS1118 or CSIS1121 or COMP2121

Assessment: 50% continuous assessment, 50% examination

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### **COMP3259. Principles of programming languages (6 credits)**

Syntax and semantics specification; data types; data control and memory management; expressions, precedence and associativity of operators; control structures; comparative study of existing programming languages; advanced topics such as polymorphism, programming paradigms, exception handling and concurrency.

Prerequisites: CSIS1119 or COMP2119; and CSIS1120 or COMP2120 or ELEC1401 or ELEC2441

Assessment: 40% continuous assessment, 60% examination

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### **COMP3270. Artificial intelligence (6 credits)**

This is an introduction course on the subject of artificial intelligence. Topics include: intelligent agents; search techniques for problem solving; knowledge representation; logical inference; reasoning under uncertainty; statistical models and machine learning. This course may not be taken with BUSI0088.

Prerequisite: CSIS1119 or COMP2119 or CSIS1122 or CSIS1123 or COMP2123

Assessment: 50% continuous assessment, 50% examination

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### **COMP3271. Computer graphics (6 credits)**

Overview of graphics hardware, basic drawing algorithms, 2-D transformations, windowing and clipping, interactive input devices, curves and surfaces, 3-D transformations and viewing, hidden-surface and hidden-line removal, shading and colour models, modelling, illumination models, image synthesis, computer animation.

Prerequisite: CSIS1119 or COMP2119 or CSIS1122 or CSIS1123 or COMP2123

Assessment: 50% continuous assessment, 50% examination

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### **COMP3278. Introduction to database management systems (6 credits)**

This course studies the principles, design, administration, and implementation of database management systems. Topics include: entity-relationship model, relational model, relational algebra, database design and normalization, database query languages, indexing schemes, integrity and concurrency control. This course may not be taken with BUSI0052.

Prerequisite: CSIS1119 or COMP2119 or ELEC1502 or ELEC1503 or ELEC2543

Assessment: 50% continuous assessment, 50% examination

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### **COMP3297. Introduction to software engineering (6 credits)**

This course introduces the fundamental principles and methodologies of software engineering. It covers the software process and methods and tools employed in the development of modern systems. The use of CASE tools and the UML are emphasized. The course includes a team-based project in which students apply their new knowledge to a full development lifecycle, including maintenance.

Prerequisite: CSIS1122 or CSIS1123 or COMP2123

Assessment: 50% continuous assessment, 50% examination

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### **COMP3311. Legal aspects of computing (6 credits)**

To introduce students to the laws affecting computing and the legal issues arising from the technology. Contents include: the legal system of Hong Kong; copyright protection for computer programs; intellectual property issues on the Internet; data privacy; computer-related crimes; codes of professional conduct for computer professionals.

Prerequisite: CSIS1122 or CSIS1123 or COMP2123

Assessment: 40% continuous assessment, 60% examination

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### **COMP3314. Machine learning (6 credits)**

An introduction to algorithms and applications of machine learning. Topics include: decision theory; parametric models; supervised learning (classification and regression); unsupervised learning (clustering, mixture models, principal component analysis); Bayesian methods.

Prerequisite: MATH1853; and CSIS1119 or COMP2119 or ELEC1502 or ELEC1503 or ELEC2543

Assessment: 50% continuous assessment, 50% examination

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### **COMP3315. Multimedia computing and applications (6 credits)**

This course introduces various aspects of the interdisciplinary and multidisciplinary field of multimedia computing. Current developments of technologies and techniques in multimedia will also be covered. Applications of multimedia techniques are also highlighted through a media production course project. Major topics include: what are media, audio, acoustics and psychoacoustics, MIDI, basic compression techniques, video compression techniques, standards, and current multimedia technologies. This course may not be taken with BUSI0068.

Prerequisite: CSIS1119 or COMP2119

Assessment: 50% continuous assessment, 50% examination

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### **COMP3317. Computer vision (6 credits)**

This course introduces the principles, mathematical models and applications of computer vision. Topics include: image processing techniques, feature extraction techniques, imaging models and camera calibration techniques, stereo vision, and motion analysis.

Prerequisite: CSIS1119 or COMP2119 or ELEC1502 or ELEC1503 or ELEC2543

Assessment: 50% continuous assessment, 50% examination

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### **COMP3320. Electronic commerce technology (6 credits)**

This course aims to help students to understand the technical and managerial challenges they will face as electronic commerce becomes a new locus of economics activities. Topics include Internet and WWW technology, information security technologies, public-key crypto-systems, public-key infrastructure, electronic payment systems, and electronic commerce activities in different sectors.

Prerequisite: CSIS0278 or COMP3278

Assessment: 30% continuous assessment, 70% examination

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### **COMP3322. Modern technologies on World Wide Web (6 credits)**

Basics on Internet and network protocols (TCP and IP); Internet applications; Domain Name System; World Wide Web; Web addressing; HTTP; HTML, XML, style sheets, etc.; programming the Web: PHP, JavaScript, etc.; other topics of current interest (AJAX, HTML5, web services, cloud computing). This course may not be taken with BUSI0063.

Prerequisite: CSIS1117 or COMP1117 or ENGG1002 or ENGG1111 or ENGG1112

Assessment: 50% continuous assessment, 50% examination

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### **COMP3323. Advanced database systems (6 credits)**

The course will study some advanced topics and techniques in database systems, with a focus on the system and algorithmic aspects. It will also survey the recent development and progress in selected areas. Topics include: query optimization, spatial-spatiotemporal data management, multimedia and time-series data management, information retrieval and XML, data mining.

Prerequisite: CSIS0278 or COMP3278

Assessment: 50% continuous assessment, 50% examination

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### **COMP3327. Computer and network security (6 credits)**

This course introduces the principles, mechanisms and implementation of computer security and data protection. Knowledge about the attack and defend are included. Topics include notion and terms of information security; introduction to encryption: classic and modern encryption technologies include public-key systems; authentication methods; access control methods; system integrity attacks and defences (e.g. viruses); introduction to network/Internet security; analysis and models of secure systems.

Pre-requisites: CSIS0230 or COMP3230; and CSIS0234 or COMP3234

Assessment: 30% continuous assessment, 70% examination

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### **COMP3328. Wireless and mobile communication (6 credits)**

This course introduces the basic principles and technologies in various mobile and wireless communication systems. Topics include mobile communication environment; digital modulation; channel coding; medium access technologies; cellular mobile radio systems; wireless LANs; security in wireless systems; internetworking in wireless systems; mobility applications.

Prerequisite: CSIS0234 or COMP3234; and CSIS0396 or COMP2396



Assessment: 50% continuous assessment, 50% examination

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### **COMP3329. Computer game design and programming (6 credits)**

The course will study practical topics in game design. Topics includes: types of game, game platforms, design of game, 3D model and kinematics, rendering techniques, collision detection, project management, AI, UI, sound effects, and networking.

Pre-requisite: CSIS1119 or COMP2119

Assessment: 50% continuous assessment, 50% examination

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### **COMP3351. Advanced algorithm analysis (6 credits)**

This class introduces advanced mathematical techniques for analyzing the complexity and correctness of algorithms. NP-complete problems are believed to be not solvable in polynomial time and we study how approximation algorithms could give near optimal solutions. In particular, we will see that probability theory gives us a very powerful tool to tackle problems that are otherwise hard to solve.

Prerequisite: CSIS0250 or COMP3250; or basic knowledge in probability and algorithms

Assessment: 50% continuous assessment, 50% examination

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### **COMP3402. System architecture and distributed computing (6 credits)**

This course introduces the architecture of modern systems and the concepts and principles of distributed computing. Topics include: client-server computing, multi-tier architectures, data/object persistence, parallel server systems, naming services, transaction processing, middleware and messaging, component technologies, and web services/APIs.

Prerequisite: CSIS0396 or COMP2396

Assessment: 50% continuous assessment, 50% examination

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### **COMP3403. Implementation, testing and maintenance of software systems (6 credits)**

This course examines the theory and practice of software implementation, testing and maintenance. Topics in implementation include: detailed design issues and implementation strategies; coding style and standards; the review process; quality metrics; pattern implementation and reuse. Testing covers strategies and techniques for unit and component testing; integration testing; system, performance and acceptance testing; test documentation and test management. Topics in maintenance include maintenance techniques, tools and metrics; software rejuvenation; and refactoring.

Pre/Co-requisite: CSIS0396 or COMP2396

Assessment: 50% continuous assessment, 50% examination

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### **COMP3404. Software quality and project management (6 credits)**

Topics in software quality include: software quality models; quality assurance; software quality metrics; quality reviews, inspections and audits. Topics in project management include: project planning, cost estimation and scheduling; project monitoring and control; agile, traditional and extreme process models and their management; risk analysis; configuration management and control; software

acquisition; contract management; and process improvement. This course may not be taken with BUSI0060 or BUSI0061.

Prerequisite: CSIS0297 or COMP3297

Assessment: 40% continuous assessment, 60% examination

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### **COMP3407. Scientific computing (6 credits)**

This course provides an overview and covers the fundamentals of scientific and numerical computing. Topics include numerical analysis and computation, symbolic computation, scientific visualization, architectures for scientific computing, and applications of scientific computing.

Prerequisites: CSIS1117 or COMP1117 or ENGG1002 or ENGG1111 or ENGG1112; and CSIS1118 or ENGG1007 or COMP2121

Assessment: 50% continuous assessment, 50% examination

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### **COMP3330. Interactive mobile application design and programming (6 credits)**

This course introduces the Android platform for developing interactive mobile applications. Topics include user interface, parallel computing, graphics, multimedia, sensors, database, and social computing. Students participate in both individual assignments and group projects to practice ideation, reading, writing, coding, and presentation.

Prerequisite: CSIS1117 or COMP1117 or ENGG1002 or ENGG1111 or ENGG1112 or CSIS0396 or COMP2396

Assessment: Assessment: 50% continuous assessment, 50% examination

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### **COMP3412 Internship (6 credits) *[for intakes of 2012 and thereafter (4-year curriculum)]***

The course consists of two components: internship and professionalism. Internship requires students to spend a minimum of four weeks employed, full-time, as IT interns or trainees. During this period, they are engaged in work of direct relevance to their programme of study. The Internship provides students with practical, real-world experience and represents a valuable complement to their academic training. Professionalism exposes students to social and professional issues in computing. Students need to understand their professional roles when working as computer professionals as well as the responsibility that they will bear. They also need to develop the ability to ask serious questions about the social impact of computing and to evaluate proposed answers to those questions. Topics include social context of computing, risks, safety and security concerns for computer professionals, professional and ethical responsibilities, and continuing professional development.

Assessment: 100% continuous assessment

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### **COMP3413. Research internship (6 credits)**

The student will participate in a research project under the guidance and supervision of a teacher over a prescribed period of time; the results will be presented in an oral and a written report.

Assessment: 100% continuous assessment

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### **COMP4801. Final year project (12 credits)**

Student individuals or groups, during the final year of their studies, undertake full end-to-end development of a substantial project, taking it from initial concept through to final delivery. Topics range from applied software development to assignments on basic research. In case of a team project, significant contribution is required from each member and students are assessed individually, such that each student is given a separate project title. Strict standards of quality will be enforced throughout the project development.

Assessment: 100% continuous assessment

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### **COMP4804 Computing and data analytics project (6-credits)** *[for candidates pursuing the degree BEng(EngSc) – Computing and Data Analytics]*

Students during the final year of their studies undertake a substantial project, taking it from initial concept through to final delivery, and integrating their knowledge and skills on computing and data analytics.

Assessment: 100% continuous assessment

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### **COMP4805 Project (6-credits)** *[for non-BEng(CompSc) candidates pursuing Computer Science as second major]*

Students during the final year of their studies undertake a substantial project, taking it from initial concept through to final delivery, and integrating their knowledge and skills on computing.

Assessment: 100% continuous assessment

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*Candidates may take up to two MSc(CompSc) courses as electives, subject to the approval of the Head of Department. An MSc(CompSc) course is equivalent to a 6-credit course, by undertaking additional workload than an MSc(CompSc) student in the course concerned.*

# COMPUTER ENGINEERING

## SYLLABUS

The syllabus applies to students admitted in the academic year 2014-15 under the four-year curriculum.

### Definition and Terminology

Each course offered by the Departments of Electrical and Electronic Engineering and Computer Science shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Departments of Electrical and Electronic Engineering or Computer Science for the fulfillment of the curriculum requirements of the degree of BEng in Computer Engineering that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (84 credits), comprising 42 credits of introductory core courses and 42 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 30 credits of discipline elective courses offered by the Department of Electrical and Electronic Engineering and the Department of Computer Science.

#### Elective Courses

Students are required to complete 18 credits of elective courses offered by either the Departments of Electrical and Electronic Engineering and Computer Science, or other departments within or outside of the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9541 Technical English for Electrical and Electronic Engineering”;
- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for Engineering Students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### Capstone Experience

Students are required to complete the 12-credit “ELEC4848 Senior design project” to fulfill the capstone experience requirement for the degree of BEng in Computer Engineering.

### Internship

Students are required to complete the 6-credit internship “ELEC3840 Internship”, which normally takes place after their third year of study.

### **Degree Classification**

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

### **The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Computer Engineering) comprises 240 credits of courses with the following structure:

#### **UG 5 Requirements (54 credits)**

| Course Code                       | Course  | No. of credits |
|-----------------------------------|---|----------------|
| CAES1000                          | Core University English                                     | 6              |
| CAES9541                          | Technical English for Electrical and Electronic Engineering | 6              |
| CENG9001                          | Practical Chinese for Engineering Students                  | 6              |
| CC##XXXX                          | University Common Core Course (6 courses)*                  | 36             |
| <b>Total for UG5 Requirements</b> |   | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### **General Engineering Courses (36 credits)**

| Course Code                                  | Course  | No. of credits |
|--|---|----------------|
| MATH1851                                     | Calculus and Ordinary Differential Equations          | 6              |
| MATH1853                                     | Linear Algebra, Probability & Statistics              | 6              |
| ENGG1111                                     | Computer Programming and Applications                 | 6              |
| PHYS1050                                     | Physics for engineering students                      | 6              |
| ENGG1202                                     | Introduction to Computer Science                      | 6              |
| ENGG1203                                     | Introduction to Electrical and Electronic Engineering | 6              |
| <b>Total for General Engineering Courses</b> |   | <b>36</b>      |

#### **Discipline Core Courses (90 credits)**

##### **Introductory Courses (42 credits)**

| Course Code   | Course  | No. of credits |
|---|---|----------------|
| COMP2119  | Introduction to Data Structures and Algorithms  | 6              |
| COMP2121  | Discrete Mathematics  | 6              |
| COMP2123  | Programming Technologies and Tools  | 6              |
| ELEC2346  | Electric circuit theory   | 6              |
| ELEC2441  | Computer organization and microprocessors   | 6              |
| ELEC2840  | Engineering training  | 6              |
| MECH2407 or<br>COMP3250                               | Multivariable calculus and partial differential equations or<br>Design and analysis of algorithms | 6              |
| <b>Total for Introductory Discipline Core Courses</b> |   | <b>42</b>      |

**Advanced Courses (42 credits)**

| Course Code                                       | Course                                       | No. of credits |
|---|--|----------------|
| COMP3230  | Principles of Operating Systems              | 6              |
| COMP3234  | Computer and Communication Networks          | 6              |
| COMP3297  | Introduction to Software Engineering         | 6              |
| ELEC3342  | Digital system design                        | 6              |
| ELEC3844  | Engineering management and society           | 6              |
| ELEC3848  | Integrated design project                    | 6              |
| ELEC3441 or<br>ELEC3442                           | Computer architecture or<br>Embedded systems | 6              |
| <b>Total for Advanced Discipline Core Courses</b> |  | <b>42</b>      |

**Capstone Experience and Internship (18 credits)**

| Course Code   | Course                             | No. of credits |
|---|------------------------------------|----------------|
| ELEC4848  | Senior design project <sup>+</sup> | 12             |
| ELEC3840  | Internship*                        | 6              |
| <b>Total for Capstone Experience and Internship</b> |                                    | <b>18</b>      |

+Capstone Experience

\*Training

**Discipline Elective Courses (30 credits)**

| Course Code   | Course  | No. of credits |
|---|---|----------------|
| ELEC####/<br>COMP####   | Elective Courses offered by the Departments of Electrical and Electronic Engineering and Computer Science:<br>a) 12 credits of Advanced Courses from Groups E, J; and<br>b) 18 credits of Courses from Groups A, B, C, D, E, I, J | 30             |
| <b>Complete at least five discipline elective courses for a total of 30 credits</b> |   | <b>30</b>      |

**Elective Courses (18 credits)**

At least 18 credits of courses offered by either the Departments of Electrical and Electronic Engineering or Computer Science, or other departments within or outside of the Faculty of Engineering.

**Summary of curriculum structure of BEng (Computer Engineering)**

| Course Categories                      | No. of credits |
|--|----------------|
| UG5 Requirements                       | 54             |
| General Engineering Courses            | 36             |
| Discipline Core Courses (Introductory) | 42             |
| Discipline Core Courses (Advanced)     | 42             |
| Capstone Experience and Internship     | 18             |
| Discipline Elective Courses            | 30             |
| Elective Courses                       | 18             |
| <b>Total</b>                           | <b>240</b>     |

The proposed syllabus by study year is as follows:

## **FIRST YEAR**

### **General Engineering Courses (36 credits)**

|          |   |
|----------|---|
| MATH1851 | Calculus and Ordinary Differential Equations          |
| MATH1853 | Linear Algebra, Probability & Statistics              |
| ENGG1111 | Computer Programming and Applications                 |
| PHYS1050 | Physics for engineering students                      |
| ENGG1202 | Introduction to Computer Science                      |
| ENGG1203 | Introduction to Electrical and Electronic Engineering |

### **University Requirements (UG5) (24 credits)**

|          |                           |
|----------|---------------------------|
| CAES1000 | Core University English   |
| CC##XXXX | Three Common Core Courses |

## **SECOND YEAR**

### **Introductory Core Courses (42 credits)**

|                         |   |
|-------------------------|---|
| COMP2119                | Introduction to Data Structures and Algorithms  |
| COMP2121                | Discrete Mathematics  |
| COMP2123                | Programming Technologies and Tools  |
| ELEC2346                | Electric circuit theory   |
| ELEC2441                | Computer organization and microprocessors   |
| ELEC2840                | Engineering training  |
| MECH2407 or<br>COMP3250 | Multivariable calculus and partial differential equations or<br>Design and analysis of algorithms |

### **University Requirements (UG5) (18 credits)**

|          |                           |
|----------|---------------------------|
| CC##XXXX | Three Common Core Courses |
|----------|---------------------------|

## **THIRD YEAR**

### **Advanced Core Courses (42 credits)**

|                         |  |
|-------------------------|--|
| COMP3230                | Principles of Operating Systems              |
| COMP3234                | Computer and Communication Networks          |
| COMP3297                | Introduction to Software Engineering         |
| ELEC3342                | Digital system design                        |
| ELEC3844                | Engineering management and society           |
| ELEC3848                | Integrated design project                    |
| ELEC3441 or<br>ELEC3442 | Computer architecture or<br>Embedded systems |

### **Internship (6 credits)**

|          |            |
|----------|------------|
| ELEC3840 | Internship |
|----------|------------|

### **University Requirements (UG5) (6 credits)**

|          |  |
|----------|--|
| CENG9001 | Practical Chinese for Engineering Students |
|----------|--|

### **Discipline Elective Courses (6 credits)**

## **FOURTH YEAR**

### **Discipline Elective Courses (24 credits)**

**Capstone Experience (12 credits)**

ELEC4848      Senior design project

**University Requirements (UG5) (6 credits)**

CAES9541      Technical English for Electrical and Electronic Engineering

**Elective Courses (18 credits)**

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**ELECTRICAL ENGINEERING****SYLLABUS**

The syllabus applies to students admitted in the academic year 2014-15 and thereafter under the four-year curriculum.

Definition and Terminology

Each course offered by the Department of Electrical and Electronic Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Electrical and Electronic Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Electrical Engineering that are not classified as discipline core course.

**Curriculum**

The Curriculum comprises 240 credits of courses as follows:

General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

Discipline Core Courses

Students are required to complete ALL discipline core courses (72 credits), comprising 36 credits of introductory core courses and 36 credits of advanced core courses.

Discipline Elective Courses

Students are required to complete at least 48 credits of discipline elective courses offered by the Department of Electrical and Electronic Engineering.

Elective Courses

Students are required to complete 12 credits of elective courses offered by either the Department of Electrical and Electronic Engineering, or other departments within or outside of the Faculty of Engineering.

University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9541 Technical English for Electrical and Electronic Engineering”;



- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for Engineering Students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### Capstone Experience

Students are required to complete the 12-credit “ELEC4848 Senior design project” to fulfill the capstone experience requirement for the degree of BEng in Electrical Engineering.

#### Internship

Students are required to complete the 6-credit internship “ELEC3840 Internship”, which normally takes place after their third year of study.

#### **Degree Classification**

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

#### **The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Electrical Engineering) comprises 240 credits of courses with the following structure:

#### **UG 5 Requirements (54 credits)**

| Course Code                       | Course  | No. of credits |
|-----------------------------------|---|----------------|
| CAES1000                          | Core University English                                     | 6              |
| CAES9541                          | Technical English for Electrical and Electronic Engineering | 6              |
| CENG9001                          | Practical Chinese for Engineering Students                  | 6              |
| CC##XXXX                          | University Common Core Course (6 courses)*                  | 36             |
| <b>Total for UG5 Requirements</b> |   | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### **General Engineering Courses (36 credits)**

| Course Code                                  | Course   | No. of credits |
|--|--|----------------|
| MATH1851                                     | Calculus and Ordinary Differential Equations   | 6              |
| MATH1853                                     | Linear Algebra, Probability & Statistics   | 6              |
| ENGG1111                                     | Computer Programming and Applications  | 6              |
| PHYS1050                                     | Physics for engineering students   | 6              |
| ENGG1203                                     | Introduction to Electrical and Electronic Engineering  | 6              |
| ENGG120#                                     | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering* | 6              |
| <b>Total for General Engineering Courses</b> |  | <b>36</b>      |

\*Choose one General Engineering Course from the following list:

- ENGG1201      Engineering for sustainable development
- ENGG1202      Foundation of computer science
- ENGG1204      Industrial management and logistics

|          |  |
|----------|--|
| ENGG1205 | Introduction to mechanical engineering |
| ENGG1206 | Introduction to biomedical engineering |

### **Discipline Core Courses (72 credits)**

#### *Introductory Courses (36 credits)*

| <b>Course Code</b>                                    | <b>Course</b>   | <b>No. of credits</b> |
|---|---|-----------------------|
| ELEC2147  | Electrical energy technology                              | 6                     |
| ELEC2242  | Introduction to electromagnetic waves and fields          | 6                     |
| ELEC2346  | Electric circuit theory                                   | 6                     |
| ELEC2441  | Computer organization and microprocessors                 | 6                     |
| ELEC2840  | Engineering training                                      | 6                     |
| MECH2407  | Multivariable calculus and partial differential equations | 6                     |
| <b>Total for Introductory Discipline Core Courses</b> |   | <b>36</b>             |

#### *Advanced Courses (36 credits)*

| <b>Course Code</b>                                | <b>Course</b>                       | <b>No. of credits</b> |
|---|-------------------------------------|-----------------------|
| ELEC3141  | Power transmission and distribution | 6                     |
| ELEC3142  | Electrical energy conversion        | 6                     |
| ELEC3143  | Power electronics                   | 6                     |
| ELEC3241  | Signal and linear systems           | 6                     |
| ELEC3844  | Engineering management and society  | 6                     |
| ELEC3848  | Integrated design project           | 6                     |
| <b>Total for Advanced Discipline Core Courses</b> |                                     | <b>36</b>             |

### **Capstone Experience and Internship (18 credits)**

| <b>Course Code</b>                                  | <b>Course</b>                      | <b>No. of credits</b> |
|---|------------------------------------|-----------------------|
| ELEC4848  | Senior design project <sup>+</sup> | 12                    |
| ELEC3840  | Internship*                        | 6                     |
| <b>Total for Capstone Experience and Internship</b> |                                    | <b>18</b>             |

+Capstone Experience

\*Training

### **Discipline Elective Courses (48 credits)**

| <b>Course Code</b>   | <b>Course</b>  | <b>No. of credits</b> |
|--|--|-----------------------|
| ELEC####   | Elective Courses offered by the Department of Electrical and Electronic Engineering:<br>a) 24 credits of Courses from Groups A, B, C, D, E, J; and<br>b) 6 credits of Course from Group I; and<br>c) 18 credits of Advanced Courses from Group A | 48                    |
| <b>Complete at least eight discipline elective courses for a total of 48 credits</b> |  | <b>48</b>             |

### **Elective Courses (12 credits)**

At least 12 credits of courses offered by either the Department of Electrical and Electronic Engineering, or other departments within or outside of the Faculty of Engineering.

## Summary of curriculum structure of BEng (Electrical Engineering)

| Course Categories                      | No. of credits |
|--|----------------|
| UG5 Requirements                       | 54             |
| General Engineering Courses            | 36             |
| Discipline Core Courses (Introductory) | 36             |
| Discipline Core Courses (Advanced)     | 36             |
| Capstone Experience and Internship     | 18             |
| Discipline Elective Courses            | 48             |
| Elective Courses                       | 12             |
| <b>Total</b>                           | <b>240</b>     |

The proposed syllabus by study year is as follows:

### FIRST YEAR

#### General Engineering Courses (36 credits)

|          |   |
|----------|---|
| MATH1851 | Calculus and Ordinary Differential Equations  |
| MATH1853 | Linear Algebra, Probability & Statistics  |
| ENGG1111 | Computer Programming and Applications   |
| PHYS1050 | Physics for engineering students  |
| ENGG1203 | Introduction to Electrical and Electronic Engineering   |
| ENGG120X | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering |

#### University Requirements (UG5) (24 credits)

|          |                           |
|----------|---------------------------|
| CAES1000 | Core University English   |
| CC##XXXX | Three Common Core Courses |

### SECOND YEAR

#### Introductory Core Courses (36 credits)

|          |   |
|----------|---|
| ELEC2147 | Electrical energy technology                              |
| ELEC2242 | Introduction to electromagnetic waves and fields          |
| ELEC2346 | Electric circuit theory                                   |
| ELEC2441 | Computer organization and microprocessors                 |
| ELEC2840 | Engineering training                                      |
| MECH2407 | Multivariable calculus and partial differential equations |

#### Advanced Core Courses (6 credits)

|          |                           |
|----------|---------------------------|
| ELEC3241 | Signal and linear systems |
|----------|---------------------------|

#### University Requirements (UG5) (18 credits)

|          |                           |
|----------|---------------------------|
| CC##XXXX | Three Common Core Courses |
|----------|---------------------------|

### THIRD YEAR

#### Advanced Core Courses (30 credits)

|          |                                     |
|----------|-------------------------------------|
| ELEC3141 | Power transmission and distribution |
| ELEC3142 | Electrical energy conversion        |
| ELEC3143 | Power electronics                   |
| ELEC3844 | Engineering management and society  |
| ELEC3848 | Integrated design project           |

**Internship (6 credits)**

ELEC3840 Internship

**University Requirements (UG5) (6 credits)**

CENG9001 Practical Chinese for Engineering Students

**Discipline Elective Courses (18 credits)****FOURTH YEAR****Discipline Elective Courses (30 credits)****Capstone Experience (12 credits)**

ELEC4848 Senior design project

**University Requirements (UG5) (6 credits)**

CAES9541 Technical English for Electrical and Electronic Engineering

**Elective Courses (12 credits)**

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**ELECTRONIC ENGINEERING****SYLLABUS**

The syllabus applies to students admitted in the academic year 2014-15 and thereafter under the four-year curriculum.

Definition and Terminology

Each course offered by the Department of Electrical and Electronic Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Electrical and Electronic Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Electronic Engineering that are not classified as discipline core course.

**Curriculum**

The Curriculum comprises 240 credits of courses as follows:

General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

Discipline Core Courses

Students are required to complete ALL discipline core courses (78 credits), comprising 42 credits of introductory core courses and 36 credits of advanced core courses.

### Discipline Elective Courses

Students are required to complete at least 42 credits of discipline elective courses offered by the Department of Electrical and Electronic Engineering.

### Elective Courses

Students are required to complete 12 credits of elective courses offered by either the Department of Electrical and Electronic Engineering, or other departments within or outside of the Faculty of Engineering.

### University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9541 Technical English for Electrical and Electronic Engineering”;
- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for Engineering Students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

### Capstone Experience

Students are required to complete the 12-credit “ELEC4848 Senior design project” to fulfill the capstone experience requirement for the degree of BEng in Electronic Engineering.

### Internship

Students are required to complete the 6-credit internship “ELEC3840 Internship”, which normally takes place after their third year of study.

### **Degree Classification**

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

### **The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Electronic Engineering) comprises 240 credits of courses with the following structure:

### **UG 5 Requirements (54 credits)**

| Course Code                       | Course  | No. of credits |
|-----------------------------------|---|----------------|
| CAES1000                          | Core University English                                     | 6              |
| CAES9541                          | Technical English for Electrical and Electronic Engineering | 6              |
| CENG9001                          | Practical Chinese for Engineering Students                  | 6              |
| CC##XXXX                          | University Common Core Course (6 courses)*                  | 36             |
| <b>Total for UG5 Requirements</b> |   | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

**General Engineering Courses (36 credits)**

| Course Code                                  | Course   | No. of credits |
|--|--|----------------|
| MATH1851                                     | Calculus and Ordinary Differential Equations   | 6              |
| MATH1853                                     | Linear Algebra, Probability & Statistics   | 6              |
| ENGG1111                                     | Computer Programming and Applications  | 6              |
| PHYS1050                                     | Physics for engineering students   | 6              |
| ENGG1203                                     | Introduction to Electrical and Electronic Engineering  | 6              |
| ENGG120#                                     | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering* | 6              |
| <b>Total for General Engineering Courses</b> |  | <b>36</b>      |

\*Choose one General Engineering Course from the following list:

|          |   |
|----------|---|
| ENGG1201 | Engineering for sustainable development |
| ENGG1202 | Foundation of computer science          |
| ENGG1204 | Industrial management and logistics     |
| ENGG1205 | Introduction to mechanical engineering  |
| ENGG1206 | Introduction to biomedical engineering  |

**Discipline Core Courses (78 credits)****Introductory Courses (42 credits)**

| Course Code   | Course  | No. of credits |
|---|---|----------------|
| ELEC2147  | Electrical energy technology                              | 6              |
| ELEC2242  | Introduction to electromagnetic waves and fields          | 6              |
| ELEC2346  | Electric circuit theory                                   | 6              |
| ELEC2347  | Fundamentals of optics                                    | 6              |
| ELEC2441  | Computer organization and microprocessors                 | 6              |
| ELEC2840  | Engineering training                                      | 6              |
| MECH2407  | Multivariable calculus and partial differential equations | 6              |
| <b>Total for Introductory Discipline Core Courses</b> |   | <b>42</b>      |

**Advanced Courses (36 credits)**

| Course Code                                       | Course                             | No. of credits |
|---|------------------------------------|----------------|
| ELEC3241  | Signal and linear systems          | 6              |
| ELEC3242  | Communications engineering         | 6              |
| ELEC3346  | Electronic circuits                | 6              |
| ELEC3348  | Electronic devices                 | 6              |
| ELEC3844  | Engineering management and society | 6              |
| ELEC3848  | Integrated design project          | 6              |
| <b>Total for Advanced Discipline Core Courses</b> |                                    | <b>36</b>      |

**Capstone Experience and Internship (18 credits)**

| Course Code   | Course                             | No. of credits |
|---|------------------------------------|----------------|
| ELEC4848  | Senior design project <sup>+</sup> | 12             |
| ELEC3840  | Internship*                        | 6              |
| <b>Total for Capstone Experience and Internship</b> |                                    | <b>18</b>      |

+Capstone Experience  
\*Training

### Discipline Elective Courses (42 credits)

| Course Code  | Course   | No. of credits |
|--|--|----------------|
| ELEC####   | Elective Courses offered by the Department of Electrical and Electronic Engineering:<br>a) 24 credits of Courses from Groups A, B, C, D, E, J; and<br>b) 6 credits of Course from Group I; and<br>c) 12 credits of Advanced Courses from Groups B, C, D, E | 42             |
| <b>Complete at least seven discipline Elective courses for a total of 42 credits</b> |  | <b>42</b>      |

### Elective Courses (12 credits)

At least 12 credits of courses offered by either the Department of Electrical and Electronic Engineering, or other departments within or outside of the Faculty of Engineering.

### Summary of curriculum structure of BEng (Electronic Engineering)

| Course Categories                      | No. of credits |
|--|----------------|
| UG5 Requirements                       | 54             |
| General Engineering Courses            | 36             |
| Discipline Core Courses (Introductory) | 42             |
| Discipline Core Courses (Advanced)     | 36             |
| Capstone Experience and Internship     | 18             |
| Discipline Elective Courses            | 42             |
| Elective Courses                       | 12             |
| <b>Total</b>                           | <b>240</b>     |

The proposed syllabus by study year is as follows:

### FIRST YEAR

#### General Engineering Courses (36 credits)

|          |   |
|----------|---|
| MATH1851 | Calculus and Ordinary Differential Equations  |
| MATH1853 | Linear Algebra, Probability & Statistics  |
| ENGG1111 | Computer Programming and Applications   |
| PHYS1050 | Physics for engineering students  |
| ENGG1203 | Introduction to Electrical and Electronic Engineering   |
| ENGG120X | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering |

#### University Requirements (UG5) (24 credits)

|          |                           |
|----------|---------------------------|
| CAES1000 | Core University English   |
| CC##XXXX | Three Common Core Courses |

### SECOND YEAR

#### Introductory Core Courses (42 credits)

|          |  |
|----------|--|
| ELEC2147 | Electrical energy technology                     |
| ELEC2242 | Introduction to electromagnetic waves and fields |
| ELEC2346 | Electric circuit theory                          |

|          |   |
|----------|---|
| ELEC2347 | Fundamentals of optics                                    |
| ELEC2441 | Computer organization and microprocessors                 |
| ELEC2840 | Engineering training                                      |
| MECH2407 | Multivariable calculus and partial differential equations |

**University Requirements (UG5) (18 credits)**

|          |                           |
|----------|---------------------------|
| CC##XXXX | Three Common Core Courses |
|----------|---------------------------|

**THIRD YEAR**

**Advanced Core Courses (36 credits)**

|          |                                    |
|----------|------------------------------------|
| ELEC3241 | Signal and linear systems          |
| ELEC3242 | Communications engineering         |
| ELEC3346 | Electronic circuits                |
| ELEC3348 | Electronic devices                 |
| ELEC3844 | Engineering management and society |
| ELEC3848 | Integrated design project          |

**Internship (6 credits)**

|          |            |
|----------|------------|
| ELEC3840 | Internship |
|----------|------------|

**University Requirements (UG5) (6 credits)**

|          |  |
|----------|--|
| CENG9001 | Practical Chinese for Engineering Students |
|----------|--|

**Discipline Elective Courses (12 credits)**

**FOURTH YEAR**

**Discipline Elective Courses (30 credits)**

**Capstone Experience (12 credits)**

|          |                       |
|----------|-----------------------|
| ELEC4848 | Senior design project |
|----------|-----------------------|

**University Requirements (UG5) (6 credits)**

|          |   |
|----------|---|
| CAES9541 | Technical English for Electrical and Electronic Engineering |
|----------|---|

**Elective Courses (12 credits)**

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**Minor in Electrical and Electronic Engineering**  
**[not applicable to students of BEng(CE), BEng(EE) and BEng(ElecE)]**

Candidates who are interested in pursuing minor in Electrical and Electronic Engineering must satisfy the following prerequisites:

- Level 3 or above in Mathematics and
- Level 3 or above in Physics or Combined Science with Physics component in the Hong Kong Diploma in Secondary Education (HKDSE) Examination

Candidates are required to complete a total of 48 credits of courses in the following manner:

| <u>Code</u>  | <u>Course Name</u>                                     | <u>Credits</u> |
|--|--|----------------|
| <i>(i) 12 credits of core courses</i>  |  |                |
| ELEC2346   | Electric circuit theory                                | 6              |
| ENGG1203   | Introduction to electrical and electronic engineering* | 6              |
| <i>(ii) 36 credits of disciplinary elective courses selected from the following:</i> |  |                |
| ELEC2147   | Electrical energy technology                           | 6              |
| ELEC2242   | Introduction to electromagnetic waves and fields       | 6              |
| ELEC2347   | Fundamentals of optics                                 | 6              |
| ELEC2441   | Computer organization and microprocessors              | 6              |
| ELEC3141   | Power transmission and distribution                    | 6              |
| ELEC3142   | Electrical energy conversion                           | 6              |
| ELEC3143   | Power electronics                                      | 6              |
| ELEC3241   | Signals and linear systems                             | 6              |
| ELEC3242   | Communications engineering                             | 6              |
| ELEC3244   | Digital signal processing                              | 6              |
| ELEC3245   | Control and instrumentation                            | 6              |
| ELEC3247   | Engineering electromagnetism                           | 6              |
| ELEC3342   | Digital system design                                  | 6              |
| ELEC3346   | Electronic circuits                                    | 6              |
| ELEC3347   | Electronic materials and quantum physics               | 6              |
| ELEC3348   | Electronic devices                                     | 6              |
| ELEC3349   | Optical devices  | 6              |
| ELEC3441   | Computer architecture                                  | 6              |
| ELEC3443   | Computer networks                                      | 6              |
| ELEC3641   | Human computer interaction                             | 6              |
| ELEC3643   | Systems and network programming                        | 6              |
| ELEC4343   | Design of digital integrated circuits                  | 6              |
| ELEC4344   | Advanced electronic circuits                           | 6              |

\*ENGG1203 cannot be used for satisfying the requirement of both this Minor programme and another degree programme. If ENGG1203 has already been taken for to fulfill the requirement of another degree programme, the student should take 6 credits of disciplinary Elective course in list (ii) in lieu.

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## **COURSE DESCRIPTIONS**

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

### **General Engineering Courses**

|          |   |
|----------|---|
| ENGG1111 | Computer programming (6 credits)                                      |
| MATH1851 | Calculus and Ordinary Differential Equations (6 credits)              |
| MATH1853 | Linear Algebra, Probability & Statistics (6 credits)                  |
| MECH2407 | Multivariable calculus and partial differential equations (6 credits) |
| PHYS1050 | Physics for engineering students (6 credits)                          |
| ENGG1201 | Engineering for sustainable development (6 credits)                   |
| ENGG1202 | Foundation of computer science (6 credits)                            |
| ENGG1203 | Introduction to electrical and electronic engineering (6 credits)     |
| ENGG1204 | Industrial management and logistics (6 credits)                       |
| ENGG1205 | Introduction to mechanical engineering (6 credits)                    |
| ENGG1206 | Introduction to biomedical engineering (6 credits)                    |

Please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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### **University Requirements on Language Enhancement Courses**

- CAES1000. Core University English (6 credits)**  
**CENG9001. Practical Chinese for engineering students (6 credits)**

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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### **CAES9541. Technical English for Electrical and Electronic Engineering (6 credits)**

Adjunct course: ELEC4848 Senior design project  
ELEC3848 Integrated design project

Co-requisite: ELEC4848 Senior design project  
ELEC3848 Integrated design project (for BEng(Sc) Energy Engineering students only)

Running alongside the Senior Design Projects, this one semester, 6-credit course will build and consolidate final year BEngEEE and BEng(Sc) Energy Engineering students' ability to compose technical reports and technical papers, and make technical oral presentations. The focus of this course is on helping students to present the findings of their Senior Design Project in an effective, professional manner in both written and oral communication. Topics include accessing, abstracting, analyzing, organizing and summarizing information; making effective grammatical and lexical choices; technical report/paper writing; and technical presentations. Assessment is wholly by coursework.

Assessment: 100% continuous assessment

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### **University Common Core Curriculum**

36 credits of courses in the University Common Core Curriculum, in which students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than

two courses from each Area of Inquiry during the whole period of study:

- Scientific and Technology Literacy
  - Humanities
  - Global Issues
  - China: Culture, State and Society
- 

### **ELEC2147. Electrical energy technology (6 credits)**

This is an introductory course on various electrical energy technologies and systems by which students will be able to comprehend their major industry and their applications.

The course covers: Characteristics of values of electricity; Renewable electrical energy sources, convertible forms and sustainability; Generation and delivery; Direct current and alternating current supplies, Single-phase and three-phase systems, waveform inversion, rectification and transformation, Engineering and service applications of electrical technology; Analogue and digital instruments and measurements.

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

1. link technology to betterment of the society in a renewable manner;
2. describe the generation, delivery and utilization of electrical energy;
3. use circuit diagrams, phasor diagrams, graphs and mathematical equations to describe systems and to analyse performances;
4. manage electrical technology in a valuable, sustainable, dependable, efficient and smart manner.

Mutually exclusive with: ELEC1107

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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### **ELEC2242. Introduction to electromagnetic waves and fields (6 credits)**

This is the first course introducing basic mathematical and physical concepts of electromagnetism. It aims at providing fundamental understanding about key electromagnetic principles. It tries to establish the mathematical foundation through vector analysis and then gradually go through essentials of Maxwell's equations. Wave equations, boundary conditions and the basic methods of solving Poisson and Helmholtz equations are all discussed to provide a complete picture of electromagnetic problems. Material properties are studied and compared to understand various wave propagation features in different medium.

Specifically, the course covers the following topics in contemporary electromagnetics: vectors and fields, Gauss' Law, Ampere's Circular Law, Faraday's Law, electrostatic field, wave propagations, material properties, and transmission lines (optional). It serves as the entry class of engineering electromagnetism.

Mutually exclusive with: ELEC1202

Assessment: 60% continuous assessment, 40% examination

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### **ELEC2346. Electric circuit theory (6 credits)**

This is an introductory course that provides students with a solid foundation of knowledge on electric circuits and concepts, to prepare them for subsequent circuit-related courses. At the end of the course,

the student will be able to identify, analyse, design and optimize basic circuits based on fundamental circuit laws and theorems, using passive and active circuit components as well as the op-amp.

The topics to be covered include basic circuit concepts and laws, methods of analysis, circuit theorems, op-amps, first and second order circuits, ac-analysis, diode and diode circuits.

Mutually exclusive with: ENGG1008, ELEC1306

Assessment: 10% practical work, 30% continuous assessment, 60% examination

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### **ELEC2347. Fundamentals of optics (6 credits)**

This is an introductory course that provides students with a solid foundation of knowledge on optics, to prepare them for subsequent photonics-related courses. At the end of the course, the student will be able to identify, analyse, design and optimize optical systems such as microscopy based on fundamental laws and theorems.

The topics to be covered include ray optics, wave optics, beam optics, polarization optics, guided-wave optics and quantum optics.

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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### **ELEC2441. Computer organization and microprocessors (6 credits)**

This course aims at providing fundamental knowledge on the principles of computer organization and microprocessors, and serves as the first course to other more advanced computer courses. In order to bring out the essential principles, a simple processor is used for illustration and is studied in detail, and on top of it, more general systems are also introduced.

Specifically, the course covers the following topics: integer and floating point number representations; basic computer building blocks; register transfers and phases of instruction execution; micro-computer system organization - bus signals, timing, and address decoding; study of a simple model microprocessor: signals, instruction set and addressing modes; subroutines; reentrancy; context switching; I/O programming; interrupt I/O and DMA; memory cells and systems; exception handling; assembler, linker and loader.

Mutually exclusive with: COMP2120, ELEC1401

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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### **ELEC2543. Object-oriented programming and data structures (6 credits)**

This course aims to provide a hands-on and in depth survey of object oriented programming paradigm, and the basic concepts of data structures through the Java programming language. It serves to provide a solid foundation of essential concepts on object oriented programming and data structures that will be required in its sequels — including the Systems and Network Programming, Distributed Computing Systems or Embedded Systems.

Specifically, the course covers the following topics: basics of the Java development environment; Java applications and applets; Java syntaxes; control structures; methods in Java; iteration; recursion; objects; classes; interfaces; inheritance; polymorphism; overloading; overriding; wrapper classes; type conversions; strings; string manipulations in Java; Java exceptions; try blocks; throwing and catching exceptions in Java; byte and character streams; stream classes; file classes; file manipulation in Java;

arrays; dynamic memory allocation; dynamic data structures including the dynamically linked lists, stacks, queues, trees, graphs, hash tables; sorting; searching; examples of Java applications.

Pre-requisite: ENGG1111 Computer programming and applications

Mutually exclusive with: ELEC1502, COMP2396, ELEC1503

Assessment: 40% continuous assessment, 60% examination

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### **ELEC2840. Engineering training (6 credits)**

The aims of this course are to provide practical trainings for students to acquire essential practical skills related to Electrical and Electronic Engineering. There are 5 modules namely Electronic Practice, Practical Networking, CAD/CAE tools practice, Virtual Instrumentation and Microcontroller. Students of each program are required to take 4 compulsory modules to fulfill the workshop training requirement. The aims of each module are:-

- CAD/CAE tools practice – To learn how to use CAD software application to design circuit
- Electronics Practice – To learn how to produce a PCB circuit board and soldering technique
- Practical Networking – To learn how to design and configure a data network
- Microcontroller – To learn how to design and program a microcontroller
- Virtual instrumentation – To learn how to write codes and build hardware on virtual instrumentation circuits

Mutually exclusive with: ELEC1812, ELEC1810, ELEC1803

Assessment: 100% continuous assessment

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### **ELEC3141. Power transmission and distribution (6 credits)**

The course aims at providing detailed understanding about power transmission and distribution systems. The emphasis is on the mathematical models and equivalent circuits of power transmission lines and the basic structure of distribution systems. The model for high voltage transmission system is the basis for power system analysis and operation. The introduction of distribution systems provides the basic understanding of how power is distributed to customers and the technologies applied in power distribution.

Specifically, the course covers the following topics:

- Power transmission systems
- Transmission line model
- Power distribution systems
- Distribution overhead lines and underground cables
- Various issues in distribution systems

Co-requisite: ELEC2147 Electrical energy technology

Mutually exclusive with: ELEC2101

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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### **ELEC3142. Electrical energy conversion (6 credits)**

This course aims at providing sound understanding of various electrical energy conversion devices and systems. The emphasis is on four kinds of electrical energy conversion – electromechanical motion, electric heating, electric lighting and electrochemistry.

Specifically, the course covers the following topics: electric machines including DC machines, synchronous machines, induction machines and special machines; electric heating including resistive heating, induction heating and dielectric heating; electric lighting including incandescent lighting, discharge lighting and LED lighting; electrochemical sources including batteries and ultracapacitors.

Pre-requisite: ELEC2147 Electrical energy technology

Mutually exclusive with: ELEC2102

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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### **ELEC3143. Power electronics (6 credits)**

Electrical energy is essential today. In order to effectively utilize electrical energy it must be converted and processed to the right forms for different types of loads. A modern microprocessor might need low voltage high current DC for its power supply whereas a rotational machine might need high voltage high frequency AC for its operation. Power electronics is a power conversion technology. It enables conversion of electrical energy to the right form. It also enables the conversion process to be carried out with high efficiency. High efficiency power conversion plays a crucial role in energy saving, reducing carbon emission and global warming. Power electronics is based on the application of electronics technology to control the electrical conversion process. It is a field that spreads across various disciplines such as electrical, electronics and control.

The course starts with an introduction to various power semiconductors. Power semiconductors are the basic components for power converters. Power converters for AC to DC, AC to AC, DC to DC and DC to AC conversions are studied. Students are expected to learn the operation and design of these converters. Students should also know where and how these converters are applied in various electrical and electronic engineering systems.

Mutually exclusive with: ELEC2103

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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### **ELEC3241. Signals and linear systems (6 credits)**

Signals and linear system theory is fundamental to all engineering discipline, especially in the field of electrical, computer and medical engineering. This is a first course in signals and linear systems for engineering students without any pre-requisite knowledge in signal theory or signal processing other than some knowledge in fundamental calculus and use of complex numbers. The course uses simple real life examples of signals and systems to illustrate how signal theory can be used in practical application, and will include an introduction to MATLAB as a tool for signal analysis and system modelling.

This course aims to help students gain a firm understanding of the fundamentals of signal and linear systems concepts and theory using adequate mathematical and computing techniques to tackle simple signal processing problems. It serves as a pre-requisite course for many other courses including Digital Signal Processing, Control and Instrumentation, Communication Systems, and Digital Image Processing.

Specifically, the course covers the following topics: time-domain signal representation, periodic and aperiodic signals; spectral representation of signals, Fourier series and Fourier transform; system responses and linear system modelling; sampling, aliasing and analog-to-digital conversion; z-transform and concepts of poles and zeros; convolution; FIR filters and digital filtering; IIR filters and frequency response of digital filters; continuous-time systems and Fourier transform properties; application examples of signal analysis and processing.

At the end of the course, students should have a clear understanding of the fundamentals of signals and system theory to enable them to perform simple signal analysis and processing using both analytical method as well as using computing tools, link the mathematical representation of signals to some very simple real life signals and vice versa, and appreciate the applications of linear systems theory in solving some simple real life problems. In addition, students should be aware of the complexity of real life problems and the need to continue investigation in practice after graduation.

Mutually exclusive with: ELEC2201

Assessment: 20% practical work, 10% continuous assessment, 70% examination

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### **ELEC3242.    Communications engineering (6 credits)**

This course is an introduction to communications systems taught at a level appropriate for second-year undergraduates in electrical and electronic engineering. It is aimed at providing a general understanding of the basic communications theory and the principles of communications systems.

The following topics will be covered in the course: communications system models; modes of transmissions; properties of signals; baseband transmission; analogue modulations such as amplitude modulation, phase modulation and frequency modulation; noise in CW modulations; digital modulations such as binary-phase shift keying, quaternary binary-phase shift keying, frequency-shift keying, quadrature-amplitude modulation; antenna basic; basic concepts of modern communications systems such as cellular mobile systems and GPS system.

At the end of the course, students should have gained an understanding of the concepts of communications systems and modern communications systems.

Co-requisite: ELEC3241 Signals and linear systems

Mutually exclusive with: ELEC2202

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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### **ELEC3244.    Digital signal processing (6 credits)**

This course aims to help students gain a firm understanding of digital signal processing theory and practice. It includes the discussion on the theoretical aspect of the interfaces between the continuous-time domain and the discrete-time domain, and the design of discrete-time infinite impulse response filters as well as finite impulse response filters. It also covers the formulation of convolution, correlation and fast algorithms. Moreover, it outlines the derivation of discrete Fourier transform, from which a detailed study of fast Fourier transform algorithms is given. It concludes by the study of sampling rate conversion and its application.

Specifically, the course covers the following topics in digital signal processing: DSP fundamentals, filter structures, analog-to-digital conversion, digital-to-analog conversion, design of IIR filters, design of other frequency selective filters, design of FIR filters, digital convolution, cross- and auto-correlation, fast convolution, discrete Fourier transform, fast Fourier transform algorithms, decimation, interpolation, sampling rate conversion, applications of multi-rate signal processing.

Pre-requisite: ELEC3241 Signals and linear systems

Mutually exclusive with: ELEC2204

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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### **ELEC3245. Control and instrumentation (6 credits)**

Control systems and instrumentation methods are fundamental to many engineering disciplines. In this course, a general approach will be taken to study of control systems and instrumentation, so that the theory and methods are applicable to other disciplines at the system level.

The course is aimed at providing a general understanding of the fundamental principles of control systems and instrumentation methods. The following topics will be covered in the course: system modeling, transient response, principles of feedback, root locus, frequency response methods, state-space models, introduction to digital control, instrumentation and measurement systems, electromagnetic compatibility, noise and interference.

At the end of the course, students should have gained an understanding of the concepts and methodologies for the complete process of modeling, analysis and design of a feedback control system, including instrumentation technologies for measuring controlled variables.

Co-requisite: ELEC3241 Signals and linear systems

Mutually exclusive with: ELEC2205

Assessment: 15% practical work, 85% examination

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### **ELEC3247. Engineering electromagnetism (6 credits)**

The objective of this course is to offer comprehensive understanding in electromagnetics including topics of Maxwell's Equations, property of matters, wave propagation, wave reflection and transmission as well as important electromagnetic theorems. With the knowledge on the topics, students can have the ability to understand the physics and details of other courses and technologies such as microwave engineering, optoelectronics, photonics etc.

Students will also learn some representing devices of electromagnetic such as waveguides and antennas. The course will focus more on the dynamic field analysis.

Pre-requisite: ELEC2242 Introduction to electromagnetic waves and fields

Mutually exclusive with: ELEC2207

Assessment: 50% continuous assessment, 50% examination

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### **ELEC3342. Digital system design (6 credits)**

This course aims at providing students the fundamental understanding of digital system structures and system design techniques using discrete and programmable devices. Digital system design as a synthesis process using building block components, and the electrical characteristics of basic gate components are discussed. The main issues in system interconnection are treated with major emphasis on design considerations for high-speed digital systems. Use of Hardware Description Language (HDL) for design is introduced. The analysis and synthesis of digital system structure, especially those related to circuit timing, data transfer, and data clocking are discussed. Various testing schemes for logic and memory testing are introduced. Simple stuck-at fault detection techniques and modern Design for Test (DFT) techniques are discussed.

Specifically this course covers the following topics in digital system design: Digital system concepts and digital components; digital design using discrete and programmable devices; high speed digital system design considerations; Hardware Description Language (HDL); design of digital system structures; digital logic and memory testing; fault detection analysis and design; Design for Test (DFT) techniques.

Pre-requisite: ELEC2441 Computer organization and microprocessors



Mutually exclusive with: ELEC2302

Assessment: 50% continuous assessment; 50% examination

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### **ELEC3346. Electronic circuits (6 credits)**

This course aims to provide students with a basic understanding of analogue circuits and amplifiers based on bipolar junction transistor (BJT) and MOS field-effect transistors (MOSFET), as well as digital logic circuits.

The course begins with the operating principles and I-V characteristics of bipolar junction transistor (BJT). Next, it moves on to discuss amplifier operations and how voltage or/and current is/are amplified by using various transistor configurations. It covers transistor biasing techniques, DC analysis and small-signal equivalent circuits. These will be repeated for the MOS field-effect transistor (MOSFET). Transistor as a switch and digital logic circuits will be introduced in the final part of the course. The electrical properties of different logic families will be studied.

Pre-requisite: ELEC2346 Electric circuit theory

Mutually exclusive with: ELEC2306

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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### **ELEC3347. Electronic materials and quantum physics (6 credits)**

This course deals with the fundamental aspects of electronic materials, including solid-state physics, material growth and processing, material properties and material properties at the nano-scale: quantum physics.

It begins with coverage of crystal structures and a study crystallography, followed by the physics and methods of crystal growth and ways of processing crystals for the formation of functional devices. In the next section, the properties of materials will be studied in detail. The optical properties of materials, including absorption and luminescence, will be covered. The dielectric properties of insulating materials, including the different mechanisms of polarization, will be taught. This is followed by understanding the electrical properties of semiconductors in terms of carrier transport. Towards the end of the course, an introduction to quantum mechanics will be given.

Mutually exclusive with: ELEC2305

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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### **ELEC3348. Electronic devices (6 credits)**

This course aims to provide students with a basic understanding of the principles underlying the operation of common semiconductor devices: p-n junction diode, bipolar junction transistor (BJT) and metal-oxide-semiconductor field-effect transistor (MOSFET).

The course begins with introducing the basics semiconductor physics and p-n junction theories using band diagrams. It then proceeds to teach the device structures and physical operations of bipolar junction transistor (BJT) and metal-oxide-semiconductor field-effect transistor (MOSFET), introducing device models as appropriate.

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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**ELEC3349. Optical devices (6 credits)**

The course aims at providing detailed understanding about active and passive optical devices and optical systems. Students will learn optical components such as optical waveguides, fibers, variety of light sources (e.g. laser and light emitting diodes), passive and active components, wavelength division multiplexer, transmitters, receivers, photovoltaic devices and systems. Students will gain the knowledge in the physics, operation principles and the applications of optical components.

Pre-requisite: ELEC2346 Electric circuit theory or ELEC2347 Fundamentals of optics

Assessment: 20% continuous assessment, 80% examination

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**ELEC3441. Computer architecture (6 credits)**

This course aims at providing detailed understanding about how modern high performance microprocessors are designed and the rationales behind their different design principles. The emphasis is on the relationship between the microarchitecture and the system software (e.g., operating system and compiler). Contemporary processors such as MIPS and Pentium are used as practical cases to illustrate the different design principles. Pipelining microarchitecture and some elementary concepts on instruction level parallelism (ILP) are discussed. Compiler support and optimizations for exploiting the parallel processing capability provided by the microarchitecture are discussed.

Specifically, the course covers the following topics in contemporary computer architecture design: Design and performance issues of a computer system; RISC vs CISC; design of control unit; design of ALU; instruction pipeline; memory system; input/output system; and parallel processors.

Pre-requisite: ELEC2441 Computer organization and microprocessors

Mutually exclusive with: COMP3231 Computer architecture, ELEC2401

Assessment: 60% continuous assessment, 40% examination

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**ELEC3442. Embedded systems (6 credits)**

This course introduces the design concepts of modern embedded systems, with an emphasis on the integration of hardware and software. Topics include: hardware/software interface design and implementation, the role of operating system in embedded systems, embedded application development and the tradeoffs involving the use of hardware accelerators. A key component of the course is to design and implement a real-world embedded system using field-programmable gate array (FPGA) as a platform.

Upon completing this course, the student should be able to:

- Develop basic understanding of the role of embedded systems in contemporary electronic systems.
- Evaluate embedded systems in terms of performance, power and energy consumptions.
- Understand the fundamentals of hardware-software codesign in embedded system.
- Develop practical techniques in constructing embedded systems with hardware and software components addressing real-world challenges.

Pre-requisite: ELEC3342 Digital system design

Mutually exclusive with: ELEC3226

Assessment: 55% practical work, 45% continuous assessment

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### **ELEC3443. Computer networks (6 credits)**

This course aims at providing detailed understanding of the basic principles of computer and data communications, and the essential functions and protocols for co-ordinated exchange of data through computer networks. It covers data communication networks and facilities; network structures; protocols; local area networks; wide area networks; network trends; data security.

Mutually exclusive with: ELEC2402, ELEC2403, ELEC2701 & CSIS0234

Assessment: 20% continuous assessment, 80% examination

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### **ELEC3541. Software engineering & operating systems (6 credits)**

This course aims at providing students the fundamental knowledge of software engineering practices and system software for development and execution of computer software. The first part of this course presents software engineering methodologies for the development of quality, cost-effective, and maintainable software. Software is dealt with as an engineered product that requires planning, analysis, design, implementation, testing and maintenance. The object is to provide a concise presentation of each step in the engineering process. The second part of the course aims at providing fundamental concepts and ideas of operating systems, and the underlying principles of computer resource management by system software.

Specifically this course covers the following topics in Software Engineering and Operating Systems: software engineering process; principles that guide practice; requirements and modeling; software design concepts; software architectural and detail design methodologies; software testing strategies; software maintenance; software quality; software documentation.

Software development systems: assembler, linker and loader, compiler; basic operating system and process concepts; concurrent processes; processor management; primary and secondary memory management; file and database systems.

Mutually exclusive with: COMP3230 & COMP3297 or ELEC2501

Assessment: 15% practical work, 85% examination

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### **ELEC3641. Human computer interaction (6 credits)**

This course aims at providing fundamental knowledge on the principles of Human Computer Interaction (HCI): Design and Programming, and serves as the first course to other more advanced computer courses. In order to bring out the essential principles, a simple processor is used for illustration and is studied in detail, and on top of it, more general systems are also introduced.

Specifically, the course covers the following topics: human factors of interactive systems, design principles of user-interface, user conceptual models and interface metaphors, information and interactivity structures, interaction devices, presentation styles, information visualization; general features and components of window programming toolkits, event handling and layout management; strategies for effective human-computer interaction, managing design process, evaluation of human-computer interaction.

Pre-requisite: ELEC2543 Object-oriented programming and data structures or COMP2396 Object-oriented programming and Java

Mutually exclusive with: ELEC2601

Assessment: 40% continuous assessment, 60% examination

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### **ELEC3643. Systems and network programming (6 credits)**

This course aims to provide students with solid background on systems programming, in particular, UNIX system programming, and working level network software development using Java or Unix system facilities. It covers both classical UNIX multiprogramming software development and object oriented system implementations for networked applications.

Specifically, the course covers the following topics: Unix system calls, file I/O, Unix system data; process control, signals; daemon processes; threading approaches; concurrency control; socket programming; I/O multiplexing; IPv4 and IPv6 interoperability; broadcasting; multicasting; concurrent network servers; the 3-tier model; middlewares and their classification; distributed objects; Java sockets; multicasting in Java; the Java distributed computing platform including the Remote Method Invocation (RMI), the Java Servlets; the JavaServer Pages (JSP); the Extensible Markup Language (XML); the Java peer-to-peer (P2P) technologies.

Pre-requisite: ELEC2543 Object-oriented programming and data structures or (COMP1119 Introduction to data structures and algorithms and COMP2396 Object-oriented programming and Java)  
Mutually exclusive with: (ELEC3628 & COMP3402) or ELEC2603  
Assessment: 40% continuous assessment, 60% examination

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### **ELEC3840. Internship (6 credits)**

Students are trained on-the-job under the supervision of a company from the industry. At the end of the training, every student is required to submit a training report to the Department for assessment.

Mutually exclusive with: ELEC1813, ELEC1811, ELEC1804  
Assessment: 100% continuous assessment

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### **ELEC3844. Engineering management and society (6 credits)**

The aims of this course are to develop basic understanding of organization and management skills, professional ethics and legal foundation for the engineering discipline. Topics on engineering organization, project management and managerial skills, decision making processes, contingency and crisis management, leadership, corporate culture and philanthropy will be discussed. In order to provide a clear and right insight for engineering students to interact and contribute to the society, topics related to professional conduct, social responsibility, sustainability and safety issues, technology and environment, professional ethics are included. For the legal foundation, topics such as contract, intellectual property, tort, professional negligence and related law issues are discussed.

Mutually exclusive with: ELEC2814  
Assessment: 30% continuous assessment, 70% examination

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### **ELEC3845. Economics, finance and marketing for engineers (6 credits)**

The aims of this course are to develop basic understanding of economics, finance and marketing for the engineering discipline. The syllabus includes macroeconomics, microeconomics, value chain, financial management, cost and profit, shares and bonds, accounting concepts and financial statements, cash flow, rate of return; risk management, investment portfolio, technical analysis; marketing management, marketing mix, marketing media, marketing plan, and business ethics.

Mutually exclusive with: ELEC2815

Assessment: 30% continuous assessment, 70% examination

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### **ELEC3846. Numerical methods and optimization (6 credits)**

This course aims at introducing numerical methods and optimization used for the solution of engineering problems. Specifically:

1. In the first part of the course, numerical algorithms to solve various mathematical problems are provided. Development of algorithms, their mathematical analysis, and an analysis of their errors and performance are discussed. The applications of numerical methods in solving equations, differentiation and integration, ordinary differential equations, and linear algebra, are illustrated.
2. In the second part of the course, essential concepts of optimization theory are introduced, and fundamental classes of optimization problems are analyzed. Theoretical results and practical algorithms for solving optimization problems are introduced and explained. Applications in engineering fields and other areas are illustrated.

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

1. demonstrate knowledge and understanding of the basic concepts of numerical methods and optimization;
2. apply theoretical results and practical algorithms for solving equations and optimization problems.

Mutually exclusive with: COMP3407, ELEC2816

Assessment: 20% continuous assessment, 80% examination

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### **ELEC3847. Probability and statistics in engineering (6 credits)**

The objective of the course is to introduce applied probability and statistics at the intermediate level. The concepts of random variables, mathematical expectation, functions of random variables, moment generating functions and characteristics functions, fundamental sampling distributions, sample estimation problems, hypothesis testing, and linear regression are discussed. Applications of the concepts to various disciplines in engineering are also illustrated.

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

1. Gain understanding of concepts in applied probability and statistics;
2. Illustrate the applications of concepts to various disciplines in engineering;
3. Explore the foundations of analytical and critical thinking, academic research, and preparing students some mathematical techniques for conducting academic research;
4. Acquire learning strategies that will enhance their learning experience;
5. Explore some topics as a showcase over the course of the Engineering degree.

Mutually exclusive with: ELEC2817

Pre-requisite: MECH2407

Assessment: 30% continuous assessment, 70% examination

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### **ELEC3848. Integrated design project (6 credits)**

This course aims at providing senior undergraduate students in small teams an opportunity to apply and integrate their knowledge and skills in electrical and electronic engineering courses, as well as project management, to implement a practical system that requires knowledge and skills from different EEE disciplines (i.e., Computer Engineering, Electronic Engineering, and Electrical Engineering). Typically,

the system to be built has electrical components for interfacing with the real world (e.g., a smart plug that can measure and regulate power consumption as well as display measured data to user through an external user interface), electronic components that integrated the external interfaces with the processing and networking cores, and computing components that handle the data manipulations. Thus, by design, each project team should consist of students from electrical engineering, electronic engineering and computer engineering.

At the beginning of the course, students are guided to acquire skills in using hardware and software development tools through introductory lectures and laboratory exercises. Students then begin working on the project. Technical consultation sessions are conducted as supplementary to help students throughout the process.

Assessment and grading will be made according to the quality of design product, demonstration and documentations. Besides implementing the system to the required project specification, students are encouraged to extend the project with their own inputs.

Mutually exclusive with: ELEC2805, ELEC2807, ELEC2812, ELEC2813, ELEC2818

Assessment: 100% continuous assessment

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#### **ELEC4141. Electric railway systems (6 credits)**

The aim of this course is to provide fundamental knowledge of electric power in railways, on system and component levels. It elaborates on the power supply systems, rolling-stocks, traction systems, supporting systems, automatic train operation, control, and protection systems. Magnetic levitation systems are discussed. Topics on high-speed rail networks, railway engineering management, health and safety are included.

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

1. describe and understand the construction and functions of electrical installations and the prerequisites that apply in the operation of installations;
2. explain different electrical installations that are parts of the operation of electric railway traffic with respect to both function and the essential connections with the parts of the installation;
3. understand the basic concepts of power supply systems for railways;
4. understand the rolling-stocks, traction systems and supporting systems of electric railway systems;
5. understand the automatic train operation, control, and protection systems;
6. have a general grasp on the basic concepts of magnetic levitation systems;
7. demonstrate knowledge, understanding of high-speed rail networks and railway engineering management, health and safety.

Pre-requisite: ELEC2147 Electrical energy technology

Mutually exclusive with: ELEC3111

Assessment: 25% continuous assessment, 75% examination

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#### **ELEC4142. Power system protection and switchgear (6 credits)**

The aim of this course is to provide fundamental knowledge of electric power in power system protection and switchgear. It elaborates on protective relays, protection transformer, transmission line protection, rotating machine protection, substation protection. Principles of over-voltages and electrical breakdown are discussed. Circuit breaker technologies, switchgears and their protection schemes, and auto-recloser and sectionalizer are included.

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

1. grasp and understand the basic principles and functions of protection relays and switchgears;

2. have a general grasp on the basic concepts of protection transformer;
3. understand the basic concepts of over-current protection, distance protection, pilot protection of transmission lines;
4. understand the basic concepts of rotating machinery protection;
5. understand the basic concepts of substation protection;
6. have a general grasp on the basic concepts of electric arc and switching overvoltage;
7. understand the general principles of circuit breaker technologies;
8. have a general grasp on the switchgear technologies;
9. understand the basic concepts of auto-recloser and sectionalizer for power systems.

Pre-requisite: ELEC3141 Power transmission and distribution

Mutually exclusive with: ELEC3112

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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#### **ELEC4144. Electric vehicle technology (6 credits)**

This course aims at providing sound understanding of various electric vehicle (EV) technologies. The emphasis is on five key areas of EVs – System integration, propulsion systems, energy sources, auxiliaries and impacts.

Specifically, the course covers the following topics: system integration including battery EVs, hybrid EVs and fuel cell EVs; propulsion systems including single-motor and multiple-motor drives, geared and gearless in-wheel motors and hybrid powertrains; energy sources including batteries, fuel cells, ultracapacitors and ultrahigh-speed flywheels; auxiliaries including battery chargers and indicators, temperature control units, power steering units, auxiliary power supplies and regenerative braking units; impacts including power system, environment and economy.

Mutually exclusive with: ELEC3104

Assessment: 40% continuous assessment, 60% examination

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#### **ELEC4145. Building services- electrical services (6 credits)**

The aim of this course is to provide fundamental knowledge of building services design and installation, on system and component levels. It elaborates on the Heating, Ventilation and Air-conditioning System, Plumbing & Drainage System, Fire Services System, Lighting Installation, Vertical Transportation System and Building Automation System. Various building services systems are discussed covered engineering fundamentals, system components, design and statutory requirements, system integration as well as practical familiarization of systems.

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

1. describe and understand the construction and functions of building services installation for building to operate;
2. explain different building services installation forming part of a building and its connection between each others;
3. understand the lighting installation;
4. understand the vertical transportation system;
5. understand the plumbing and drainage systems;
6. understand the fire services system;
7. understand the heating, ventilation and air-conditioning system;
8. understand the building automation system.

Mutually exclusive with: ELEC3105

Assessment: 20% continuous assessment, 80% examination

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#### **ELEC4146. Building services- electrical installations (6 credits)**

To develop classmates' potential in selecting electrical equipment, designing electrical installation, and making them professional in achieving optimal benefits in building services without compromising safety.

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

1. describe and understand the electrical installation as a system; and the major components that build up the installations;
2. be aware of the potential hazards of electrical installations, yet be able to prevent those hazards;
3. select proper equipment and protective devices to facilitate expected functions of the electrical installations;
4. be competent in electrical safety and codes of practice;

Mutually exclusive with: ELEC3106

Assessment: 20% continuous assessment, 80% examination

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#### **ELEC4147. Power system analysis and control (6 credits)**

The aim of this course is to provide fundamental knowledge of electric power in power system analysis and control. It elaborates on the power flow analysis, fault analysis, economic dispatch algorithms, and small/large disturbance stability. Power system component models and network matrices are included.

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

1. describe and understand the structure and functions of electrical power systems;
2. understand electrical power network modeling and algorithms for network matrices construction;
3. understand the basic concepts of steady-state analysis for power systems and some algorithms for power flow analysis;
4. have a general grasp on the basic concepts of power system operation and understand some algorithms for power system economic dispatch;
5. understand the basic concepts and methods of fault analysis for power systems;
6. understand the basic concepts and methods of stability analysis for power systems.

Pre-requisite: ELEC3141 Power transmission and distribution

Mutually exclusive with: ELEC3107

Assessment: 20% continuous assessment, 80% examination

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#### **ELEC4241. Communication systems (6 credits)**

This course aims at providing detailed understanding of the basic principles of analogue and digital communication systems in the presence of noise with focus on basic issues relating to system design. It covers spectral analysis; random signal theory; information theory; noise in analogue systems; digital transmission through AWGN channels; digital carrier-modulation schemes; DM and PCM, error control coding.

Pre-requisite: ELEC3242 Communications engineering



Mutually exclusive with: ELEC3201  
Assessment: 10% practical work, 90% examination

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#### **ELEC4242. Robotics (6 credits)**

The development of robotics has evolved from early programmable industrial arms or manipulators (consisting of a driven mechanical structure) to a diverse range of objects that may generally be referred to as robots. As a result, robotics has become a highly interdisciplinary subject involving different kinds of technologies.

The first part of the course is aimed at providing a general understanding of the fundamental principles of robot manipulators covering robot kinematics, robot dynamics and robot control. The second part of the course will venture into selected topics in robotics (such as robot vision, AI in robotics etc.) and then consider robot applications to different areas (such as humanoid robot, medical and surgical robots, etc.).

At the end of the course, students should have gained an understanding in the principles and mathematical techniques that underlie the traditional manipulator as a basic building block of different kinds of robots, and also an appreciation of how other technologies can be applied to enhance the capabilities and scope of applications of robots.

Pre-requisite: ELEC3241 Signals and linear systems  
Mutually exclusive with: ELEC3222  
Assessment: 20% continuous assessment, 80% examination

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#### **ELEC4243. Cellular radio and personal communications systems (6 credits)**

This course is an introduction to cellular radio communications systems taught at a level appropriate for third-year undergraduates in electrical and electronic engineering. It is aimed at providing a general understanding of the basic theory and design of wireless communications.

The following topics will be covered in the course: cellular-systems concepts, advanced digital modulations, digital cellular technologies, code-division-multiple access, GSM system, IS-95 CDMA system, 3G mobile systems, TD-SCDMA system, and safety issues on non-ionizing radiation from wireless systems.

At the end of the course, students should have gained an understanding of the concepts of cellular radio communications systems and analyses the advantages and disadvantages of different mobile systems.

Pre-requisite: ELEC3242 Communications engineering  
Mutually exclusive with: COMP3328, ELEC6071, ELEC3203  
Assessment: 30% practical work, 70% examination

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#### **ELEC4244. Multimedia signals and applications (6 credits)**

This course provides an introduction to the basic concept of multimedia applications with particular emphasis on media compression standards/formats for speech, audio, image and videos. Specifically, the course will cover basic concept and terminology in multimedia applications. Furthermore, the course will also discuss in detail about digital representations of important media such as speech, audio, images and videos. Finally, the course will include in-depth coverage of digital media formats, compression methods and standards.

The course is designed to achieve the following:

1. Enable the students to acquire fundamental knowledge/terminologies on essential multimedia components including image, video, audio and speech and their compression techniques/standards for supporting multimedia applications. It will also allow them to keep abreast with more recent development in multimedia compression standards and system development.

2. Enable the students to understand the following basic technical concept on multimedia:

1. multimedia, example systems, and common media components such as hypertext, image, videos, and audio,
2. some popular authoring tools,
3. common color systems used in images and videos and simple image/graphic data type and file formats,
4. videos, digital videos and HDTV,
5. digital audios such as sampling rate, and quantization techniques (e.g. companding, and prediction)
6. lossless compression principle and algorithms such as Huffman codes, dictionary-based codes (e.g. LZW), JPEG lossless image compression, and runlength code.
7. the principle/merits/demerits of image compression standards such as JPEG Baseline and related algorithms,
8. the principle of video compression using motion estimation/hybrid DCT/DPCM codec and simple motion estimation algorithm such as the logarithmic search,
9. the principle of MPEG-1/2 video compression algorithm,
10. speech production/speech analysis techniques using STFT and all-pole modeling/Principle of Multiband Excitation codec and Analysis/Synthesis codec and example coding standards.

3. Enable the students to appreciate the design and implementation issues in a selected multimedia application through the completion of an individual miniproject. The project should have sufficient coverage for the students to apply and integrate the knowledge they have learnt from lectures to develop practical multimedia applications and learn to use relevant state of the art engineering tools.

4. Enable the student to analyze the arithmetic complexity requirements, relative merits, design considerations and other relevant parameters etc for these essential multimedia components through the tutorial questions and assessment by examination.

Pre-requisite: ELEC3241 Signal and linear systems

Mutually exclusive with: COMP3315, ELEC3224

Assessment: 30% continuous assessment, 70% examination

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#### **ELEC4245. Digital image processing (6 credits)**

This course aims to help students gain a firm understanding in digital image processing and master its methods and techniques. It intends to build upon the knowledge students acquire in Signals and Linear Systems (ELEC3241) and extends it.

The course in general begins with the basics in 2D signals and systems, visual perception, image sensing and acquisition. It then proceeds to study various intensity transformations, histogram processing techniques, filters in both spatial and frequency domains, and how they can be used to enhance the quality of digital images. Next, it considers reconstruction and restoration of images due to degradations, how image quality is measured and color image processing. It then moves onto Image compression, which plays a pivotal role today's Internet and multimedia applications. A core area of this course is to learn how to segment features/patterns from images. This includes using various methods to extract

point, line, edge and regions. The course concludes by considering some typical image processing applications.

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, color image processing, image quality evaluation, image transform and compression, applications and computer implementations.

Pre-requisite: ELEC3241 Signal and linear systems

Mutually exclusive with: ELEC3505, ELEC3225

Assessment: 40% continuous assessment, 60% examination

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#### **ELEC4247. Information theory and coding (6 credits)**

This course aims at providing the basic principles of information theory and coding techniques for compact data representation, error control and data secrecy. The fundamental concepts of information theory - entropy, mutual information, information channel, channel capacity, Shannon's theorems are introduced. Various techniques for lossless source coding are examined, including Huffman code, arithmetic code, dictionary code and transform coding. Analysis and design of error-control channel codes are considered, covering linear block code, cyclic code, BCH and RS codes, and convolution code. Finally, private-key and public-key encryption systems are studied.

Mutually exclusive with: ELEC3204, ELEC3227

Assessment: 30% continuous assessment, 70% examination

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#### **ELEC4248. Photonic systems technologies (6 credits)**

The course aims at providing detailed understanding about the key technologies of photonic systems, especially in the application for communications. Students will learn optical components such as fibers, transmitters and receivers, passive and active components, wavelength-division multiplexer, optical amplifiers. Students will gain the knowledge in the operation principles and the applications of optical components and systems. With the knowledge, the requirement and knowhow to build an optical communication system from optical components are discussed. Some experiments will be conducted for gaining the practical knowledge.

Pre-requisite: ELEC2346 Electric circuit theory or ELEC3349 Optical devices

Mutually exclusive with: ELEC3223

Assessment: 30% continuous assessment, 10% practical work, 60% examination

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#### **ELEC4249. Microwave engineering (6 credits)**

This course focuses on the fundamental concepts necessary for real world designs of microwave circuits and components. It aims to establish necessary design methodologies and introduce essential tools for engineering development related but not limited to microwave engineering. Using Maxwell's equations as the basis, this course will introduce the transmission line theory, waveguides, network parameters, antenna theory, impedance matching methods, and filter design methodologies. Waveguide modes will be derived from wave equations to establish the waveguide concept. Important microwave circuit and components, such as couplers and filters, will be discussed based on learned technologies in the course. Antenna and microwave system analysis will be briefly discussed to establish a complete microwave transceiver system that could serve as the foundation of communication system applications.

Pre-requisite: ELEC2242 Introduction to electromagnetic waves and fields or ELEC3247 Engineering electromagnetism

Mutually exclusive with ELEC3221

Assessment: 30% continuous assessment, 30% practical work, 40% examination

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### **ELEC4250. Control systems (6 credits)**

This course provides the students with a good understanding of feedback control systems. The fundamental concepts, mathematics and techniques for the analysis of control systems will be given. Both analogue and digital control systems will be covered as well as a basic understanding of fuzzy control systems. The course will also provide many examples of feedback control systems in different domains of engineering.

This course will cover many important topics in the field of control systems. By the end of this course, student should possess a firm grounding in the concepts and techniques of feedback control systems. The student should be able to apply the acquired knowledge for the analysis of control systems, as well as to carry out design of feedback systems.

Pre-requisite: ELEC3245 Control and instrumentation

Mutually exclusive with: ELEC3206

Assessment: 20% practical work, 10% continuous assessment, 70% examination

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### **ELEC4251. Microscopy (6 credits)**

This is an advanced course that provides students with an in-depth knowledge of various optical and electronic microscopy technologies. The course will cover the essential theories of optical image formation, image analysis, experimental designs of microscopes. Discussion of their practical applications in biomedicine and basic science research will be covered. Selected technologies include phase-contrast microscopy, fluorescence microscopy, super-resolution (far-field) microscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM), scanning probe microscopy, e.g. atomic force microscopy (AFM).

Assessment: 20% practical work, 40% continuous assessment, 40% examination

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### **ELEC4343. Design of digital integrated circuits (6 credits)**

The aim of this course is to design logic and memory circuits on silicon micro-chips fabricated by various IC technologies.

Specifically, the course covers the following topics: MOS processing : polysilicon gate, LOCOS isolation; MOSFET, as a switch in an inverter; NMOS logic : R-load, E-load, D-load, and their comparisons; Layout design of NMOS circuits; Design rules, extraction of device parameters, isolation concerns; Design of memory circuits : ROM, EPROM, EEPROM, DRAM, SRAM; CMOS processing : different types of well, threshold control; Problems in CMOS circuits : field inversion, latchup, SOI; CMOS circuits : analysis, layout design; Effects of scaling on the performance of MOS circuits; Bipolar junction transistor, BiCMOS circuits.

Pre-requisite: ELEC3346 Electronic circuits

Mutually exclusive with: ELEC2303, ELEC3303

Assessment: 50% continuous assessment, 50% examination

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#### **ELEC4344. Advanced electronic circuits (6 credits)**

The aim of this course is to provide students with more advanced knowledge on analogue electronic circuits like amplifiers, filters, diode circuits, oscillators, AD converters and DA converters.

Specifically, the course covers the following topics: s-domain analysis; low-frequency and high frequency response of single-stage BJT and MOSFET amplifiers, cascode configurations, cascade configurations; The BJT differential pair; small-signal operation: input differential resistance, differential voltage gain common-mode input resistance and gain, biasing in BJT integrated circuits :current source circuits, cascode configurations, MOS differential amplifiers, BiCMOS amplifiers, multistage amplifiers; Class A output stage; Class B output stage; Class AB output stage; biasing techniques of the class AB circuit; Basic feedback concepts; feedback amplifier configurations: shunt-shunt, shunt-series, series-shunt, series-series; loop-gain; stability problem; Op-amp realization of Butterworth and Chebyshev filter types; switched-capacitor filters; tuned amplifiers; Series voltage regulators; overcurrent protections; shunt voltage regulators; Sinusoidal oscillators; op amp-RC oscillator circuits; the Wien-Bridge oscillator, the phase-shift oscillator, the quadrature oscillator, the active-filter tuned oscillator; LC oscillators: Colpitts and Hartley oscillators; crystal oscillators; bistable and astable multivibrators; the 555 as an oscillator and as a monostable circuit; D/A converters: inverted ladder converter, current switching converter; A/D converters: the voltage-to-frequency converter, ramp-comparison technique, the counter-binary ramp converter, the dual ramp integrator converter, successive-comparison method.

Pre-requisite: ELEC3346 Electronic circuits

Mutually exclusive with: ELEC2301 and ELEC3341

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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#### **ELEC4442. Advanced networking technologies (6 credits)**

This course takes a systematic approach to study the various components that form the infrastructure of the next generation Internet. Topics include optical switching technologies, survivable optical networks, IEEE 802.11, wireless mesh networks, mobile ad hoc networks, wireless sensor networks, high performance switches and routers, advanced topics on congestion and flow control, traffic management.

- To provide a comprehensive coverage of key technologies in optical and wireless networking;
- To study fundamental problems and approach in providing QoS in the next generation Internet.

Pre-requisite: ELEC3443 Computer networks or COMP3234 Computer and communication networks

Mutually exclusive with: ELEC3402

Assessment: 40% continuous assessment, 60% examination

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#### **ELEC4543. Fuzzy systems and neural networks (6 credits)**

This course provides a general introduction to fuzzy logic and neural network. The fundamental concepts and techniques in the general field of fuzzy systems and neural networks will be given. The course will also provide examples on the application of fuzzy logic and neural network to a variety of engineering problems.

This course will cover two important topics in the field of Artificial Intelligence. By the end of this course, student should possess a firm grounding in the concepts and techniques of fuzzy logic and neural

network. The student should be able to apply the acquired knowledge to the development of intelligent systems or to the exploration of research problems.

Mutually exclusive with: ELEC3503

Assessment: 30% continuous assessment, 70% examination

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#### **ELEC4640. Distributed computing systems (6 credits)**

This course aims at providing detailed understanding about the concept and design of distributed computing systems. The emphasis is on distributed protocol design and analysis. Various existing distributed systems, such as the Internet, are discussed. Network programming is introduced for students to develop their own distributed applications.

Pre-requisite: (ELEC3541 Software engineering and operating systems or COMP3230 Principles of operating systems) and (ELEC3443 Computer networks or COMP3234 Computer and communication networks)

Mutually exclusive with: ELEC3622, ELEC3630

Assessment: 40% continuous assessment, 60% examination

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#### **ELEC4641. Computer network security (6 credits)**

This course focuses on state-of-the-art computer network security technologies, which are crucial to the success of any electronic commerce systems. The course covers fundamental techniques of cryptography, security threats and their possible countermeasures, secure protocols, and other network security schemes (authentication, key management, firewalls, intrusion detection, etc.).

Pre-requisite:-ELEC3443 Computer networks or COMP3234 Computer and communication networks

Mutually exclusive with: COMP3327, ELEC3631

Assessment: 40% continuous assessment, 60% examination

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#### **ELEC4642. VLSI design principles (6 credits)**

To give a detailed treatment on the principles and methods for designing large-scale digital integrated circuits.

The course content ranges from low level fabrics like MOSFET (metal-oxide-semiconductor field-effect transistor) basics, logic gate families, layout and fabrication practices, to higher level system knowledge like timing, memory, design optimization and tests; and eventually extends into basic analog circuit blocks like CMOS (complementary metal-oxide-semiconductor) transistor amplifiers and opamps etc.

The course also includes a Verilog design project that covers the typical VLSI design flow using the most popular electronic design automation (EDA) tools.

Mutually exclusive with: ELEC3612

Assessment: 50% continuous assessment, 50% examination

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### **ELEC4649. Parallel computing (6 credits)**

This course aims at providing detailed understanding about parallel computing architecture and parallel programming techniques. The course starts with a survey of multiprocessor architectures including multi-core processors, symmetric multiprocessors, high-performance interconnection networks, clusters, and computing Grids. This is followed by quantitative discussions about software development challenges such as synchronization issues, cache coherency, memory consistency, performance scaling, and high speed I/O. The final group of topics mainly focus on parallel programming. Specifically, parallel programming models such as PRAM, LogP, BSP, etc. are introduced. Using variants of the MPI language (e.g., OpenMP), different parallel programming techniques are discussed. Example algorithms including searching, sorting, matrix arithmetic, etc. are used.

Mutually exclusive with: ELEC3441, ELEC3629

Assessment: 40% continuous assessment, 60% examination

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### **ELEC4745. Queueing theory (6 credits)**

The objective of the course is to introduce the basic principles of queueing theory. The concepts of random processes, birth-death queueing systems, Markovian queues in equilibrium, and simulation techniques are discussed. Applications of these concepts are also illustrated.

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

1. Gain understanding of concepts in queueing theory;
2. Illustrate the applications of concepts to engineering;
3. Explore the foundations of analytical and critical thinking, academic research, and preparing students some mathematical techniques for conducting academic research;
4. Acquire learning strategies that will enhance their learning experience;
5. Explore some practical examples as a showcase over the course of the Engineering degree.

Pre-requisite: ELEC3847 Probability and statistics in engineering

Mutually exclusive with: ELEC3705

Assessment: 30% continuous assessment, 70% examination

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### **ELEC4848. Senior design project (12 credits)**

This course aims at providing the very fundamental training in conducting an individual design project prior to leaving the University.

The essence of the project is for student to re-enforce and consolidate all the learned engineering skill and theory in the school into a real-life practical technical project. 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.

Depending on each project offered by teaching staff, students are usually required to individually carry out the Project Requirement and Design, Implementation and Evaluation, Report and Presentation on the selected project. Students are encouraged to explore and lean his/her own direction of the Project over the year during which project supervisor shall provide assistance and aids along each Project phase with the students.

Students are required to have meeting and discussion with his/her supervisors on a regular basis, usually every week or every fortnight. Mid-term Review will be held with both the supervisors and the 2<sup>nd</sup>

examiner in order review the student progress. The final assessment will be based Project Report, Presentation and Demonstration.

Mutually exclusive with: ELEC3801, ELEC3802, ELEC3818

Assessment: 100% continuous assessment

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### List of Courses by Subject Groups

Note:

Each course shall be classified as either introductory level course or advanced level course, and be assigned a Level – One, Two, Three or Four, in which Level One and Level Two courses are introductory courses whereas advanced courses include Level Three and Four courses.

Courses with similar contents are flagged as "mutually exclusive". For each set of mutually exclusive courses, students are not allowed to take more than one course. Subject to approval, some MSc courses may also be taken as Disciplinary Elective Courses in their respective subject groups. Each MSc course is equivalent to a 6-credit course by undertaking additional workload than an MSc student in the course concerned.

#### Group A: Electrical Energy

| Level | Code     | Course Title                                   | Credit | Prerequisite | Co-requisite |
|-------|----------|--|--------|--------------|--------------|
| 2     | ELEC2147 | Electrical energy technology (core: EE)        | 6      | -            | -            |
| 3     | ELEC3141 | Power transmission and distribution (core: EE) | 6      | -            | ELEC2147     |
| 3     | ELEC3142 | Electrical energy conversion (core: EE)        | 6      | ELEC2147     | -            |
| 3     | ELEC3143 | Power electronics (core: EE)                   | 6      | -            | -            |
| 4     | ELEC4141 | Electric railway systems                       | 6      | ELEC2147     | -            |
| 4     | ELEC4142 | Power system protection and switchgear         | 6      | ELEC3141     | -            |
| 4     | ELEC4144 | Electric vehicle technology                    | 6      | -            | -            |
| 4     | ELEC4145 | Building services - electrical services        | 6      | -            | -            |
| 4     | ELEC4146 | Building services - electrical installations   | 6      | -            | -            |
| 4     | ELEC4147 | Power system analysis and control              | 6      | ELEC3141     | -            |

#### Group B: Electronics and Optics

| Level | Code     | Course Title                                  | Credit | Prerequisite | Co-requisite |
|-------|----------|---|--------|--------------|--------------|
| 2     | ELEC2346 | Electric circuit theory (core: CE, EE, ElecE) | 6      | -            | -            |
| 2     | ELEC2347 | Fundamentals of optics                        | 6      | -            | -            |
| 3     | ELEC3342 | Digital system design (core: CE)              | 6      | ELEC2441     | -            |
| 3     | ELEC3346 | Electronic circuits (core: ElecE)             | 6      | ELEC2346     | -            |
| 3     | ELEC3347 | Electronic materials and                      | 6      |              | -            |



|   |          |                                       |   |                      |   |
|---|----------|---------------------------------------|---|----------------------|---|
|   |          | quantum physics                       |   |                      |   |
| 3 | ELEC3348 | Electronic devices (core: ElecE)      | 6 | -                    | - |
| 3 | ELEC3349 | Optical devices                       | 6 | ELEC2346 or ELEC2347 | - |
| 4 | ELEC4248 | Photonic systems technologies         | 6 | ELEC2346 or ELEC3349 | - |
| 4 | ELEC4251 | Microscopy                            | 6 | -                    | - |
| 4 | ELEC4343 | Design of digital integrated Circuits | 6 | ELEC3346             | - |
| 4 | ELEC4344 | Advanced electronic circuits          | 6 | ELEC3346             | - |
| 4 | ELEC4642 | VLSI design principles                | 6 | -                    | - |

**Group C: Signal Processing and Control Systems**

| Level | Code     | Course Title   | Credit | Prerequisite | Co-requisite |
|-------|----------|--|--------|--------------|--------------|
| 3     | ELEC3241 | Signals and linear systems (core: ElecE, EE)                           | 6      | -            | -            |
| 3     | ELEC3244 | Digital signal processing  | 6      | ELEC3241     | -            |
| 3     | ELEC3245 | Control and instrumentation  | 6      | -            | ELEC3241     |
| 4     | ELEC4250 | Control systems  | 6      | ELEC3245     | -            |
| 4     | ELEC4242 | Robotics   | 6      | ELEC3241     | -            |
| 4     | ELEC4244 | Multimedia signals and applications (mutually exclusive with COMP3315) | 6      | ELEC3241     | -            |
| 4     | ELEC4245 | Digital image processing   | 6      | ELEC3241     | -            |

**Group D: Communications and Networking**

| Level | Code     | Course Title   | Credit | Prerequisite         | Co-requisite |
|-------|----------|--|--------|----------------------|--------------|
| 2     | ELEC2242 | Introduction to electromagnetic waves and fields (core: ElecE) | 6      | -                    | -            |
| 3     | ELEC3242 | Communications engineering (core: ElecE)                       | 6      | -                    | ELEC3241     |
| 3     | ELEC3247 | Engineering electromagnetism                                   | 6      | ELEC2242             | -            |
| 3     | ELEC3443 | Computer networks (mutually exclusive with COMP3234)           | 6      | -                    | -            |
| 4     | ELEC4241 | Communication systems  | 6      | ELEC3242             | -            |
| 4     | ELEC4243 | Cellular radio and personal communication systems              | 6      | ELEC3242             | -            |
| 4     | ELEC4247 | Information theory and coding                                  | 6      | -                    | -            |
| 4     | ELEC4249 | Microwave engineering  | 6      | ELEC2242 or ELEC3247 | -            |
| 4     | ELEC4442 | Advanced networking technologies                               | 6      | ELEC3443 or COMP3234 | -            |

**Group E: Computer Systems**

| Level | Code     | Course Title   | Credit | Prerequisite                                    | Co-requisite |
|-------|----------|--|--------|---|--------------|
| 2     | ELEC2441 | Computer organization and microprocessors (core: CE, ElecE, EE)<br>(mutually exclusive with COMP2120)    | 6      | -   | -            |
| 2     | ELEC2543 | Object-Oriented programming and data structures (mutually exclusive with COMP2396)<br>(core: ElecE)      | 6      | ENGG1111  | -            |
| 3     | ELEC3441 | Computer architecture (core: CE)<br>(mutually exclusive with COMP3231)                                   | 6      | ELEC2441  | -            |
| 3     | ELEC3442 | Embedded systems (core: CE)  | 6      | ELEC3342  | -            |
| 3     | ELEC3541 | Software engineering and operating systems (mutually exclusive with COMP3230 and COMP3297) (core: ElecE) | 6      | -   | -            |
| 3     | ELEC3641 | Human computer interaction   | 6      | ELEC2543 or COMP2396                            | -            |
| 3     | ELEC3643 | Systems and network programming (mutually exclusive with COMP3402)                                       | 6      | ELEC2543 or (COMP2119 & COMP2396)               | -            |
| 4     | ELEC4543 | Fuzzy systems and neural networks  | 6      | -   | -            |
| 4     | ELEC4640 | Distributed computing systems  | 6      | (ELEC3541 or COMP3230) & (ELEC3443 or COMP3234) | -            |
| 4     | ELEC4641 | Computer network security<br>(mutually exclusive with COMP3327)  | 6      | ELEC3443 or COMP3234                            | -            |
| 4     | ELEC4649 | Parallel computing   | 6      | ELEC3441  | -            |

**Group F: Complementary Studies**

| Level | Code     | Course Title                                   | Credit | Prerequisite | Co-requisite |
|-------|----------|--|--------|--------------|--------------|
| 2     | ELEC2840 | Engineering training                           | 6      | -            | -            |
| 2     | ELEC3840 | Internship                                     | 6      | -            | -            |
| 3     | ELEC3844 | Engineering management and society             | 6      | -            | -            |
| 3     | ELEC3845 | Economics, finance and marketing for engineers | 6      | -            | -            |

**Group G: Projects**

| Level | Code     | Course Title              | Credit | Prerequisite | Co-requisite |
|-------|----------|---------------------------|--------|--------------|--------------|
| 3     | ELEC3848 | Integrated design project | 6      | -            | -            |
| 4     | ELEC4848 | Senior design project     | 12     | -            | -            |

**Group H: General Engineering**

| Level | Code     | Course Title  | Credit | Prerequisite | Co-requisite |
|-------|----------|---|--------|--------------|--------------|
| 1     | ENGG1111 | Computer programming and applications                 | 6      | -            | -            |
| 1     | ENGG1201 | Engineering for sustainable development               | 6      | -            | -            |
| 1     | ENGG1202 | Introduction to computer science                      | 6      | -            | -            |
| 1     | ENGG1203 | Introduction to electrical and electronic engineering | 6      | -            | -            |
| 1     | ENGG1204 | Industrial management and logistics                   | 6      | -            | -            |
| 1     | ENGG1205 | Introduction to mechanical engineering                | 6      | -            | -            |
| 1     | ENGG1206 | Introduction to biomedical engineering                | 6      | -            | -            |
| 1     | PHYS1050 | Physics for Engineering students                      | 6      | -            | -            |

**Group I: Mathematics**

| Level | Code     | Course Title  | Credit | Prerequisite | Co-requisite |
|-------|----------|---|--------|--------------|--------------|
| 1     | MATH1851 | Calculus and ordinary differential equation                           | 6      |              |              |
| 1     | MATH1853 | Linear algebra, probability & statistics                              | 6      |              |              |
| 2     | COMP2121 | Discrete mathematics  | 6      |              |              |
| 2     | MECH2407 | Multivariable calculus and partial differential equations             | 6      |              |              |
| 3     | MECH3407 | Advanced partial differential equations & complex variables           |        |              |              |
| 3     | ELEC3846 | Numerical methods and optimization (mutually exclusive with COMP3407) | 6      |              |              |
| 3     | ELEC3847 | Probability and statistics in engineering                             | 6      | MECH2407     |              |
| 4     | ELEC4745 | Queueing theory   | 6      | ELEC3847     |              |

**Group J: Software and IT Applications**

| Level | Code     | Course Title  | Credit | Prerequisite                      | Co-requisite                     |
|-------|----------|---|--------|-----------------------------------|----------------------------------|
| 2     | COMP2119 | Introduction to data structures and algorithms (core: CE)                     | 6      | COMP1117 or ENGG1111              | COMP2123 (Pre- or Co-requisites) |
| 2     | COMP2123 | Programming technologies and tools (core: CE)                                 | 6      | COMP1117 or ENGG1111              | -                                |
| 2     | COMP2396 | Object-oriented programming and Java (mutually exclusive with ELEC2543)       | 6      | COMP1117 or ENGG1111              | -                                |
| 3     | COMP3230 | Principles of operating systems (mutually exclusive with ELEC3541) (core: CE) | 6      | COMP2123 & (COMP2120 or ELEC2441) | -                                |
| 3     | COMP3234 | Computer and communication  | 6      | COMP2120 or                       | -                                |

|   |          |  |   |   |   |
|---|----------|--|---|---|---|
|   |          | networks (mutually exclusive with ELEC3443) (core: CE)                             |   | ELEC2441  |   |
| 3 | COMP3235 | Compiling techniques   | 6 | COMP2119; and COMP2123                                | - |
| 3 | COMP3250 | Design and analysis of algorithms  | 6 | COMP2119 or ELEC2543 (Pre- or Co-requisites)          | - |
| 3 | COMP3258 | Functional programming   | 6 | COMP2121  |   |
| 3 | COMP3259 | Principles of programming languages  | 6 | COMP2119 & (COMP2120 or ELEC2441)                     | - |
| 3 | COMP3270 | Artificial intelligence  | 6 | COMP2119 or COMP2123                                  | - |
| 3 | COMP3271 | Computer graphics  | 6 | COMP2119 or COMP2123                                  | - |
| 3 | COMP3278 | Introduction to database management systems  | 6 | COMP2119 or ELEC2543                                  | - |
| 3 | COMP3297 | Introduction to software engineering (mutually exclusive with ELEC3541) (core: CE) | 6 | COMP2123  | - |
| 3 | COMP3311 | Legal aspects of computing   | 6 | COMP2123  | - |
| 3 | COMP3314 | Machine learning   | 6 | MATH1853; and COMP2119 or ELEC2543                    | - |
| 3 | COMP3315 | Multimedia computing and applications (mutually exclusive with ELEC4244)           | 6 | COMP2119  | - |
| 3 | COMP3317 | Computer vision  | 6 | COMP2119 or ELEC2543                                  | - |
| 3 | COMP3320 | Electronic commerce technology   | 6 | COMP3278  | - |
| 3 | COMP3322 | Modern technologies on World Wide Web (mutually exclusive with COMP3325)           | 6 | COMP1117 or ENGG1111                                  | - |
| 3 | COMP3323 | Advanced database systems  | 6 | COMP3278  | - |
|   |          |  |   |   | - |
| 3 | COMP3327 | Computer and network security (mutually exclusive with ELEC4641)                   | 6 | COMP3230 & COMP3234                                   | - |
| 3 | COMP3328 | Wireless and mobile communication  | 6 | COMP3234 & COMP2396                                   | - |
| 3 | COMP3329 | Computer game design and programming   | 6 | COMP3271  | - |
| 3 | COMP3330 | Interactive mobile application design and programming                              | 6 | COMP1117 or ENGG1002 or ENGG1111 or ENGG1112 COMP2396 |   |
| 3 | COMP3351 | Advanced algorithm analysis  | 6 | COMP3250  | - |
| 3 | COMP3402 | System architecture and distributed computing (mutually exclusive with             | 6 | COMP2396  | - |

|   |          |   |   |                                     |   |
|---|----------|---|---|-------------------------------------|---|
|   |          | ELEC3643)   |   |                                     |   |
| 3 | COMP3403 | Implementation, testing and maintenance of software systems | 6 | COMP2396 (Pre- or Co-requisite)     | - |
| 3 | COMP3404 | Software quality and project management                     | 6 | COMP3297                            | - |
| 3 | COMP3407 | Scientific computing (mutually exclusive with ELEC3846)     | 6 | (COMP1117 or ENGG1111) and COMP2121 | - |

# **INDUSTRIAL ENGINEERING AND TECHNOLOGY MANAGEMENT**

## **SYLLABUS**

The syllabus applies to students admitted in the academic year 2014-15 under the four-year curriculum.

### Definition and Terminology

Each course offered by the Department of Industrial and Manufacturing Systems Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Industrial and Manufacturing Systems Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Industrial Engineering and Technology Management that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (84 credits), comprising 30 credits of introductory core courses and 54 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 36 credits of discipline elective courses offered by the Department of Industrial and Manufacturing Systems Engineering.

#### Elective Courses

Students are required to complete 12 credits of elective courses offered by either the Department of Industrial and Manufacturing Systems Engineering, or other departments within or outside of the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9520 Technical English for Industrial and Manufacturing Systems Engineering”;
- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for Engineering Students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### Capstone Experience

Students are required to complete the 12-credit “IMSE4114 Project” to fulfill the capstone experience requirement for the degree of BEng in Industrial Engineering and Technology Management.

### Internship

Students are required to complete the 6-credit internship “IMSE3129 Internship”, which normally takes place after their third year of study.

### **Degree Classification**

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

### **The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Industrial Engineering and Technology Management) comprises 240 credits of courses with the following structure:

#### **UG 5 Requirements (54 credits)**

| Course Code                       | Course   | No. of credits |
|-----------------------------------|--|----------------|
| CAES1000                          | Core University English  | 6              |
| CAES9520                          | Technical English for Industrial and Manufacturing Systems Engineering | 6              |
| CENG9001                          | Practical Chinese for Engineering Students                             | 6              |
| CC##XXXX                          | University Common Core Course (6 courses)*                             | 36             |
| <b>Total for UG5 Requirements</b> |  | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### **General Engineering Courses (36 credits)**

| Course Code                                  | Course  | No. of credits |
|--|---|----------------|
| MATH1851                                     | Calculus and Ordinary Differential Equations  | 6              |
| MATH1853                                     | Linear Algebra, Probability & Statistics  | 6              |
| ENGG1111/<br>ENGG1112                        | Computer Programming and Applications/<br>Computer Programming and Applications I   | 6              |
| PHYS1050                                     | Physics for engineering students  | 6              |
| ENGG120#                                     | Any two of the General Engineering Courses offered by the Dept. of IMSE or other Departments of the Faculty of Engineering* | 12             |
| <b>Total for General Engineering Courses</b> |   | <b>36</b>      |

\*Choose two General Engineering Courses from the following list:

|          |   |
|----------|---|
| ENGG1201 | Engineering for sustainable development               |
| ENGG1202 | Foundation of computer science                        |
| ENGG1203 | Introduction to electrical and electronic engineering |
| ENGG1204 | Industrial management and logistics                   |
| ENGG1205 | Introduction to mechanical engineering                |
| ENGG1206 | Introduction to biomedical engineering                |
| ENGG1207 | Foundations of biochemistry for medical engineering   |

#### **Discipline Core Courses (84 credits)**

**Introductory Courses (30 credits)**

| Course Code   | Course  | No. of credits |
|---|---|----------------|
| IMSE2103  | Introduction to business and management                   | 6              |
| IMSE2109  | Fundamentals of engineering design                        | 6              |
| IMSE2121  | Engineering training                                      | 6              |
| IMSE2133  | Operational research techniques I                         | 6              |
| MECH2407  | Multivariable calculus and partial differential equations | 6              |
| <b>Total for Introductory Discipline Core Courses</b> |   | <b>30</b>      |

**Advanced Courses (54 credits)**

| Course Code                                       | Course                             | No. of credits |
|---|------------------------------------|----------------|
| IMSE3105  | Managerial accounting and finance  | 6              |
| IMSE3106  | Manufacturing technology           | 6              |
| IMSE3109  | Quality management                 | 6              |
| IMSE3125  | Integrative studies (IE Practice)  | 6              |
| IMSE3126  | Engineers in society               | 6              |
| IMSE3133  | Operational research techniques II | 6              |
| IMSE4101  | Computer integrated manufacturing  | 6              |
| IMSE4115  | Industrial systems integration     | 6              |
| IMSE4116  | Operational planning and control   | 6              |
| <b>Total for Advanced Discipline Core Courses</b> |                                    | <b>54</b>      |

**Capstone Experience and Internship (18 credits)**

| Course Code   | Course               | No. of credits |
|---|----------------------|----------------|
| IMSE4114  | Project <sup>+</sup> | 12             |
| IMSE3129  | Internship*          | 6              |
| <b>Total for Capstone Experience and Internship</b> |                      | <b>18</b>      |

+Capstone Experience

\*Training

**Discipline Elective Courses (36 credits)**

| Course Code | Course                                 | No. of credits |
|-------------|--|----------------|
| IMSE2112    | Engineering technology                 | 6              |
| IMSE2113    | Information systems                    | 6              |
| IMSE2114    | Product development                    | 6              |
| IMSE2116    | Fundamentals of business logistics     | 6              |
| IMSE2117    | Engineering systems analysis           | 6              |
| IMSE3101    | Supply chain design and development    | 6              |
| IMSE3103    | Systems automation                     | 6              |
| IMSE3107    | Systems modeling and simulation        | 6              |
| IMSE3116    | Internet technology for e-commerce     | 6              |
| IMSE3118    | Industrial organisation and management | 6              |
| IMSE3119    | Stochastic decision systems            | 6              |
| IMSE3127    | Facilities planning and design         | 6              |
| IMSE3128    | Human factors engineering              | 6              |
| IMSE4102    | Engineering project management         | 6              |
| IMSE4110    | Financial engineering                  | 6              |
| IMSE4118    | Advanced manufacturing technology      | 6              |



|   |   |           |
|---|---|-----------|
| IMSE4119  | Digital enterprises and e-commerce              | 6         |
| IMSE4120  | Technology marketing                            | 6         |
| IMSE4121  | Strategic management of business and technology | 6         |
| IMSE4128  | Innovation and entrepreneurship                 | 6         |
| IMSE4129  | Manufacturing system analysis and design        | 6         |
| <b>Complete six discipline elective courses for a total of 36 credits</b> |   | <b>36</b> |

Note: Course availability and electives are subject to change.

### **Elective Courses (12 credits)**

At least 12 credits of courses offered by either the Department of Industrial and Manufacturing Systems Engineering, or other departments within or outside of the Faculty of Engineering.

### **Summary of curriculum structure of BEng (Industrial Engineering and Technology Management)**

| <b>Course Categories</b>               | <b>No. of credits</b> |
|--|-----------------------|
| UG5 Requirements                       | 54                    |
| General Engineering Courses            | 36                    |
| Discipline Core Courses (Introductory) | 30                    |
| Discipline Core Courses (Advanced)     | 54                    |
| Capstone Experience and Internship     | 18                    |
| Discipline Elective Courses            | 36                    |
| Elective Courses                       | 12                    |
| <b>Total</b>                           | <b>240</b>            |

The proposed syllabus by study year is as follows:

### **FIRST YEAR**

#### **General Engineering Courses (36 credits)**

|           |   |
|-----------|---|
| MATH1851  | Calculus and Ordinary Differential Equations  |
| MATH1853  | Linear Algebra, Probability & Statistics  |
| ENGG1111/ | Computer Programming and Applications/  |
| ENGG1112  | Computer Programming and Applications I   |
| PHYS1050  | Physics for engineering students  |
| ENGG120X  | Any two of the General Engineering Courses offered by IMSE or other Departments of the Faculty of Engineering |

#### **University Requirements (UG5) (24 credits)**

|          |                           |
|----------|---------------------------|
| CAES1000 | Core University English   |
| CC##XXXX | Three Common Core Courses |

### **SECOND YEAR**

#### **Introductory Core Courses (30 credits)**

|          |   |
|----------|---|
| IMSE2103 | Introduction to business and management                   |
| IMSE2109 | Fundamentals of engineering design                        |
| IMSE2121 | Engineering training                                      |
| IMSE2133 | Operational research techniques I                         |
| MECH2407 | Multivariable calculus and partial differential equations |

**Discipline Elective Courses (6 credits)****University Requirements (UG5) (24 credits)**

CC##XXXX Three Common Core Courses

CAES9520 Technical English for Industrial and Manufacturing Systems Engineering

**THIRD YEAR****Advanced Core Courses (36 credits)**

IMSE3105 Managerial accounting and finance

IMSE3106 Manufacturing technology

IMSE3109 Quality management

IMSE3125 Integrative studies (IE Practice)

IMSE3126 Engineers in society

IMSE3133 Operational research techniques II

**Internship (6 credits)**

IMSE3129 Internship

**University Requirements (UG5) (6 credits)**

CENG9001 Practical Chinese for Engineering Students

**Discipline Elective Courses (12 credits)****FOURTH YEAR****Advanced Core Courses (18 credits)**

IMSE4101 Computer integrated manufacturing

IMSE4115 Industrial systems integration

IMSE4116 Operational planning and control

**Discipline Elective Courses (18 credits)****Capstone Experience (12 credits)**

IMSE4114 Project

**Elective Courses (12 credits)**

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# **LOGISTICS ENGINEERING AND SUPPLY CHAIN MANAGEMENT**

## **SYLLABUS**

The syllabus applies to students admitted in the academic year 2014-15 under the four-year curriculum.

### Definition and Terminology

Each course offered by the Department of Industrial and Manufacturing Systems Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Industrial and Manufacturing Systems Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Logistics Engineering and Supply Chain Management that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (84 credits), comprising 36 credits of introductory core courses and 48 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 36 credits of discipline elective courses offered by the Department of Industrial and Manufacturing Systems Engineering.

#### Elective Courses

Students are required to complete 12 credits of elective courses offered by either the Department of Industrial and Manufacturing Systems Engineering, or other departments within or outside of the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) 12 credits in English language enhancement, including 6 credits in “CAES1000 Core University English” and 6 credits in “CAES9520 Technical English for Industrial and Manufacturing Systems Engineering”;
- b) 6 credits in Chinese language enhancement course “CENG9001 Practical Chinese for Engineering Students”; and
- c) 36 credits of courses in the Common Core Curriculum, selecting not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### Capstone Experience

Students are required to complete the 12-credit “IMSE4124 Project” to fulfill the capstone experience requirement for the degree of BEng in Logistics Engineering and Supply Chain Management.

### Internship

Students are required to complete the 6-credit internship “IMSE3129 Internship”, which normally takes place after their third year of study.

### **Degree Classification**

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

### **The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Logistics Engineering and Supply Chain Management) comprises 240 credits of courses with the following structure:

#### **UG 5 Requirements (54 credits)**

| Course Code                       | Course   | No. of credits |
|-----------------------------------|--|----------------|
| CAES1000                          | Core University English  | 6              |
| CAES9520                          | Technical English for Industrial and Manufacturing Systems Engineering | 6              |
| CENG9001                          | Practical Chinese for Engineering Students                             | 6              |
| CC##XXXX                          | University Common Core Course (6 courses)*                             | 36             |
| <b>Total for UG5 Requirements</b> |  | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

#### **General Engineering Courses (36 credits)**

| Course Code                                  | Course  | No. of credits |
|--|---|----------------|
| MATH1851                                     | Calculus and Ordinary Differential Equations  | 6              |
| MATH1853                                     | Linear Algebra, Probability & Statistics  | 6              |
| ENGG1111/<br>ENGG1112                        | Computer Programming and Applications/<br>Computer Programming and Applications I   | 6              |
| PHYS1050                                     | Physics for engineering students  | 6              |
| ENGG120#                                     | Any two of the General Engineering Courses offered by the Dept. of IMSE or other Departments of the Faculty of Engineering* | 12             |
| <b>Total for General Engineering Courses</b> |   | <b>36</b>      |

\*Choose two General Engineering Courses from the following list:

|          |   |
|----------|---|
| ENGG1201 | Engineering for sustainable development               |
| ENGG1202 | Foundation of computer science                        |
| ENGG1203 | Introduction to electrical and electronic engineering |
| ENGG1204 | Industrial management and logistics                   |
| ENGG1205 | Introduction to mechanical engineering                |
| ENGG1206 | Introduction to biomedical engineering                |
| ENGG1207 | Foundations of biochemistry for medical engineering   |

#### **Discipline Core Courses (84 credits)**

**Introductory Courses (36 credits)**

| Course Code   | Course  | No. of credits |
|---|---|----------------|
| IMSE2103  | Introduction to business and management                   | 6              |
| IMSE2109  | Fundamentals of engineering design                        | 6              |
| IMSE2116  | Fundamentals of business logistics                        | 6              |
| IMSE2121  | Engineering training                                      | 6              |
| IMSE2133  | Operational research techniques I                         | 6              |
| MECH2407  | Multivariable calculus and partial differential equations | 6              |
| <b>Total for Introductory Discipline Core Courses</b> |   | <b>36</b>      |

**Advanced Courses (48 credits)**

| Course Code                                       | Course                                   | No. of credits |
|---|--|----------------|
| IMSE3101  | Supply chain design and development      | 6              |
| IMSE3121  | Transportation and distribution planning | 6              |
| IMSE3126  | Engineers in society                     | 6              |
| IMSE3133  | Operational research techniques II       | 6              |
| IMSE3135  | Integrative studies (LSC Practice)       | 6              |
| IMSE4116  | Operational planning and control         | 6              |
| IMSE4122  | Global logistics systems                 | 6              |
| IMSE4125  | Logistics systems integration            | 6              |
| <b>Total for Advanced Discipline Core Courses</b> |  | <b>48</b>      |

**Capstone Experience and Internship (18 credits)**

| Course Code   | Course               | No. of credits |
|---|----------------------|----------------|
| IMSE4124  | Project <sup>+</sup> | 12             |
| IMSE3129  | Internship*          | 6              |
| <b>Total for Capstone Experience and Internship</b> |                      | <b>18</b>      |

+Capstone Experience

\*Training

**Discipline Elective Courses (36 credits)**

| Course Code | Course                                 | No. of credits |
|-------------|--|----------------|
| IMSE2112    | Engineering technology                 | 6              |
| IMSE2113    | Information systems                    | 6              |
| IMSE2114    | Product development                    | 6              |
| IMSE2117    | Engineering systems analysis           | 6              |
| IMSE3103    | Systems automation                     | 6              |
| IMSE3105    | Managerial accounting and finance      | 6              |
| IMSE3107    | Systems modeling and simulation        | 6              |
| IMSE3109    | Quality management                     | 6              |
| IMSE3116    | Internet technology for e-commerce     | 6              |
| IMSE3118    | Industrial organisation and management | 6              |
| IMSE3119    | Stochastic decision systems            | 6              |
| IMSE3120    | Purchasing and supply management       | 6              |
| IMSE3127    | Facilities planning and design         | 6              |
| IMSE3128    | Human factors engineering              | 6              |
| IMSE4101    | Computer integrated manufacturing      | 6              |
| IMSE4102    | Engineering project management         | 6              |

|   |   |           |
|---|---|-----------|
| IMSE4110  | Financial engineering                           | 6         |
| IMSE4119  | Digital enterprises and e-commerce              | 6         |
| IMSE4120  | Technology marketing                            | 6         |
| IMSE4121  | Strategic management of business and technology | 6         |
| IMSE4123  | Warehousing and terminal operations             | 6         |
| IMSE4128  | Innovation and entrepreneurship                 | 6         |
| <b>Complete six discipline elective courses for a total of 36 credits</b> |   | <b>36</b> |

Note: Course availability and electives are subject to change.

### **Elective Courses (12 credits)**

At least 12 credits of courses offered by either the Department of Industrial and Manufacturing Systems Engineering, or other departments within or outside of the Faculty of Engineering.

### **Summary of curriculum structure of BEng (Logistics Engineering and Supply Chain Management)**

| <b>Course Categories</b>               | <b>No. of credits</b> |
|--|-----------------------|
| UG5 Requirements                       | 54                    |
| General Engineering Courses            | 36                    |
| Discipline Core Courses (Introductory) | 36                    |
| Discipline Core Courses (Advanced)     | 48                    |
| Capstone Experience and Internship     | 18                    |
| Discipline Elective Courses            | 36                    |
| Elective Courses                       | 12                    |
| <b>Total</b>                           | <b>240</b>            |

The proposed syllabus by study year is as follows:

### **FIRST YEAR**

#### **General Engineering Courses (36 credits)**

|           |   |
|-----------|---|
| MATH1851  | Calculus and Ordinary Differential Equations  |
| MATH1853  | Linear Algebra, Probability & Statistics  |
| ENGG1111/ | Computer Programming and Applications/  |
| ENGG1112  | Computer Programming and Applications I   |
| PHYS1050  | Physics for engineering students  |
| ENGG120X  | Any two of the General Engineering Courses offered by IMSE or other Departments of the Faculty of Engineering |

#### **University Requirements (UG5) (24 credits)**

|          |                                      |
|----------|--------------------------------------|
| CAES1000 | Core University English              |
| CC##XXXX | Three Common Core Curriculum Courses |

### **SECOND YEAR**

#### **Introductory Core Courses (36 credits)**

|          |   |
|----------|---|
| IMSE2103 | Introduction to business and management |
| IMSE2109 | Fundamentals of engineering design      |
| IMSE2116 | Fundamentals of business logistics      |
| IMSE2121 | Engineering training                    |
| IMSE2133 | Operational research techniques I       |

MECH2407          Multivariable calculus and partial differential equations

**University Requirements (UG5) (24 credits)**

CC##XXXX          Three Common Core Courses

CAES9520          Technical English for Industrial and Manufacturing Systems Engineering

**THIRD YEAR**

**Advanced Core Courses (30 credits)**

IMSE3101          Supply chain design and development

IMSE3121          Transportation and distribution planning

IMSE3126          Engineers in society

IMSE3133          Operational research techniques II

IMSE3135          Integrative studies (LSC Practice)

**Internship (6 credits)**

IMSE3129          Internship

**University Requirements (UG5) (6 credits)**

CENG9001          Practical Chinese for Engineering Students

**Discipline Elective Courses (18 credits)**

**FOURTH YEAR**

**Advanced Core Courses (18 credits)**

IMSE4116          Operational planning and control

IMSE4122          Global logistics systems

IMSE4125          Logistics systems integration

**Discipline Elective Courses (18 credits)**

**Capstone Experience (12 credits)**

IMSE4124          Project

**Elective Courses (12 credits)**

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**Minor in Industrial Engineering and Technology Management**  
**[not eligible for BEng(IETM) and BEng(LESCM) students]**

Candidates who are interested in pursuing minor in Industrial Engineering and Technology Management must satisfy the following prerequisites:

- Level 3 or above in Mathematics and
- Level 3 or above in Physics or Combined Science with Physics component in the Hong Kong Diploma in Secondary Education (HKDSE) Examination

Candidates are required to complete a total of 36 credits of courses in the following manner:

| <u>Code</u>  | <u>Course Name</u>                | <u>Credits</u> |
|--|-----------------------------------|----------------|
| <i>(i) 12 credits of core courses</i>  |                                   |                |
| IMSE3107   | Systems modeling and simulation   | 6              |
| IMSE3127   | Facilities planning and design    | 6              |
| <i>(ii) 24 credits of discipline elective courses selected from the following:</i> |                                   |                |
| IMSE2114   | Product development               | 6              |
| IMSE2133   | Operational research techniques I | 6              |
| IMSE3105   | Management accounting and finance | 6              |
| IMSE3126   | Engineers in society              | 6              |
| IMSE4101   | Computer integrated manufacturing | 6              |

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**Minor in Logistics Engineering and Supply Chain Management**  
**[not eligible for BEng(IETM) and BEng(LESCM) students]**

Candidates who are interested in pursuing minor in Industrial Engineering and Technology Management must satisfy the following prerequisites:

- Level 3 or above in Mathematics and
- Level 3 or above in Physics or Combined Science with Physics component in the Hong Kong Diploma in Secondary Education (HKDSE) Examination

Candidates are required to complete a total of 36 credits of courses in the following manner:

| <u>Code</u>  | <u>Course Name</u>                       | <u>Credits</u> |
|--|--|----------------|
| <i>(i) 12 credits of core courses</i>  |  |                |
| IMSE3101   | Supply chain design and development      | 6              |
| IMSE3107   | Systems modeling and simulation          | 6              |
| <i>(ii) 24 credits of discipline elective courses selected from the following:</i> |  |                |
| IMSE2133   | Operational research techniques I        | 6              |
| IMSE3105   | Management accounting and finance        | 6              |
| IMSE3121   | Transportation and distribution planning | 6              |
| IMSE3126   | Engineers in society                     | 6              |
| IMSE4119   | Digital enterprises and e-commerce       | 6              |

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## **COURSE DESCRIPTIONS**

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

### **General Engineering Courses**

|          |   |
|----------|---|
| ENGG1111 | Computer programming (6 credits) or                                   |
| ENGG1112 | Computer programming I (6 credits)                                    |
| MATH1851 | Calculus and Ordinary Differential Equations (6 credits)              |
| MECH2407 | Multivariable calculus and partial differential equations (6 credits) |
| MATH1853 | Linear Algebra, Probability & Statistics (6 credits)                  |
| PHYS1050 | Physics for engineering students (6 credits)                          |
| ENGG1201 | Engineering for sustainable development (6 credits)                   |
| ENGG1202 | Foundation of computer science (6 credits)                            |
| ENGG1203 | Introduction to electrical and electronic engineering (6 credits)     |
| ENGG1204 | Industrial management and logistics (6 credits)                       |
| ENGG1205 | Introduction to mechanical engineering (6 credits)                    |
| ENGG1206 | Introduction to biomedical engineering (6 credits)                    |
| ENGG1207 | Foundations of biochemistry for medical engineering (6 credits)       |

Please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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### **University Requirements on Language Enhancement Courses**

- CAES1000. Core University English (6 credits)**  
**CENG9001. Practical Chinese for engineering students (6 credits)**

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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### **CAES9520. Technical English for Industrial and Manufacturing Systems Engineering (6 credits)**

This 6-credit English-in-the-Discipline course will introduce IMSE students to professional and technical communication in the context of oral presentation and report writing. The course will provide an intensive English environment and engage students in activities which help them prepare for the completion of the assessments required by the discipline course titled “IMSE2103 Introduction to business and management”. Assessment is wholly by coursework.

Co-requisite: IMSE2103 Introduction to Business and Management

Assessment: 100% continuous assessment

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### **University Common Core Curriculum**

36 credits of courses in the University Common Core Curriculum, in which students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study:

- Scientific and Technology Literacy

- Humanities
  - Global Issues
  - China: Culture, State and Society
- 

**IMSE2103. Introduction to business and management (6 credits)**

Business of production; business environment, globalization, the positions of Hong Kong and China; marketing and distribution; the firm and the customer; the firm and its suppliers; finance and the firm; costs of production; human resource management; introduction to manufacturing systems; management and integration; the engineer in society, professional ethics; development of technology and interaction between societies and technology, intellectual property; the environment and safety.

Assessment: 30% continuous assessment, 70% examination

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**IMSE2109. Fundamentals of engineering design (6 credits)**

Visualization of technical information; application of CAD software to prepare product design models and drawings; principles of engineering graphics: orthographic projections, isometric views, auxiliary views, sectioning, dimensioning and tolerancing; assembly modelling and drawing; design of components; general principles of product and tool design.

Assessment: 100% continuous assessment

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**IMSE2112. Engineering technology (6 credits)**

Kinematics and dynamics of rigid bodies, centre of percussion, design for reduction of impact stress; analysis, simulation and applications of 4-bar mechanisms, velocity diagram and instantaneous centre of rotation; Geneva mechanism, gear train and motion transmission; analysis and applications of simple harmonic motion, damping of vibrations; fundamental electrical circuit analysis; alternating current electricity, AC circuits and phasors.

Assessment: 20% continuous assessment, 80% examination

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**IMSE2113. Information systems (6 credits)**

Information systems; the strategic role of information technology; data communications and networking; online databases and their applications; development and implementation of information systems.

Assessment: 60% continuous assessment, 40% examination

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**IMSE2114. Product development (6 credits)**

Organisation and management, performance measurement; market research, product design specification, product safety, product and the environment, concept generation and selection, design review and improvements; product appraisal from functional, ergonomic and aesthetic, manufacturing and economical aspects; design theory and methodology, information / literature search.

Assessment: 40% continuous assessment, 60% examination

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**IMSE2116. Fundamentals of business logistics (6 credits)**

Definition, importance and objectives of business logistics; transport fundamentals and transport decisions; storage and handling systems and decisions; inventory policies; forecasting logistics requirements; facility location analysis; network planning process; purchasing scope and objectives; purchasing structure and organisation; purchasing variables – price, time and quality; buying commodities; buying capital goods; buying services; purchasing systems.

Assessment: 20% continuous assessment, 80% examination

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**IMSE2117. Engineering systems analysis (6 credits)**

Fundamental and elements of engineering system; system analysis and design principles; structured system analysis and design method (SSADM), object-oriented analysis and design (OOAD); applications of SSADM and OOAD for engineering system development.

Assessment: 20% continuous assessment, 80% examination

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**IMSE2121. Engineering training (6 credits)**

Metal work, manufacturing practice, practical networking, computing practice, design practice, plastic processing, metrology, CNC programming and CAD/CAM, electronics, work study.

Assessment: 100% practical work

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**IMSE2133. Operational research techniques I (6 credits)**

Random samples and sampling distributions; parameter estimation and hypothesis testing; analysis of variance; linear and logistic regression; support vector machine; reliability engineering; statistical quality control; design of experiments; application examples in industrial and logistics engineering.

Prerequisite: MATH1851 Calculus and ordinary differential equations or  
MATH1853 Linear algebra, probability & statistics

Assessment: 10% continuous assessment, 90% examination

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**IMSE3101. Supply chain design and development (6 credits)**

Supply chain overview; operating objectives; barriers to internal integration; supply chain performance cycles; logistics positioning; supply chain environmental assessment; time-based supply chains; information flow; alternative supply chain strategies; supply chain integration theory; logistics location structure; warehouse location patterns; transportation economies; inventory economies; least total cost design; formulating supply chain strategy; planning and design supply chain methodology; supply chain administration and dimensions of change management.

Prerequisite: IMSE2116 Fundamentals of business logistics  
Assessment: 20% continuous assessment, 80% examination

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### **IMSE3103. Systems automation (6 credits)**

Fundamental of systems automation; basic components of system automation for services and manufacturing industries; electric, pneumatic/hydraulic systems, automation systems design, open-loop and closed-loop control; system performance analysis, analogue and digital control systems; introduction to robotics and the application of robots in industry; artificial intelligence and their roles and applications in system automation.

Prerequisite: MATH1851 Calculus and ordinary differential equations (6 credits)

Assessment: 30% continuous assessment, 70% examination

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### **IMSE3105. Managerial accounting and finance (6 credits)**

Cost accounting - procedures; direct costs, absorption costing; marginal costing. Planning and control – activity-based costing systems; standard costing systems; capital expenditure and investment; health, safety and environmental aspects of company activities; contemporary issues in management accounting; financial accounting - accounting rules; basic financial accounts; manufacturing accounts; company account; financial performance – ratio analysis; interpretation of accounting data.

Prerequisite: IMSE2103 Introduction to business and management

Assessment: 30% continuous assessment, 70% examination

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### **IMSE3106. Manufacturing technology (6 credits)**

Introduction to manufacturing, safety in manufacturing, manufacturing and the environment; metrology, measuring standards, limits and fits, geometrical tolerances, limit gauging, surface texture; casting processes, pattern and gating, permanent and non-permanent moulds; forming processes, principles of bulk deformation and sheet metal working; joining processes, fastening, liquid and solid states welding, powder metallurgy; machining processes, cutting and grinding operations, non-traditional machining, cutting conditions; plastics materials and processing.

Assessment: 40% continuous assessment and 60% examination

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### **IMSE3107. Systems modeling and simulation (6 credits)**

Basic concepts of modelling and simulation; discrete-event simulation techniques; introduction to computer-aided simulation and the use of simulation packages; methodology of simulation study of industrial systems; model development for industrial systems, analysis of systems; model validation and verification; analysis of simulation results, case studies of industrial and manufacturing systems using discrete event simulations.

Assessment: 60% continuous assessment, 40% examination

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### **IMSE3109. Quality management (6 credits)**

Total quality management; management tools for quality; benchmarking; quality assurance management systems; ISO9000 series; national quality awards; design of industrial experiments; statistical process control; control charts; acceptance sampling; environmental management; ISO14000 series; environmental management systems; business process reengineering; customer services quality.

Assessment: 30% continuous assessment, 70% examination

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**IMSE3116. Internet technology for e-commerce (6 credits)**

Overview of e-Business and e-Commerce; Electronic Business Solutions (EBS) and technology; roles and applications of e-business solutions; design and development of e-business systems;; adoption and implementation: internet programming, web-based system development, online database design and implementation.

Assessment: 60% continuous assessment and 40% examination

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**IMSE3118. Industrial organisation and management (6 credits)**

Managing and managers; evolution of management theory; planning - decision making; strategic management; strategy implementation, strategic management; organising - organisational design and structure; power and the distribution of authority; managing organisational change and innovation; leading – motivation, leadership, teams and teamwork; controlling, principles of effective control, operations control.

Prerequisite: IMSE2103 Introduction to business and management

Assessment: 40% continuous assessment, 60% examination

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**IMSE3119. Stochastic decision systems (6 credits)**

Decision analysis: decision making under uncertainty, axioms of decision analysis, methodology of decision analysis, analytical hierarchy approach, quantification of judgemental uncertainties, assessing utilities, and group decision problems; game theory and gaming: extensive and normal forms, zero-sum two-person games, two-persons nonzero-sum games, n-persons games, teaching and training and operational gaming; stochastic processes: random walks, recurrent events, Markov chains, and renewal-processes.

Prerequisite: MATH1851 Calculus and ordinary differential equations and  
MATH1853 Linear algebra, probability & statistics

Assessment: 30% continuous assessment, 70% examination

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**IMSE3120. Purchasing and supply management (6 credits)**

Introduction of purchasing function/process; quality management for goods and service; sourcing and market analysis; make-or-buy decisions and subcontracting ; negotiation; controlling price and costs; vendor selection; commodity buying; service buying; capital buying; strategic purchasing; e-procurement and public procurement

Assessment: 40% continuous assessment, 60% examination

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**IMSE3121. Transportation and distribution planning (6 credits) [for BEng(LESCM)]**

The evolution of transportation management; traffic management; transportation alternatives and technologies; transportation infrastructure; transportation performance analysis; total transportation cost analysis; fleet development and management; fleet performance indicators; routing and scheduling;

shipment planning; containerisation-alternatives and selection criteria; mode selection criteria; transportation management and information systems requirements; international transportation strategies; implementation organisational issues.

Prerequisite: IMSE2116 Fundamentals of business logistics  
Assessment: 30% continuous assessment, 70% examination

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### **IMSE3125. Integrative studies (IE practice) (6 credits)**

To develop students in the areas of technical literature survey, analysis and assimilation of materials, skills of written and oral presentation, composition and implementation of ideas, communication and interactive skills through student and product centred activities, interactive and project-based learning.

The major element of the module is a group project on the product and manufacturing system design of a manufactured product. The group project is to integrate the applications of various topics including: project management; product life-cycle management; manufacturing logistics; cost accounting; scheduling; process planning and workflow; human factors; distribution and marketing.

Assessment: 100% continuous assessment

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### **IMSE3126. Engineers in society (6 credits)**

Economic, industrial and social context of engineering; responsibilities of professional engineers, the legal, environmental, economical and ethical roles of engineers in society, judgment and decision process based on non-technical aspects such as financial, environmental and cultural considerations, meeting with professional engineers from the industrial and logistics sectors.

Assessment: 40% continuous assessment, 60% examination

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### **IMSE3127. Facilities planning and design (6 credits)**

Plant location problem; advanced techniques in plant layout design, computer-based layout planning, and quantitative approaches; materials handling, storage and warehousing for global manufacturing; lean manufacturing, cellular manufacturing, one-piece flow; workplace design in the information age; digital factory; fire safety and security; study cases drawn from the manufacturing and service industries.

Assessment: 30% continuous assessment, 70% examination

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### **IMSE3128. Human factors engineering (6 credits)**

Human-organization interaction; human-machine interface usability and design; workplace safety and health; applied anthropometry and biomechanics; physical work and manual material handling; workplace and environmental design, illumination, noise, thermal; information processing; display and control; skills and learning; job design and shift work.

Assessment: 40% continuous assessment, 60% examination

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### **IMSE3129      Internship (6 credits)**

An internship in an appropriate industry six to twelve weeks duration. All Year 3 students must undergo a 6 to 12-week Internship in the summer immediately after the second semester of Level 3 studies ends. Most students undergo Internships in services or manufacturing companies in Hong Kong or China. The content of such on-the-job training may include engineering design and modification, installation, repairing, computation, programming, site inspection, measurement, quality assurance, warehouse management, etc. In some companies, the training programmes are project-orientated and often predetermined. The Internship is an important part of this 4-year BEng programme, as it gives students an opportunity to gain practical experience in industry and to develop their professional skills.

At the end of the training period, all the sponsoring organisations will complete an appraisal form on the trainees' performance. Students must submit a report after the training, and assessments are based on both the training logbook and performance appraisal.

Assessment:      100% practical work

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### **IMSE3133.      Operational research techniques II (6 credits)**

Formulation of linear programming; Geometry of linear programming; Simplex method; Sensitivity analysis; Duality theory; Formulation of integer programming; Branch-and-bound; Network flow; Application of queueing models; Poisson process; Birth-and-death process; M/M/1 queue; M/M/k queue

Prerequisite:      MATH1851 Calculus and ordinary differential equations or  
MATH1853 Linear algebra, probability & statistics

Assessment:      30% continuous assessment and 70% examination

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### **IMSE3135.      Integrative studies (LSC practice) (6 credits)**

To develop students in the areas of technical literature survey, analysis and assimilation of materials, skills of written and oral presentation, composition and implementation of ideas, communication and interactive skills through student and product centred activities, interactive and project-based learning.

The major element of the module is a group project on the design of a logistic system or a logistic-related product or service. The group project is to integrate the applications of various topics including: project management; product life-cycle management; business logistics; cost accounting; scheduling; transportation planning; material handling; workflow design; human factors; distribution and marketing.

Assessment:      100% continuous assessment

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### **IMSE4101.      Computer integrated manufacturing (6 credits)**

Overview of Computer Integrated Manufacturing (CIM) system and CAD/CAM functions; geometric modelling in CAD - principles of surface and solid modelling; CNC applications in CAM; computer aided process planning, automated process planning; rapid and virtual manufacturing; CAD and CAM integration.

Prerequisite:      IMSE2109 Fundamentals of engineering design and  
IMSE3125 Integrative studies (IE practice) or

IMSE3135 Integrative studies (LSC practice)  
Assessment: 30% continuous assessment, 70% examination

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**IMSE4102. Engineering project management (6 credits)**

Fundamentals of engineering project management; project environment; project evaluation; risk management process; project selection and proposal preparation; project scheduling and contingency setting and control; control of variation and claims; project management methodologies and techniques, change management; multi-criteria decision making process; analytic hierarchy process; PERT/GANTT techniques for project control and resources allocation; simulation of critical paths; case studies.

Co-requisite: IMSE2133 Operational research techniques I  
Assessment: 30% continuous assessment, 70% examination

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**IMSE4110. Financial engineering (6 credits)**

Financial markets and financial securities, portfolio management and investment strategies; international finance, foreign exchange markets; project evaluation and financing, present value, cost of capital, cost-benefit ratio and internal rates of return; financial instruments, forwards, futures; swaps, options and hedging strategies; foreign trade and investment in China.

Prerequisite: IMSE3105 Managerial accounting and finance  
Assessment: 30% continuous assessment, 70% examination

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**IMSE4114. Project (12 credits)**

A dissertation or report on a topic consisting of design, experimental or analytical investigation in the field of industrial engineering and technology management.

Assessment: 100% continuous assessment

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**IMSE4115. Industrial systems integration (6 credits)**

Student-centred learning on system integration and analysis and evaluation of system performance.

The module covers the application of techniques as follows:

Business analysis and decision making process; industrial modelling and simulation; layout planning; project management, strategic management; industry analysis; value chain analysis and critical success factors.

Assessment: 100% continuous assessment

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**IMSE4116. Operations planning and control (6 credits)**

The use of operations planning and control systems in forecasting, scheduling and inventory control; functions and organisation of production and inventory control systems; demand forecasting; deterministic and stochastic inventory control problems; aggregate production planning; master production scheduling; requirements and capacity planning systems; operations scheduling and control



of production systems; Just-In-Time techniques; balancing of assembly lines; information reporting and processing; supply chain management.

Prerequisite: IMSE2133 Operational research techniques I  
Assessment: 20% continuous assessment, 80% examination

---

#### **IMSE4118. Advanced manufacturing technology (6 credits)**

Metal cutting and machining, analysis of cutter geometry and materials; mechanics of cutting, tool wear and tool life, cutting optimization, analysis of milling, grinding, EDM, ECM, LBM; analysis of metal forming processes; engineering plasticity, Upper-Bound Theorem, CAD/CAM for mould and dies, rapid prototyping technologies; melt rheology, temperature and pressure effects, viscosity, mixing systems, polymeric materials, analysis of injection, extrusion, mould and die design.

Prerequisite: IMSE3106 Manufacturing technology  
Assessment: 20% continuous assessment, 80% examination

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#### **IMSE4119. Digital enterprises and e-commerce (6 credits)**

Enterprise resource management; EDI applications; data mining and warehousing; virtual enterprises; advanced Internet and web applications in product development, industrial applications of virtual reality; electronic product and component cataloguing; cryptographic systems; capability maturity model; social accountability standard; E-commerce business models; technological, business planning and social issues of E-commerce; order taking and processing; electronic payment systems, smart cards.

Prerequisite: IMSE3116 Internet technology for e-commerce or  
IMSE2113 Information systems or  
ENGG1111 Computer programming and applications or  
ENGG1112 Computer programming and applications I  
Assessment: 50% continuous assessment, 50% examination

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#### **IMSE4120. Technology marketing (6 credits)**

Customer relationships and value, marketing strategies and plans, marketing environment, ethical and social responsibility in marketing, marketing mix, marketing research and forecasting, marketing segmentation and positioning, technology trend, distribution channels, intellectual property, e-marketing.

Prerequisite: IMSE2103 Introduction to business and management  
Assessment: 30% continuous assessment, 70% examination

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#### **IMSE4121. Strategic management of business and technology (6 credits)**

Analysis of the external environment and industry clusters for local industries – threats and opportunities from government policies as well as the legal, economic, social and technological environment; competitive forces from industry rivals, customers and other sources; analysis of internal weaknesses and strengths – resources, competences and success factors; mission and strategic intent; strategic directions and methods – conditions and implications; implementing and evaluating strategic changes; management for technology innovation.

Prerequisite: IMSE2103 Introduction to business and management  
Assessment: 30% continuous assessment, 70% examination

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#### **IMSE4122. Global logistics systems (6 credits)**

Global operations and logistics strategies, strategic changes required by globalisation, the strategic framework for integrating 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, foreign exchange risk management in global operations; operations analysis of global supply chains, information management for global logistics, performance measurement and evaluation in global logistics.

Prerequisite: IMSE3101 Supply chain design and development  
Assessment: 20% continuous assessment, 80% examination

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#### **IMSE4123. Warehousing and terminal operations (6 credits)**

Introduction to warehousing; material handling technologies, MH principles, container and unitizing equipment, storage and retrieval equipment, AS/RS, material transport equipment, automatic data collection and communication equipment, packaging; warehouse management system, receiving, cycle counting, order processing, picking, replenishment, shipping; warehouse planning and design: simulation model and software; design procedures.

Introduction to container terminal and air cargo terminal, basic operation flow at ship, quay, container yard, gate and CFS, container handling equipment and operation modes organization structure of a terminal and its various functions, container ship structure and generations, terminal management system, terminal planning and design methodology and analysis tools.

Prerequisite: IMSE2116 Fundamentals of business logistics  
Assessment: 25% continuous assessment, 75% examination

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#### **IMSE4125. Logistics systems integration (6 credits)**

Student-centred learning on system integration and analysis and evaluation of logistics system performance. The module is based on case studies and covers the application of various techniques as follows:

Facility location analysis; network planning process; warehouse design and management; logistics information management; supply chain performance analysis; alternative supply chain strategies; vehicle routing and scheduling; systems modelling and simulation; customer-supplier relationship; international transportation strategies.

Assessment: 100% continuous assessment

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#### **IMSE4128. Innovation and entrepreneurship (6 credits)**

Entrepreneurship in the new world economy, developments in the Pacific region and Greater China; general characteristics of entrepreneurs; enterprise formation, organizational structure, new economy business models; enterprise resources, business plan, venture capital; technological growth; environmental and contingency factors; case studies. Skill workshops: identifying strengths and

improving skills; organising yourself and your time; communication; systematic problem solving; group work; negotiating and assertiveness; coping with pressure; leadership.

Assessment: 30% continuous assessment, 70% examination

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**IMSE4129. Manufacturing system analysis and design (6 credits)**

Types of manufacturing systems; modelling and analysis of manufacturing systems, material flow analysis, assembly line balancing, discrete-event simulation; stochastic modelling: Markov chains, central server model, network of queues; factory physics, effects of variability on performance; competitive manufacturing: just-in-time production, quick-response manufacturing; advanced manufacturing systems, group technology, flexible manufacturing systems, holonic manufacturing.

Prerequisite: IMSE2133 Operational research techniques I

Assessment: 30% continuous assessment, 70% examination

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# **MECHANICAL ENGINEERING**

## **SYLLABUS**

The syllabus applies to students admitted in the academic year 2014-2015 under the four-year curriculum.

### Definition and Terminology

Each course offered by the Department of Mechanical Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Mechanical Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Mechanical Engineering that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to complete at least 36 credits of General Engineering Course.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (78 credits), comprising 36 credits of introductory core courses and 42 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 42 credits of discipline elective courses offered by the Department of Mechanical Engineering.

#### Elective Courses

Students are required to complete 12 credits of elective courses offered by other departments within or outside the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) Two English language courses, “CAES1000 Core University English” and “CAES 9543 Technical English for mechanical and building services engineering”, for a total of 12 credits;
- b) One Chinese language enhancement course “CENG9001 Practical Chinese for engineering students”, for a total of 6 credits; and
- c) 36 credits of courses in the Common Core Curriculum, selecting at least one but no more than two courses from each Area of Inquiry.

#### Capstone Experience

Students are required to complete the 12-credit Integrated capstone experience to fulfill the capstone experience requirement for the degree of BEng in Mechanical Engineering.

#### Engineering Training

Students are required to complete the 6-credit Engineering Training which normally takes place in the summer semester after their second year of study.

## Degree Classification

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of the Regulations for the Degree of Bachelor of Engineering and UG9 of the Regulations for the First Degree Curricula.

**The details of the distribution of the above course categories are as follows:**

The curriculum of BEng in Mechanical Engineering comprises 240 credits of courses with the following structure:

### UG 5 Requirements (54 credits)

| Course Code                       | Course   | No. of credits |
|-----------------------------------|--|----------------|
| CAES1000                          | Core University English  | 6              |
| CAES9543                          | Technical English for mechanical and building services engineering | 6              |
| CENG9001                          | Practical Chinese for engineering students                         | 6              |
| CC##XXXX                          | University common core course (6 courses)*                         | 36             |
| <b>Total for UG5 Requirements</b> |  | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study.

### General Engineering Courses (36 credits)

| Course Code                                  | Course   | No. of credits |
|--|--|----------------|
| MATH1851                                     | Calculus and ordinary differential equations   | 6              |
| MATH1853                                     | Linear algebra, probability & statistics   | 6              |
| ENGG1111                                     | Computer programming and applications<br>(or the equivalent course ENGG1112 Computer programming and applications I) | 6              |
| PHYS1050                                     | Physics for engineering students   | 6              |
| ENGG1205                                     | Introduction to mechanical engineering   | 6              |
| ENGG120X                                     | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering*               | 6              |
| <b>Total for General Engineering Courses</b> |  | <b>36</b>      |

\*Choose one General Engineering Course from the following list:

|          |   |
|----------|---|
| ENGG1201 | Engineering for sustainable development               |
| ENGG1202 | Introduction to computer science                      |
| ENGG1203 | Introduction to electrical and electronic engineering |
| ENGG1204 | Industrial management and logistics                   |
| ENGG1206 | Introduction to biomedical engineering                |

### Discipline Core Courses (78 credits)

#### *Introductory Courses (36 credits)*

| Course Code | Course  | No. of credits |
|-------------|---|----------------|
| MECH2404    | Drawing and elements of design and manufacture            | 6              |
| MECH2406    | Fundamentals of electrical engineering                    | 6              |
| MECH2407    | Multivariable calculus and partial differential equations | 6              |
| MECH2413    | Engineering mechanics                                     | 6              |
| MECH2414    | Thermofluids  | 6              |

|   |                         |           |
|---|-------------------------|-----------|
| MECH2419  | Properties of materials | 6         |
| <b>Total for Introductory Discipline Core Courses</b> |                         | <b>36</b> |

**Advanced Courses (42 credits)**

| Course Code                                       | Course   | No. of credits |
|---|--|----------------|
| MECH3402  | Engineering thermodynamics                                   | 6              |
| MECH3407  | Advanced partial differential equation and complex variables | 6              |
| MECH3408  | Mechanics of fluids  | 6              |
| MECH3409  | Mechanics of solids  | 6              |
| MECH3418  | Dynamics and control   | 6              |
| MECH3427  | Design and manufacture                                       | 6              |
| MECH4410  | Engineering & technology management                          | 6              |
| <b>Total for Advanced Discipline Core Courses</b> |  | <b>42</b>      |

**Capstone Experience and Engineering Training (18 credits)**

| Course Code   | Course                                  | No. of credits |
|---|---|----------------|
| MECH2418  | Engineering training* (Summer semester) | 6              |
| MECH4429  | Integrated capstone experience+         | 12             |
| <b>Total for Capstone Experience and Engineering Training</b> |   | <b>18</b>      |

+Capstone Experience

\*Training

**Discipline Elective Courses (42 credits)**

| Course Code | Course  | No. of credits |
|-------------|---|----------------|
| BBSE4409    | Project management and engineering economics    | 6              |
| MECH3406    | Electrical and electronic engineering           | 6              |
| MECH3416    | Fundamentals of aeronautical engineering        | 6              |
| MECH3417    | Industrial training* (Summer semester)          | 6              |
| MECH3420    | Air pollution control                           | 6              |
| MECH3422    | Building services engineering I                 | 6              |
| MECH3423    | Building services engineering II                | 6              |
| MECH3428    | Research experience for undergraduates          | 6              |
| MECH4404    | Automatic control                               | 6              |
| MECH4407    | CAD/CAM   | 6              |
| MECH4409    | Energy conversion systems                       | 6              |
| MECH4411    | Heat transfer                                   | 6              |
| MECH4412    | Product design and development                  | 6              |
| MECH4414    | Materials for engineering applications          | 6              |
| MECH4415    | Applied stress and strength analysis            | 6              |
| MECH4421    | Viscous flow                                    | 6              |
| MECH4423    | Building energy management and control systems  | 6              |
| MECH4428    | Sound and vibration                             | 6              |
| MEDE4601    | Biomaterials II                                 | 6              |
| MEDE4602    | Molecular and cellular biomechanics             | 6              |
| MEDE4603    | Transport phenomena in biological systems       | 6              |
| MEDE4604    | Cell and tissue engineering                     | 6              |
| CIME2101    | Water and air quality: concepts and measurement | 6              |
| CIVL3111    | Municipal and industrial waste treatment        | 6              |
| CIVL3115    | Solid and hazardous waste management            | 6              |

|  |                  |           |
|--|------------------|-----------|
| CIVL3122                                     | Wind engineering | 6         |
| <b>Total for Discipline Elective Courses</b> |                  | <b>42</b> |

\* Industrial training course normally takes place in the summer semester after the third year of study

### **Elective Courses (12 credits)**

Up to 12 credits of courses offered by other departments within or outside the Faculty of Engineering.

### **Summary of curriculum structure of BEng in Mechanical Engineering**

| <b>Course Categories</b>                     | <b>No. of credits</b> |
|--|-----------------------|
| UG5 Requirements                             | 54                    |
| General Engineering Courses                  | 36                    |
| Discipline Core Courses (Introductory)       | 36                    |
| Discipline Core Courses (Advanced)           | 42                    |
| Capstone Experience and Engineering Training | 18                    |
| Discipline Elective Courses                  | 42                    |
| Elective Courses                             | 12                    |
| <b>Total</b>                                 | <b>240</b>            |

The proposed syllabus by study year is as follows:

### **FIRST YEAR**

#### **General Engineering Courses (36 credits)**

|           |   |
|-----------|---|
| MATH1851  | Calculus and ordinary differential equations  |
| MATH1853  | Linear algebra, probability & statistics  |
| ENGG1111/ | Computer programming and applications/  |
| ENGG1112  | Computer programming and applications I   |
| PHYS1050  | Physics for engineering students  |
| ENGG1205  | Introduction to mechanical engineering  |
| ENGG120X  | Any one of the General Engineering Courses offered by other Departments of the Faculty of Engineering |

#### **University Requirements (UG5) (24 credits)**

|          |                           |
|----------|---------------------------|
| CAES1000 | Core University English   |
| CC##XXXX | Three Common Core Courses |

### **SECOND YEAR**

#### **Introductory Core Courses (36 credits)**

|          |   |
|----------|---|
| MECH2404 | Drawing and elements of design and manufacture          |
| MECH2406 | Fundamentals of electrical engineering                  |
| MECH2407 | Multivariable calculus & partial differential equations |
| MECH2413 | Engineering mechanics                                   |
| MECH2414 | Thermofluids  |
| MECH2419 | Properties of materials                                 |

#### **University Requirements (UG5) (18 credits)**

|          |                           |
|----------|---------------------------|
| CC##XXXX | Three Common Core Courses |
|----------|---------------------------|

#### **Training (6 credits)**

|          |  |
|----------|--|
| MECH2418 | Engineering training (Summer semester) |
|----------|--|

## **THIRD YEAR**

### **Advanced Core Courses ( 36 credits)**

|          |  |
|----------|--|
| MECH3402 | Engineering thermodynamics                                   |
| MECH3407 | Advanced partial differential equation and complex variables |
| MECH3408 | Mechanics of fluids  |
| MECH3409 | Mechanics of solids  |
| MECH3418 | Dynamics and control   |
| MECH3427 | Design and manufacture                                       |

### **University Requirements (UG5) (6 credits)**

|          |  |
|----------|--|
| CENG9001 | Practical Chinese for Engineering Students |
|----------|--|

### **Discipline Elective Courses (18 credits)**

## **FOURTH YEAR**

### **Advanced Core Courses (6 credits)**

|          |                                     |
|----------|-------------------------------------|
| MECH4410 | Engineering & technology management |
|----------|-------------------------------------|

### **University Requirements (UG5) (6 credits)**

|          |  |
|----------|--|
| CAES9543 | Technical English for mechanical and building services engineering |
|----------|--|

### **Discipline Elective Courses (24credits)**

### **Capstone Experience (12 credits)**

|          |                                |
|----------|--------------------------------|
| MECH4429 | Integrated capstone experience |
|----------|--------------------------------|

### **Elective Courses (12 credits)**



## **MINOR IN MECHANICAL ENGINEERING**

**[not eligible for students of BEng(ME)]**

Candidates from other departments in the Faculty of Engineering or from other faculties who have keen interest in Mechanical Engineering with good background in mathematics may pursue Minor in Mechanical Engineering.

### **Minor in Mechanical Engineering**

Candidates are required to complete a total of 48 credits of courses comprising:

- (a) Introductory courses (18 credits)

Students must complete 18 credits of Introductory core courses to be chosen from the following list:

| <b>Course Code</b>                             | <b>Course Title</b>                            | <b>No. of credits</b> |
|--|--|-----------------------|
| MECH2404                                       | Drawing and elements of design and manufacture | 6                     |
| MECH2406                                       | Fundamentals of electrical engineering         | 6                     |
| MECH2413                                       | Engineering mechanics                          | 6                     |
| MECH2414                                       | Thermofluids                                   | 6                     |
| MECH2419                                       | Properties of materials                        | 6                     |
| Total for Introductory Discipline Core Courses |  | 18                    |

- (b) Discipline Elective Courses (30 credits)

Students must complete 30 credits of discipline elective courses to be chosen from the following list:

| <b>Course Code</b>                    | <b>Course Title</b>                            | <b>No. of credits</b> |
|---------------------------------------|--|-----------------------|
| MECH3402                              | Engineering thermodynamics                     | 6                     |
| MECH3408                              | Mechanics of fluids                            | 6                     |
| MECH3409                              | Mechanics of solids                            | 6                     |
| MECH3416                              | Fundamentals of aeronautical engineering       | 6                     |
| MECH3418                              | Dynamics and control                           | 6                     |
| MECH3420                              | Air pollution control                          | 6                     |
| MECH3427                              | Design and manufacture                         | 6                     |
| MECH4404                              | Automatic control                              | 6                     |
| MECH4407                              | CAD/CAM  | 6                     |
| MECH4409                              | Energy conversion systems                      | 6                     |
| MECH4411                              | Heat transfer                                  | 6                     |
| MECH4412                              | Product design and development                 | 6                     |
| MECH4414                              | Materials of engineering applications          | 6                     |
| MECH4415                              | Applied stress and strength analysis           | 6                     |
| MECH4421                              | Viscous flow                                   | 6                     |
| MECH4423                              | Building energy management and control systems | 6                     |
| MECH4428                              | Sound and vibration                            | 6                     |
| Total for Discipline Elective Courses |  | 30                    |

## **COURSE DESCRIPTIONS**

For course descriptions, please refer to the syllabuses of the Mechanical Engineering programme.

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## **COURSE DESCRIPTIONS**

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

### **General Engineering Courses**

|          |   |
|----------|---|
| ENGG1111 | Computer programming (6 credits)                                  |
| ENGG1112 | Computer programming I (6 credits)                                |
| MATH1851 | Calculus and ordinary differential equations (6 credits)          |
| MATH1853 | Linear algebra, probability & statistics (6 credits)              |
| PHYS1050 | Physics for engineering students (6 credits)                      |
| ENGG1201 | Engineering for sustainable development (6 credits)               |
| ENGG1202 | Introduction to computer science (6 credits)                      |
| ENGG1203 | Introduction to electrical and electronic engineering (6 credits) |
| ENGG1204 | Industrial management and logistics (6 credits)                   |
| ENGG1205 | Introduction to mechanical engineering (6 credits)                |
| ENGG1206 | Introduction to biomedical engineering (6 credits)                |

Please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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### **University Requirements on Language Enhancement Courses**

**CAES1000. Core University English (6 credits)**

**CENG9001. Practical Chinese for engineering students (6 credits)**

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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### **CAES 9543. Technical English for mechanical and building services engineering (6 credits)**

This 6-credit English-in-the-Discipline course will introduce ME/BSE and BEng(EngSc) Materials Engineering students to professional and technical communication in the context of technical project report writing and oral presentation. The course will provide an intensive English environment and engage students in activities which help them prepare for the completion of the assessments required by their capstone experience course. Assessment is wholly by coursework.

Co-requisite: MECH4429

Assessment: 100% continuous assessment

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### **University Common Core Curriculum**

36 credits of courses in the University Common Core Curriculum, in which students can select not more than one course from each Area of Inquiry within one academic year and at least one but no more than two courses from each Area of Inquiry during the whole period of study:

- Scientific and Technology Literacy
  - Humanities
  - Global Issues
  - China: Culture, State and Society
-

#### **MECH2404. Drawing and elements of design and manufacture**

This course covers the basic knowledge of engineering drawing techniques and the basic concepts in product design. It introduces standard engineering drawing methods, including orthographic and pictorial projections, dimensioning and tolerancing, limits and fits. Features, functionality and representation method for screws, fasteners, cam and gear will also be covered. This course also covers computer aided drafting with 3D CAD modeling for facilitating the production of illustrations and animations in written reports and oral presentation. To help students understand the importance of design for manufacture, the working principles of basic manufacturing processes are covered in this course. This course has the objectives: (1) provide students with an ability to communicate engineering information using standard engineering drawing methods and computer-aided design tools; (2) introduce basic manufacturing processes with emphasis on design for manufacturability; and (3) help students understand how typical products are designed and manufactured so that they can be better prepared to undertake the practical engineering training course.

Topics include: engineering drawing techniques; orthographic and pictorial projections; dimensioning and tolerancing; limits and fits; screw fasteners; cam; gears; computer aided drafting with 3D CAD modeling; product design; manufacturing processes.

Assessment: 100% continuous assessment

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#### **MECH2406. Fundamentals of electrical engineering**

Basic circuit principles; steady-state A.C. circuit theory; magnetic circuits; transformers; direct-current motors; three-phase power system; induction motors; step motors.

This course aims to: (1) provide students with fundamental concepts for analysing D.C. and A.C. circuits; (2) furnish students with knowledge of the operation of transformers and D.C. motors; (3) provide students with an understanding of three-phase power system; and (4) provide students with knowledge of the principles of operation and application of A.C. motors and step motors.

Topics include: basic circuit principles; steady-state A.C. circuit theory; magnetic circuits; transformers; direct-current motors; three-phase power system; induction motors; step motors.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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#### **MECH2407. Multivariable calculus & partial differential equations**

This course aims to further develop the foundation of mathematics used in engineering discipline. Students will be introduced and explored to: (1) the ideas of periodic functions and their Fourier series representations; (2) the concepts of differentiation and integration of multivariable functions, and their extensions to vector analysis; and (3) the methods for solving elementary partial differential equations. Through the development of solution methods, students will enrich their experience in critical analysis and problem solving.

Topics include: Fourier series; advanced calculus; vector analysis; elementary partial differential equations.

Assessment: 20% continuous assessment, 80% examination

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### **MECH2413. Engineering mechanics**

This course aims to (1) present a comprehensive study of the fundamental concepts and methods used in the analysis of stress and strain in structural and machine components, and to develop logical methods for the design of engineering components, structures and machines; (2) develop a thorough understanding of the static deformation of simple non-rigid bodies, and of the stress and strain produced in such bodies due to various loading conditions; (3) introduce the basic principles of kinematics and kinetics for particles and rigid bodies, and (4) consolidate the knowledge of dynamics by studying space applications.

Topics include: stress and strain; bending of beams; deflection of beams; thin-walled pressure vessels; kinematics of particles and rigid bodies; kinetics and principle of momentum and energy; application of dynamics principles to space applications; particles and vehicles with mass variation; velocity-dependent resistance and the action of central forces.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH2414. Thermofluids**

Thermofluids is a branch of science and engineering, covering topics in thermodynamics and fluid mechanics. These topics form the basic foundations that govern processes in engineering applications. This course is an introduction to the thermofluids and how the principles can be applied to understand/design thermal and fluid flow processes. The specific course objectives are: (1) understand and apply thermodynamic principles to engineering applications; (2) understand basic concepts and fundamental equations in fluid mechanics, and develop skills to solve practical flow problems; and (3) form a foundation for subsequent studies in engineering thermodynamics, building services, material science, heat transfer, marine engineering, environmental engineering, power engineering, energy conversion, energy system and other areas. At the end of this course, students who fulfill the requirements of this course will be able to: (1) identify, formulate and solve thermofluids engineering problems; and (2) design and conduct experiments in thermofluids engineering, as well as to analyse and interpret data.

Topics include: concepts and definitions; properties of pure substance; heat and work; first law of thermodynamics; second law of thermodynamics; entropy; basic concepts on fluids and flows; dimensional analysis; similarity and modelling; momentum theorems and pipe flow analysis.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH2418. Engineering training (Summer semester) (6 credits)**

This course aims to provide students with hands-on training and practical experience in engineering basics, design and manufacturing practices.

Topics include: instrumentation; computation fluid dynamics; programmable logic controller; basic electrical engineering; design and model making; machining and metrology; machining practice; and seminars on safety, against corruption, engineering profession and other contemporary issues.

Assessment: 100% practical work

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### **MECH2419. Properties of materials**

In this course, students will be introduced to the underlying scientific principles of the mechanical engineering behaviour of metals, and in particular to emphasise the effects of stress and heat via their influence on the microstructure of the materials. The behaviour of materials in service conditions including stress and corrosion

effects will be highlighted. The course concerns those principles governing the crystalline state, which is appropriate to metals and ceramics, as well as the amorphous and semi-crystalline states, which are relevant to polymers.

Topics include: elements of atomic structure and bonding; crystal structure; structure of polymers; solidification and phase diagrams; defects and plastic deformation in the crystalline state; TTT diagrams and heat treatment of steels; metallurgy of fatigue; corrosion resistance and surface treatment; mechanical properties of plastics.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH3402. Engineering thermodynamics**

Engineering Thermodynamics is a branch of science and engineering, covering topics in power cycles, air-conditioning, heat transfer, and combustion. The course objectives are to: (1) provide students with fundamental principles of the latest technologies of thermodynamics from a mechanical engineering perspective, and (2) enable students to apply and practice the knowledge in relevant industry and profession, such as power generation, automotive, and building services, etc. At the end of this course, students who fulfill the course requirements will be able to: (1) apply knowledge of mathematics, science, and engineering appropriate to thermodynamics, (2) identify, formulate, and solve engineering thermodynamics problems, and (3) design and conduct experiments in engineering thermodynamics, as well as to analyse and interpret data.

Topics include: IC engines; steam and gas power plants; refrigeration; jet propulsion; gas mixture; psychrometry and air-conditioning; introduction to heat transfer and combustion.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH3406. Electrical and electronic engineering**

This course aims to: (1) provide students with knowledge of solid-state electronic devices, linear circuits, digital circuits and techniques of analog / digital conversion; and (2) furnish students with knowledge of solid-state controllers for D.C. and A.C. motors.

Topics include: bipolar junction transistors; field-effect transistors; combinational logic circuits; sequential logic circuits; analog electronics; digital-to-analog and analog-to-digital converters; solid-state controller for D.C. motors; solid-state controller for A.C. motors.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH3407. Advanced partial differential equation and complex variables**

This course intends to convey mathematical techniques commonly used in disciplines relevant to mechanical engineering, e.g. heat conduction, vibration, probability, statistics, and numerical analysis. The course objectives are: (1) introduce the concepts and applications of complex variables; (2) illustrate the ideas of Fourier series and Fourier transforms; (3) obtain analytical solutions of the classical, second order partial differential equations by separation of variables, with applications of engineering interests, e.g. heat conduction and wave propagation; (4) present elementary theory of probability and statistics; and (5) discuss simple techniques in numerical analysis, e.g. solving nonlinear algebraic equations, numerical integration (quadrature), and initial value problems.

Topics include: complex variables; Fourier series and Fourier transforms; partial differential equations; introduction to probability and statistics; elementary numerical analysis.

Assessment: 20% continuous assessment, 80% examination

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### **MECH3408. Mechanics of fluids**

This course aims to: (1) provide students with an understanding of the fundamentals of the following areas of fluid mechanics: kinematics, Navier-Stokes equations, differential analysis of flows in channels and pipes, boundary layer flows, potential flows, dimensional analysis, and (2) equip students with capability of applying basic fluid mechanics principles in engineering designs.

Topics include: Navier-Stokes equations; pipe and channel viscous flows; lubrication; two-dimensional potential flows; boundary layer flows; dimensional analysis.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH3409. Mechanics of solids**

The aims of this course are: (1) to introduce the theory of elasticity for stress/strain analysis and high-light the limitations of the elementary strength of materials approach; and (2) to introduce alternate approaches for stress/strain analysis based on the numerical techniques.

Topics include: two-dimensional theory of elasticity; thermal stress and rotating disks; material failure and yielding; introduction to the finite element method; buckling; energy methods; bending of circular plate.

Assessment: 10% practical work, 15% continuous assessment, 75% examination

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### **MECH3416. Fundamentals of aeronautical engineering**

Aviation is a rapidly expanding sector in developing economies like those in Asia. Aeronautical engineering is the foundation of aviation as a mode of transport. Together with space flight, aeronautics has been a driving force behind many of the modern technological development in the past century or so. This course aims to provide students with a solid foundation in the most important aspects of aircraft design and operation. The underlying science is common with many technological branches in general mechanical engineering, but it also has distinctive features that make aeronautics more challenging and interesting. For example, flow around aircraft is compressible with possible presence of shock waves while ordinary flows in engineering is low-speed and incompressible. The engine has similar thermodynamic cycles like that found in a gas turbine power plant but its main output is not derived from the turbine. Materials used in aircraft design must have the lowest possible weight for a given strength requirement. Specifically, the course will cover the following topics: aerodynamics and propulsion, materials and structures; safety and some aspects of operation and maintenance of aircrafts.

Topics include: history of aeronautical science; wing aerodynamics; propulsion; flight mechanics; systems and airframe structures; fatigue-crack growth; crack monitoring; damage tolerance; metallic materials; composites; fibre-reinforced laminates; high-temperature alloys for turbines; creep damage.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH3417. Industrial training (Summer semester)**

This course aims to provide students with on-the-job training in local or non-local companies so that they can: (1) integrate theory learning with practical applications; (2) understand real-life organizational structure and business operation; (3) learn how to build human relations with seniors and co-workers; and (4) enrich personal resume for becoming engineering professional.

This course involves training in industry for a nominal period of at least six weeks during the summer vacation of the third year of study.

Assessment: 100% practical work

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### **MECH3418. Dynamics and control**

This course aims to provide the students with a comprehensive knowledge in advanced areas of rigid-body dynamics, theory of vibration for different types of mechanical system, dynamic system analysis techniques, basic closed-loop control system design techniques, with application to mechanical and other control systems.

Topics include: advanced rotational motion; balancing of rotating and reciprocating masses; forced vibration of single degree of freedom systems; vibration measurement; isolation and control; torsional vibration of multi-rotor systems; free transverse vibration of shafts; modelling of physical systems; time response analysis of dynamical systems; feedback control systems; control system design and applications; stability; root locus method.

Assessment: 20% practical work, 10% continuous assessment, 70% examination

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### **MECH3420. Air pollution control**

This course aims to: (1) provide students with a basic understanding of the principles and techniques related to the formation, dispersion and control of various air pollutants formed from anthropogenic pollution sources; and (2) enable students to assess common air pollution source emissions and suggest remedial solutions to polluting sources.

Topics include: micrometeorology; air dispersion; combustion fundamentals; pollutant formation mechanism and control technologies; abatement of volatile organic compounds using incineration techniques; particulate and aerosol abatement technology; particle technology, log-normal distribution; settling chamber; cyclone; electrostatic precipitator; bag filter.

Assessment: 20% continuous assessment, 80% examination

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### **MECH3422. Building services engineering I**

Building services engineering is very important to modern societies and urban cities. Building services systems are essential installations to provide the basic functionality for occupants. This course will develop students in the basic concepts and design principles of plumbing and drainage systems including practical considerations and code requirements. It will also introduce and explain the electrical services, lighting, lifts, escalators and security systems which are critical for making buildings comfortable, convenient and safe. This course aims to: (1) introduce the engineering concepts, design procedures, practical applications and related codes and regulations of the plumbing and drainage, electrical services, lighting lifts, escalators and security systems, (2) develop a basic understanding of the objectives, methods and codes/standards for effective design, operation and management of these systems and (3) enable students to design and analyse

these systems for modern buildings complying with local statutory regulations and achieving effective and efficient design solutions.

Topics include: characteristics and design of plumbing and drainage systems including practical considerations and code requirements; planning and design of electrical services systems in building basic concepts, design principles and energy management of lighting systems, design of lifts, escalators and security systems.

Assessment: 20% continuous assessment, 15% practical work, 65% examination

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### **MECH3423. Building services engineering II**

Building services engineering is very important to modern societies and urban cities. This course will introduce and explain the heating, ventilating and air-conditioning (HVAC) systems which are the most important engineering systems in many types of buildings. It will also develop students in the basic concepts of fire safety, the legislative requirements and the design of most commonly installed fire service systems. This course aims to: (1) introduce the fundamental principles, engineering concepts, design procedures, practical applications and related codes/standards of HVAC and fire services systems; (2) develop a basic understanding of the objectives, characteristics, methods for effective design, operation and management of these systems, and (3) enable students to design and analyse these systems for modern buildings complying with local statutory regulations and achieving effective and efficient design solutions.

Topics include: fundamentals of heating; ventilating and air-conditioning (HVAC) engineering including psychrometry; thermal comfort; load and energy calculations; design and analysis of HVAC systems and components; fire safety and protection concepts; fire extinguishing; detection and alarm systems; smoke management and control systems; code requirements and fire risk management; fire engineering approach.

Assessment: 20% continuous assessment, 15% practical work, 65% examination

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### **MECH3427. Design and manufacture**

The main focus of this course is on design and manufacture of engineering components and sub-systems. This course aims to: (1) provide a background for students to understand the basic procedures for designing mechanical components and sub-systems; and (2) enable students to understand the principles for material selection and design for manufacturing and assembly.

Topics include: material selection; joining and fastening; jigs and fixtures design; power transmission system design; CNC machining; rapid prototyping.

Assessment: 100% continuous assessment

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### **MECH3428. Research experience for undergraduates**

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

Assessment: 100% practical work

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#### **MECH4404. Automatic control**

This course aims to provide the students with a comprehensive knowledge of continuous-time and discrete-time linear control systems, with particular reference to the modelling, analysis and design of mechanical and related control systems using both conventional and modern approaches.

Topics include: control of mechanical and electrical systems; frequency domain analysis; Nyquist stability criterion; linear control system design; computer control systems; state-space analysis of multivariable linear system; controllability and observability; stability analysis; state feedback.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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#### **MECH4407. CAD/CAM**

This course aims to: (1) provide students with a basic understanding of the working principles and applications of computer-aided design and manufacture (CAD/CAM) technologies; and (2) enable students practice CAD/CAM tools and techniques.

Topics include: basic data structuring techniques; transformation techniques; mathematical bases for surface modeling; principles of solid modeling and applications; numerical control; computer-aided production technologies; computer-integrated manufacturing.

Assessment: 30% continuous assessment, 70% examination

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#### **MECH4409. Energy conversion systems**

This course aims to: (1) provide students with basic knowledge on energetics and development of conventional and non-conventional energy sources; and (2) develop in-depth understanding of the operation of modern power plants and an overview of energy conversion technologies.

Topics include: energy calculations; solar thermal power plant; energy storage solar photovoltaic systems; wind energy systems; nuclear energy and power plants; nuclear waste management; urban waste.

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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#### **MECH4410. Engineering & technology management**

The objectives of this course are to: (1) master the fundamental concepts of engineering management necessary to bridge the gap between management and technology; (2) provide students with an opportunity to enhance their understanding with hands-on-skill to problem solving for decision making in different technical operations; and (3) introduce managerial models that implement qualitative as well as quantitative analyses to assist students to improve their ability and skills to analyze decision making problems.

Topics include: introduction to engineering management; functions of technology management including planning and forecasting, decision making and analysis, organizing, leading and motivation, and controlling; managing technology including research and development, engineering design, production activity and operations, marketing and service activities; quantitative analysis for management including inventory control, linear programming and queuing theory.

Assessment: 20% continuous assessment, 80% examination

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### **MECH4411. Heat transfer**

This course is on the fundamental principles of heat transfer, covering heat conduction, heat convection and heat exchangers. The course objectives are: (1) to provide an understanding of fundamental principles of heat transfer; and (2) to enable students to use the fundamental principles for conducting thermal analysis and design of engineering problems. At the end of this course, students who fulfill the requirements of this course will be able to: (1) demonstrate an understanding of the principles that govern heat transfer processes; (2) analyze heat-transfer problems quantitatively; and (3) identify relevant engineering solutions in thermal systems.

Topics include: Fourier's law; heat-conduction equation; thermal conductivity; conduction; fins; basic convection principles; laminar and turbulent heat transfer in tubes and over plates; Reynolds analogy; types of heat exchangers; overall heat-transfer coefficient; log mean temperature difference; effectiveness-NTU method; heat exchanger design.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH4412. Product design and development**

This course aims to: (1) provide the general principles and techniques related to electromechanical product design and development; and (2) enable students to practice both conventional and computer-aided product design and development methods.

Topics include: product design and manufacturing process; methods and tools used for designing and developing electromechanical products; tooling design; design for manufacture and assembly; product costing; value engineering.

Assessment: 40% continuous assessment, 60% examination

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### **MECH4414. Materials for engineering applications**

Challenging engineering environments demand special material properties if design requirements are to be met. This course is to introduce the very wide range of engineering materials which have been tailored to meet some of these requirements. Examples range from high temperature materials, materials for high specific strengths, resistance to static and dynamic loadings, plus some materials selection criteria.

Topics include: materials for high strength/weight ratio; high temperature service; resistance to corrosion resistance and protection; advanced alloys; composite and ceramic materials; problem based learning module.

Assessment: 15% continuous assessment, 85% examination

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### **MECH4415. Applied stress and strength analysis**

The aims of this course are to: (1) formulate three-dimensional theory of elasticity and introduce the theory of plasticity; (2) introduce analytical and numerical methods for solving practical engineering problems; and (3) introduce theories of fracture and fatigue and their applications to practical engineering problems.

Topics include: theory of elasticity; plastic analysis; finite element methods for two- and three-dimensional continua; rectangular plate bending; fracture mechanics.

Assessment: 15% practical work, 15% continuous assessment, 70% examination

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**MECH4421. Viscous flow**

This course aims to: (1) elucidate the advanced dynamics of liquids and gases, including steady and unsteady solutions of the Navier-Stokes equations, (2) perform a study on the properties, mass flux and momentum flux of a boundary layer, (3) explain the basic mechanics of a compressible fluid flow and applications to aerodynamics, (4) discuss the ideas of surface tension and stability in simple multiphase flows; To derive the Plateau-Rayleigh instability as the basic governing model for the linear stability of droplet formation, and (5) understand the complex flow patterns behind bluff bodies, mechanisms associated with vortex shedding and drag force; To characterize the low Reynolds number flow around a sphere and to measure viscosity using the Stokes' drag formula, and (6) introduce elementary concepts of turbulence.

Topics include: continuity and Navier-Stokes equations; Laminar boundary layers; Surface tension; Elementary concepts of compressible flows and shock waves; stability theory; flow behind bluff bodies; low Reynolds number flows and turbulent flows.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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**MECH4423. Building energy management and control systems**

The objectives of this course are to: (1) introduce students to the basic concepts of computer-based integrated monitoring, control and energy management for building services installations; (2) enable students to understand the principles of design and operation of building energy management and control systems (EMCS) and their applications to modern buildings; and (3) enable students to understand modern methods of performance analysis of building services systems using building EMCS.

Topics include: concepts of distributed computer-based monitoring and control; hardware and software development; communication protocols; application to maintenance, energy management and control; system design and performance evaluation; computer simulation and emulation techniques; analysis of dynamic building services systems.

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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**MECH4428. Sound and vibration**

This course aims to achieve two purposes. In the first, it is a further study of basic physical science of waves, fluid and structural dynamics. The second aim is the application of the knowledge to solving practical problems of vibration analysis and noise control; noise pollution being one of the four major environmental pollutions, namely water, air, noise and solid waste. Specifically, the following three aspects are covered in the course: (i) fundamentals of vibration and its analysis, (ii) hearing mechanisms, environmental noise sources and their mitigation, (iii) mechanisms of sound generation, propagation and control.

Topics include: fundamentals of single- and multiple degree of freedom systems; vibration modes and finite element analyses; sound radiation by vibration and flow; human hearing; sound and vibration measurements; wave propagation and duct acoustics; sound absorption and reflection; vibration isolation and noise abatement methods.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MECH4429. Integrated capstone experience**

This is a compulsory, capstone experience course in the final year of the BEng in Mechanical Engineering degree programme. Students are required to undertake a group design project that runs from September to April of the following year. The project topics are stipulated either by teachers or by industrial sponsors. Each project group has two teachers acting as supervisors and an additional teacher serving as moderator. During the course of the project, supervisors communicate with the students and the concerned project sponsor to monitor the project progress. At the completion of the project, each project student presents his/her achievements to the supervisors, moderator and sponsor via a written report and an oral presentation. This course aims to: (1) provide a problem-based learning experience for students to learn how to apply scientific knowledge and team-work approach to tackle design/engineering problems systematically, and (2) strengthen students' inter-personal and communication skills through interaction with teammates, supervisors and sponsors.

Typical project activities include: problem identification & definition; research into information pertaining to the problem, design & analysis; materials sourcing; communication; conducting experiments/making prototypes for verification and demonstration of results; writing reports and giving oral presentations.

Assessment: 100% practical work

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### **BBSE4409. Project management and engineering economics**

The objectives of this course are to: (1) understand the project management skills in building industry and other engineering projects; (2) acquire the important knowledge and experience on contract management in real life projects; (3) appreciate the techniques of project planning and control; (4) understand the skills needed for engineering economics and company finance; (5) appreciate the significance of the economic aspect of engineering in their decision making; and (6) master the fundamental concepts of economic analysis necessary to bridge the gap between the physical and economic aspects of engineering applications.

Topics include: characteristics of building projects and typical contracts; roles of different building professionals; project planning, scheduling and control; contract documentation and contractual arrangement; estimating and tendering; site organisation and supervision; measurement and valuation of works; claim management and settlement; alternative dispute resolution; time value of money; interest and interest formulas; equivalent analysis; bases for comparison of alternatives; present worth analysis; annual equivalent worth analysis; rate of return analysis; project cash flow analysis; decision making among alternatives; applications to real-world economy.

Assessment: 30% continuous assessment, 70% examination

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### **MEDE4601. Biomaterials II**

### **MEDE4602. Molecular and cellular biomechanics**

### **MEDE4603. Transport phenomena in biological systems**

### **MEDE4604. Cell and tissue engineering**

For course descriptions, please refer to the syllabus of the Medical Engineering programme.

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**CIME2101. Water and air quality: concepts and measurement**  
**CIVL3111. Municipal and industrial waste treatment**  
**CIVL3115. Solid and hazardous waste management**  
**CIVL3122. Wind engineering**

For course descriptions, please refer to the syllabus of the Civil Engineering programme.

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# **MEDICAL ENGINEERING**

## **SYLLABUS**

The syllabus applies to students admitted in the academic year 2014-15 under the four-year curriculum.

### Definition and Terminology

Each course offered by the Medical Engineering Programme (the Programme) shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Programme for the fulfillment of the curriculum requirements of the degree of BEng (Medical Engineering) that are not classified as discipline core course.

### **Curriculum**

The Curriculum comprises 240 credits of courses as follows:

#### General Engineering Courses

Students are required to successfully complete at least 36 credits of General Engineering Courses.

#### Discipline Core Courses

Students are required to complete ALL discipline core courses (90 credits), comprising 36 credits of introductory core courses and 54 credits of advanced core courses.

#### Discipline Elective Courses

Students are required to complete at least 30 credits of discipline elective courses in either Track I “Biomechanics, biomaterials and tissue engineering” or Track II “Biomedical signals, systems and imaging”, or a combination of both tracks.

#### Elective Courses

Students are required to complete 12 credits of elective courses offered by other departments within or outside the Faculty of Engineering.

#### University Requirements

Students are required to complete:

- a) Two English language courses, including the “CAES1000 Core University English” and the “CAES9531 Technical English for Medical Engineering”, for a total of 12 credits;
- b) One Chinese language enhancement course “CENG9001 Practical Chinese for engineering students”, for a total of 6 credits; and
- c) 36 credits of courses in the Common Core Curriculum, selecting at least one but no more than two courses from each Area of Inquiry.

#### Capstone Experience

Students are required to complete the 12-credit “MEDE4010 Final year project” to fulfill the capstone experience requirement for the degree of BEng in Medical Engineering.

#### Internship

Students are required to complete a 6-credit internship “MEDE3020 Professional training (Internship)”, which normally takes place after their third year of study.

## Degree Classification

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN16 of Regulations for the Degree of Bachelor of Engineering and UG9 of the regulations for the First Degree Curricula.

**The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Medical Engineering) comprises 240 credits of courses with the following structure:

### UG 5 Requirements (54 credits)

| Course Code                       | Course                                     | No. of credits |
|-----------------------------------|--|----------------|
| CAES1000                          | Core University English                    | 6              |
| CAES9531                          | Technical English for Medical Engineering  | 6              |
| CENG9001                          | Practical Chinese for engineering students | 6              |
| CC##xxxx                          | University Common Core Course (6 courses)* | 36             |
| <b>Total for UG5 Requirements</b> |  | <b>54</b>      |

\* Students can select not more than one course from each Area of Inquiry within one academic year and at least one and no more than two courses from each Area of Inquiry during the whole period of study.

### General Engineering Courses (36 credits)

| Course Code                                  | Course  | No. of credits |
|--|---|----------------|
| MATH1851                                     | Calculus and ordinary differential equations                                      | 6              |
| MATH1853                                     | Linear algebra, probability & statistics  | 6              |
| ENGG1111/<br>ENGG1112                        | Computer programming and applications/<br>Computer programming and applications I | 6              |
| PHYS1050                                     | Physics for engineering students  | 6              |
| ENGG1206                                     | Introduction to biomedical engineering  | 6              |
| ENGG1207                                     | Foundations of biochemistry for medical engineering                               | 6              |
| <b>Total for General Engineering Courses</b> |   | <b>36</b>      |

### Discipline Core Courses (90 credits)

#### *Introductory Courses (36 credits)*

| Course Code   | Course  | No. of credits |
|---|---|----------------|
| MECH2407  | Multivariable calculus and partial differential equations | 6              |
| MEDE2020  | Engineering training                                      | 6              |
| MEDE2301  | Life sciences I (Biochemistry)                            | 6              |
| MEDE2302  | Life sciences II (Cell Biology & Physiology)              | 6              |
| MEDE2500  | Biomedical signals and linear systems                     | 6              |
| MEDE2810  | Engineering management and society                        | 6              |
| <b>Total for Introductory Discipline Core Courses</b> |   | <b>36</b>      |

#### *Advanced Courses (54 credits)*

| Course Code | Course                               | No. of credits |
|-------------|--------------------------------------|----------------|
| MEDE2600    | Biomechanics for medical engineering | 6              |
| MEDE3010    | Integrated project                   | 6              |
| MEDE3301    | Life sciences III (Physiology)       | 6              |

|   |  |           |
|---|--|-----------|
| MEDE3500  | Electromagnetics in biomedicine                              | 6         |
| MEDE3501  | Medical imaging  | 6         |
| MEDE3504  | Medical engineering laboratory                               | 6         |
| MEDE3600  | Biomaterials I   | 6         |
| MEDE3602  | Thermofluids for medical engineering                         | 6         |
| MEDE3603  | Statistics and mathematical analysis for medical engineering | 6         |
| <b>Total for Advanced Discipline Core Courses</b> |  | <b>54</b> |

### Capstone Experience and Internship (18 credits)

| Course Code   | Course                              | No. of credits |
|---|-------------------------------------|----------------|
| MEDE4010  | Final year project <sup>+</sup>     | 12             |
| MEDE3020  | Professional training (Internship)* | 6              |
| <b>Total for Capstone Experience and Internship Courses</b> |                                     | <b>18</b>      |

+Capstone Experience

\*Training

### Discipline Elective Courses (30 credits)

30 credits of courses taken from either Track I or Track II, or a combination of both tracks below:

#### *Track I: Biomechanics, biomaterials and tissue engineering*

| Course Code | Course   | No. of credits |
|-------------|--|----------------|
| ELEC3845    | Economics, finance and marketing for engineers | 6              |
| MEDE4500    | Biomedical instrumentation and systems         | 6              |
| MEDE4601    | Biomaterials II                                | 6              |
| MEDE4602    | Molecular and cellular biomechanics            | 6              |
| MEDE4603    | Transport phenomena in biological systems      | 6              |
| MEDE4604    | Cell and tissue engineering                    | 6              |

#### *Track II: Biomedical signals, systems and imaging*

| Course Code | Course   | No. of credits |
|-------------|--|----------------|
| ELEC3245    | Control and instrumentation                                  | 6              |
| ELEC3845    | Economics, finance and marketing for engineers               | 6              |
| ELEC6067    | Magnetic resonance imaging (MRI) technology and applications | 6              |
| ELEC6079    | Biomedical ultrasound  | 6              |
| ELEC6081    | Biomedical signals and systems                               | 6              |
| MEDE4500    | Biomedical instrumentation and systems                       | 6              |
| MEDE4501    | Biophotonics   | 6              |

### Elective Courses (12 credits)

At least 12 credits of elective courses offered by other departments within or outside the Faculty of Engineering

### Summary of curriculum structure of BEng (Medical Engineering)

| Course Categories                      | No. of credits |
|--|----------------|
| UG5 Requirements                       | 54             |
| General Engineering Courses            | 36             |
| Discipline Core Courses (Introductory) | 36             |
| Discipline Core Courses (Advanced)     | 54             |



|  |            |
|--|------------|
| Capstone Experience and Internship Courses | 18         |
| Discipline Elective Courses                | 30         |
| Elective Courses                           | 12         |
| <b>Total</b>                               | <b>240</b> |

The proposed syllabus by study year is as follows:

## **FIRST YEAR**

### **General Engineering Courses (36 credits)**

|           |   |
|-----------|---|
| MATH1851  | Calculus and ordinary differential equations        |
| MATH1853  | Linear algebra, probability and statistics          |
| ENGG1111/ | Computer programming and applications               |
| ENGG1112  | Computer programming and applications I             |
| PHYS1050  | Physics for engineering students                    |
| ENGG1206  | Introduction to biomedical engineering              |
| ENGG1207  | Foundations of biochemistry for medical engineering |

### **UG5 Requirements (24 credits)**

|          |                           |
|----------|---------------------------|
| CAES1000 | Core University English   |
| CC##XXXX | Three Common Core Courses |

## **SECOND YEAR**

### **Introductory Core Courses (42 credits)**

|          |   |
|----------|---|
| MECH2407 | Multivariable calculus and partial differential equations |
| MEDE2020 | Engineering training                                      |
| MEDE2301 | Life sciences I (Biochemistry)                            |
| MEDE2302 | Life sciences II (Cell Biology & Physiology)              |
| MEDE2500 | Biomedical signals and linear systems                     |
| MEDE2600 | Biomechanics for medical engineering                      |
| MEDE2810 | Engineering management and society                        |

### **UG5 Requirements (18 credits)**

|          |                           |
|----------|---------------------------|
| CC##XXXX | Three Common Core Courses |
|----------|---------------------------|

## **THIRD YEAR**

### **Advanced Core Courses (48 credits)**

|          |  |
|----------|--|
| MEDE3010 | Integrated project   |
| MEDE3301 | Life sciences III (Physiology)                               |
| MEDE3500 | Electromagnetics in biomedicine                              |
| MEDE3501 | Medical imaging  |
| MEDE3504 | Medical engineering laboratory                               |
| MEDE3600 | Biomaterials I   |
| MEDE3602 | Thermofluids for medical engineering                         |
| MEDE3603 | Statistics and mathematical analysis for medical engineering |

### **Training (6 credits)**

|          |                                    |
|----------|------------------------------------|
| MEDE3020 | Professional training (Internship) |
|----------|------------------------------------|

### **UG5 Requirements (12 credits)**

|          |  |
|----------|--|
| CAES9531 | Technical English for Medical Engineering  |
| CENG9001 | Practical Chinese for engineering students |

## **FOURTH YEAR**

### **Advanced Core Course (12 credits)**

MEDE4010     Final year project

### **Discipline Elective Courses (30 credits)**

At least 30 credits must be selected from either Track I or Track II, or a combination of both tracks:

#### **Track I: Biomechanics, biomaterials and tissue engineering**

ELEC3845     Economics, finance and marketing for engineers  
MEDE4601     Biomaterials II  
MEDE4602     Molecular and cellular biomechanics  
MEDE4603     Transport phenomena in biological systems  
MEDE4604     Cell and tissue engineering  
MEDE4500     Biomedical instrumentation and systems

#### **Track II: Biomedical signals, systems and imaging**

ELEC3245     Control and instrumentation  
ELEC3845     Economics, finance and marketing for engineers  
ELEC6067     Magnetic resonance imaging (MRI) technology and applications  
ELEC6079     Biomedical ultrasound  
ELEC6081     Biomedical signals and systems  
MEDE4500     Biomedical instrumentation and systems  
MEDE4501     Biophotonics

### **Elective Courses (12 credits)**

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## **COURSE DESCRIPTIONS**

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

### **General Engineering Courses**

ENGG1111     Computer programming and applications (6 credits)  
ENGG1112     Computer programming and applications I (6 credits)  
ENGG1206     Introduction to biomedical engineering (6 credits)  
ENGG1207     Foundations of biochemistry for medical engineering (6 credits)  
MATH1851     Calculus and ordinary differential equations (6 credits)  
MATH1853     Linear algebra, probability and statistics (6 credits)  
MECH2407     Multivariable calculus and partial differential equations (6 credits)  
PHYS1050     Physics for engineering students (6 credits)

Please refer to the General Engineering courses in the syllabus for the degree of BEng for details.

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### **University Requirements on Language Enhancement Courses**

CAES1000     Core University English (6 credits)  
CENG9001     Practical Chinese for engineering students (6 credits)

Please refer to the University Language Enhancement Courses in the syllabus for degree of BEng for details.

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**CAES9531      Technical English for Medical Engineering (6 credits)**

The course aims to develop medical engineering students' ability to write and speak in their discipline. The course will focus on developing students' ability to write a technical report and give a technical presentation on a medical device they have developed. The English course will run alongside the MEDE3010 Integrated project course. This course requires students to develop a portable medical device, such as electrocardiogram (ECG) recording device or pulse oximeters, from scratch, use the device to gain data, and use the obtained data to gain insights into human physiology. The students then need to write a report and give a presentation which explains a mixture of medical and engineering information. This English course will focus on the English language skills needed to complete these assignments. Students will be assessed using the report and the presentation they produce for the Medical Engineering course as well as a final written test and an out of class learning component.

Co-requisite: MEDE3010

Adjunct course: MEDE3010

Assessment: 100% continuous assessment

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**MEDE2020      Engineering training (6 credits)**

Knowledge and practical use of hardware and software tools for soldering, wire-wrapping, PCB design and production, virtual instrumentation hard design and production, software programming of LabView, mechanical component design and modeling, CAD/CAM, metrology, computational fluid dynamics.

Assessment: 100% practical work

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**MEDE2301      Life sciences I (Biochemistry) (6 credits)**

This course presents an overview and an understanding of the basic mechanisms underlying life processes. Topics include chemistry of life – pH, water, etc; fundamental bioenergetics; biomolecules and their functions; intermediary metabolism; enzymes and coenzymes; nucleic acids and genetic information.

Assessment: 30% continuous assessment, 70% examination

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**MEDE2302      Life sciences II (Cell Biology & Physiology) (6 credits)**

This course aims to provide a basic understand of the structure and function of cells and tissues within our body, including the structures and functions of the cell; the general organisation of epithelium and glands; the different types and functions of the connective tissues; the general organisation of the nervous tissues, muscle and skin tissues, bone marrow and lymphatic tissues. The second part of the course will provide the students with integrated knowledge of human physiology and pathophysiology that is relevant to medical engineering in such areas as organization of the body, homeostasis and excitable tissues; the cardiovascular system; the renal system, and some common disorders of the cardiovascular and renal systems.

Assessment: 30% continuous assessment, 70% examination

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### **MEDE2500    Biomedical signals and linear systems (6 credits)**

Signals and linear system theory is fundamental to all engineering discipline, especially in the field of electrical, computer and medical engineering. This is a first course in signals and linear systems for engineering students without any pre-requisite knowledge in signal theory or signal processing other than some knowledge in fundamental calculus and use of complex numbers. The course uses simple real life examples of signals and systems to illustrate how signal theory can be used in practical application, and will including an introduction to MATLAB as a tool for signal analysis and system modelling.

This course aims to help students gain a firm understanding of the fundamentals of signal and linear systems concepts and theory using adequate mathematical and computing techniques to tackle simple signal processing problems. It serves as a pre-requisite course for many other courses including Digital Signal Processing, Control and Instrumentation, Communication Systems, and Digital Image Processing.

Specifically, the course covers the following topics: time-domain signal representation, periodic and aperiodic signals; spectral representation of signals, Fourier series and Fourier transform; system responses and linear system modelling; sampling, aliasing and analog-to-digital conversion; z-transform and concepts of poles and zeros; convolution; FIR filters and digital filtering; IIR filters and frequency response of digital filters; continuous-time systems and Fourier transform properties; application examples of signal analysis and processing.

At the end of the course, students should have a clear understanding of the fundamentals of signals and system theory to enable them to perform simple signal analysis and processing using both analytical method as well as using computing tools, link the mathematical representation of signals to some very simple real life signals and vice versa, and appreciate the applications of linear systems theory in solving some simple real life problems. In addition, students should be aware of the complexity of real life problems and the need to continue investigation in practice after graduation.

Assessment: 20% practical work, 10% continuous assessment, 70% examination

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### **MEDE2810    Engineering management and society (6 credits)**

The aims are to develop basic understanding of organization and management skills, professional ethics and legal foundation for the engineering discipline. Topics on engineering organization, project management and managerial skills, decision making processes, contingency and crisis management, leadership, corporate culture and philanthropy will be discussed. In order to provide a clear and right insight for engineering students to interact and contribute to the society, topics related to professional conduct, social responsibility, sustainability and safety issues, technology and environment, professional ethics are included. For the legal foundation, topics such as contract, intellectual property, tort, professional negligence and related law issues are discussed.

Mutually exclusive with ELEC3844 & MEDE2814

Assessment: 30% continuous assessment, 70% examination

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### **MEDE2600    Biomechanics for medical engineering (6 credits)**

Stress and strain; bending and deflection of beams; structural failure and viscoelasticity; Kinematics of particles, momentum and energy principles; free vibration and kinematics of mechanisms; human gait and motion; bone fracture & fixation.

Assessment: 10% practical work, 20% continuous assessment, 70% examination

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### **MEDE3010 Integrated project (6 credits)**

This project is broadly centered around the topic of biomedical circuits. Its overall aim is to provide biomedical engineering students with a hands-on opportunity to develop a practical and functional biomedical device, such as an electrocardiogram (ECG) system or pulse oximeter based on simple electronic circuits from scratch and thereby learn more about the technical details of such devices. Upon completing this course, the student should be able to explain to others the practical importance and technical details of electronic circuits used for physiological measurements; (e.g. bio-potentials or blood oxygenation) to develop a standalone medical device package using basic electronic parts such as op-amp chips, resistors, and capacitors. Understand how proper design of circuits can play an important role in assisting medical diagnoses accordingly.

Assessment: 100% practical work

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### **MEDE3301 Life sciences III (Physiology) (6 credits)**

To provide the students with integrated knowledge of human physiology and pathophysiology that is relevant to medical engineering in such areas as (1) blood, blood clotting and immune response, (2) breathing and gas transport, (3) generation and transmission of nerve impulses, muscle contraction, bone, (4) the brain and its functions, autonomic system and reflexes, and (5) some disorders of the above.

Assessment: 30% continuous assessment, 70% examination

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### **MEDE3500 Electromagnetics in biomedicine (6 credits)**

The aim of this course is provide students with knowledge of electromagnetics and its applications in biomedicine. Fundamental physics and mathematics in electricity and magnetism are discussed. Vector analysis is included. Topics on electricity include electric field, Gauss's law, divergence theorem, electric potential, capacitor, dielectrics, Poisson's and Laplace's equations, and work and electrostatic energy. Topics on magnetism include magnetic field, Ampere's circuital law, Stokes theorem, magnetic flux, magnetic materials, and Faraday's law. Finally, Maxwell equations and particle accelerators for biomedical treatment are explained. Applications of electromagnetics in biomedicine are emphasized and integrated throughout the course.

Assessment: 10% practical work, 15% continuous assessment, 75% examination

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### **MEDE3501 Medical imaging (6 credits)**

Medical imaging is an indispensable technology in modern healthcare and biomedical research. It provides in vivo anatomical, physiological and functional information of the human body in normal, developing and pathological states. The rapid development in this field not only leads to better disease diagnosis and more accurate treatment efficacy assessment, but also paves the way for better understanding of living biological systems.

This course will focus mainly on the principles of conventional (X-ray and Ultrasound) and modern (Computerized Tomography – CT; Magnetic Resonance Imaging – MRI; Nuclear Imaging and Optical Imaging) imaging techniques applied to biological systems and in medical diagnoses and the interpretations of these images.

At the end of the course, students should gain a clear understanding in the physics, working principles and mathematics involved in the various imaging modalities covered. They should also be able to

appreciate the interdisciplinary nature of the subject and learn the latest development or advancement in the field of medical imaging.

Pre-requisites: MEDE2500 or MEDE2201 or MEDE2203 or ELEC3241

Assessment: 20% practical work, 10% continuous assessment, 70% examination

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### **MEDE3504 Medical engineering laboratory (6 credits)**

This course aims to provide the opportunity for students to have hands-on experience and develop fundamental experimental skills required in biomedical engineering. The course emphasizes biomedical engineering principles and experimental designs applied in human physiology, from cellular to tissue and organ levels. The course is comprised of four major lab modules: electrophysiology, characterization of cells and tissues, micromechanics of small objects, and biomedical imaging systems. State-of-the-art biomedical designs in these four areas will also be addressed.

Assessment: 80% practical work, 20% continuous assessment

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### **MEDE3600 Biomaterials I (6 credits)**

Bonds and crystal structure; defects in crystalline solids; diffusion; solidification; phase diagram; strength of materials; plastic deformation; recrystallization; grain growth; fracture of materials; fatigue life and fatigue crack growth; creep; corrosion; structure and properties of polymers; analytical and testing techniques; definitions in biomaterials science and engineering; history of biomaterials; structure and properties of biological materials; materials in biomedical applications.

Assessment: 20% practical work, 10% continuous assessment, 70% examination

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### **MEDE3602 Thermofluids for medical engineering (6 credits)**

Concepts and definitions in engineering thermodynamics; thermodynamic properties; first law of thermodynamics; basic concepts in fluid mechanics for medical engineering; dimensional analysis and similarity; introduction to mass transport; introduction to diffusion.

Assessment: 10% practical work, 10% continuous assessment, 80% examination

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### **MEDE3603 Statistics and mathematical analysis for medical engineering (6 credits)**

This course introduces the principles, concepts and methodologies of statistical planning and analysis for biomedical studies. The course is divided into five sections. Firstly, basic principles including probability, sampling distributions, hypothesis testing, statistical errors and power will be briefly reviewed using examples extracted from biomedical studies. Secondly, commonly used statistical tests, both parametric and non-parametric, including those for comparison studies such as the analysis of variance (ANOVA) and association studies such as regression and correlation, will be introduced. Thirdly, practical data management and statistical analyses for biomedical data will be conducted through learning the statistical software SPSS. Fourthly, some special topics useful for biomedical studies such as sample size planning, power analysis, sensitivity and specificity of diagnostic and screening tests, will be covered. Last but not the least, how to critically appraise the biomedical literature, such as understanding the common errors in design and conduct, analysis, presentation and interpretation of a study will be reviewed.

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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**MEDE3020      Professional Training (6 credits)**

This course aims to provide our students with on-the-job training in local or non-local companies or organizations so that they can integrate theory learning with practical applications; understand real-life organizational structure and business operation; learn how to build human relations with seniors and co-workers; and enrich personal resume for becoming engineering professional.

Assessment: 100% continuous assessment

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**MEDE4010      Final year project (12 credits)**

This course is a core course for all final year medical engineering students. It requires students to apply the knowledge they acquired throughout their academic studies to solving real-life medical engineering problems. Students are provided with an opportunity to pursue their own research interest under the supervision of teachers from both Engineering & Medicine. At the end of the course, students are required to present a dissertation or report on a topic consisting of design, experimental or analytical investigations. They will develop the ability to formulate and solve problems in medical engineering.

Assessment: 100% continuous assessment

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**ELEC3245      Control and instrumentation (6 credits)**

Control systems and instrumentation methods are fundamental to many engineering disciplines. In this course, a general approach will be taken to study of control systems and instrumentation, so that the theory and methods are applicable to other disciplines at the system level. The course is aimed at providing a general understanding of the fundamental principles of control systems and instrumentation methods. The following topics will be covered in the course: system modeling, transient response, principles of feedback, root locus, frequency response methods, state-space models, introduction to digital control, instrumentation and measurement systems, electromagnetic compatibility, noise and interference. At the end of the course, students should have gained an understanding of the concepts and methodologies for the complete process of modeling, analysis and design of a feedback control system, including instrumentation technologies for measuring controlled variables.

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**ELEC3845      Economics, finance and marketing for engineers (6 credits)**

The aims of this course are to develop basic understanding of economics, finance and marketing for the engineering discipline. The syllabus includes macroeconomics, microeconomics, value chain, financial management, cost and profit, shares and bonds, accounting concepts and financial statements, cash flow, rate of return; risk management, investment portfolio, technical analysis; marketing management, marketing mix, marketing media, marketing plan, and business ethics.

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**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.

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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#### **ELEC6079      Biomedical ultrasound (6 credits)**

Ultrasound physics, imaging modes, data acquisition schemes, transducer modelling; other applications of ultrasound including flow analysis, microscopy, therapy. Previous exposure to medical imaging theory (e.g. MEDE 2007/MEDE3501 – Medical Imaging, or equivalent) is highly preferred.

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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

Fundamentals of biomedical signals (physiological origins, characteristics, and acquisition); modelling and analyses of biomedical signals (linear and nonlinear modelling, digital filtering, spectral analysis, time-frequency analysis, multi-variate biomedical signal processing, etc); pattern classification and diagnostic decision; practical and clinical applications of biomedical signals; project development.

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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#### **MEDE4500      Biomedical instrumentation and systems (6 credits)**

This course introduces the essential principles of biomedical instrumentation and systems used for both diagnostic and therapeutic purposes from the level of human body, organs, cells, down to the molecular level. Their applications encompass a wide range of areas, ranging from healthcare, clinical applications to basic life science research. Examples include ECG, EEG; blood pressure sensors; DNA microarray; flow cytometry, cardiac pacemakers, defibrillators and laser surgery.

Assessment: 20% practical work, 40% continuous assessment, 40% examination

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#### **MEDE4501      Biophotonics (6 credits)**

This is an introductory course in biophotonics covering: (1) The essential concepts of (i) basic ray optics, (ii) wave optics, e.g. interference and diffraction, and (iii) photon optics, e.g. laser principles. (2) Interaction of light with biological cells/tissues and its significances and implications in optical bioimaging and other optical diagnostic and therapeutic applications. (3) State-of-the-art biophotonic instrumentations and technologies: optical bioimaging and microscopy (optical coherence tomography (OCT), fluorescence microscopy, multiphoton and other nonlinear optical microscopy), lab-on-chip biosensors, laser therapy, optical-fiber-based micro-endoscopy.

Assessment: 30% practical work, 30% continuous assessment, 40% examination



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**MEDE4601    Biomaterials II (6 credits)**

Processing, structures and properties of biomaterials; tissue response to implants; biomaterial degradation; *in vitro* and *in vivo* assessment of biomaterials; implant failure; hard tissue repair; soft tissue repair; blood interfacing implants; drug delivery, nanotechnology in medicine; tissue engineering; prosthetic medical device classification; prosthetic medical device evaluation; prosthetic medical device regulation; medical device standards; ethical issues.

Pre-requisite: MEDE2202 or MEDE3600

Assessment: 20% practical work, 80% examination

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**MEDE4602    Molecular and cellular biomechanics (6 credits)**

The focus of this course is on the physics of molecular biology and the mechanics of the cell. Topics include: (1) Biopolymer (actin filaments, microtubules, DNA etc.) conformations and dynamics (random walk model of polymers, worm-like chain model, persistence length, entropic driven elasticity); (2) Basic statistical mechanics and thermodynamics of solutions (entropy of mixing, Osmotic pressure); (3) Mechanics of the cell (membrane elasticity, cell shape, cell adhesion); and (4) Introduction to intermolecular interactions (electrostatic force, van der Waals force).

Assessment: 40% continuous assessment, 60% examination

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**MEDE4603    Transport phenomena in biological systems (6 credits)**

Basic equations of fluid mechanics; fluid flow in the circulation and tissues; transport in porous media; mass transport in biological systems; kinetics; heat conduction; heat convection; heat exchangers.

Pre-requisite: MEDE2005 or MEDE3602

Assessment: 30% continuous assessment, 70% examination

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**MEDE4604    Cell and tissue engineering (6 credits)**

This course firstly introduces the nature on cell and tissue organization, tissue dynamic processes including development, homeostatis and wound healing. Second, it reviews in detail the basic components of engineered tissues including cells, scaffolds and signals. For cells, important cellular-fate processes such as attachment, migration, proliferation, differentiation and apoptosis, and the cell culture technology will be reviewed before focusing on stem cells and their relevance in tissue engineering. For scaffolds, the analogous role of scaffolds and extracellular matrix of native tissues will be compared and the technological advancement in scaffold design and fabrication will be highlighted. On signals, different types of cell-regulating signals including soluble biofactors, insoluble matrix factors and cell-cell interactions and biophysical signals such as topological and mechanical signals will be introduced before an integrative summary on the application of these signals in designing stem cell niche can be made. Apart from employing these signals extrinsically, direct genetic manipulation of cells can also achieve the purpose of modifying cellular functions. The basic understanding and technological achievement of gene transfer and delivery and its applications in tissue engineering will be covered.

Assessment: 20% practical work, 20% continuous assessment, 60% examination

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