# MEDICAL ENGINEERING

## SYLLABUS

*This syllabus applies to students admitted in the academic year 2011-12.*

### Definitions and Terminology

Each course offered for the BEng in Medical Engineering curriculum shall be classified as either introductory level course or advanced level course, and be assigned a Level --- One, Two or Three, in which Level One courses are generally classified as introductory courses whereas advanced courses includes Level Two and Three courses.

A *Compulsory course* is a course which a student must study. A *Core Engineering course* is a Compulsory course which a student must pass in the manner as stipulated in the Regulations.

*The Projects* shall include MEDE2008 integrated project and MEDE3002 final-year project.

The *training course* in this curriculum consists of MEDE1010 Engineering Training and MEDE2010 Professional Training.

*An Elective course in Medical Engineering* is a Level 2 or Level 3 course offered as an optional course for the curriculum.

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### Loading

The normal load for a student is 60 credits of courses (excluding summer semester) per academic year with 30 credits in each semester. Students are allowed to increase the loading by not more than 6 credits in a semester or decrease the loading by the equivalent number of credits which they have previously taken as additional loading and passed.

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### Curriculum Requirement

The curriculum comprises 180 credits of courses as follows:

(a) 114 credits of Core Engineering courses
(b) 24 credits of Compulsory courses
(c) at least 9 credits of elective courses in Medical Engineering
(d) 21 credits of courses satisfying the UG5 requirements:
    (i) Professional and technical communication for medical engineering students[1] (3 credits)
    (ii) Professional and technical oral communication for engineers (3 credits)
    (iii) Practical Chinese language course for engineering students[2] (3 credits)

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[1] Students pursuing the double degrees in BEng/BBA are required to take CAES1907 in lieu of CAES1511.

[2] Putonghua-speaking students should take CUND0002 or CUND0003. 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 CENG1001 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.

(iv) Two courses from the Common Core Curriculum, selecting no more than one course from each Area of Inquiry (12 credits)

(e) at least 6 credits of Complementary Studies courses comprising:
  (i) Engineering management and society[3] (6 credits)

(f) Engineering training[3] (3 credits)

(g) Professional training[3] (3 credits)

To complete the degree requirement, a student must obtain at least 180 credits including all courses listed under (a) to (g).

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**Order of Study**

Order of study is dictated by pre-requisite and co-requisite requirements. Generally, Level 1 course should be taken before Level 2 courses, Level 2 courses should be taken before Level 3 courses. Medical Engineering elective course can be taken in any order as long as pre-requisites are met.

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**Degree Classification**

The best 180 credits including the courses below shall be taken into account:

(i) 6 credits of Complementary courses;
(ii) 21 credits of courses satisfying the UG5 requirements;
(iii) 114 credits of Core Engineering Courses;
(iv) the remaining courses with the best results including at least 9 credits of elective courses in Medical Engineering and 24 credits of Compulsory courses.

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The programme structure is as follows:

**FIRST YEAR**

**Core Engineering Courses (Total 39 credits)**
*(The number in brackets is the number of credits of the particular course)*

| | |
|---|---|
| ENGG1015 | Introduction to electrical and electronic engineering (6 credits) |
| ENGG1010 | Foundations of engineering mechanics (6 credits) |
| ENGG1011 | Introduction to biomedical engineering (6 credits) |
| MEDE0001 | Life science I (Biochemistry) (6 credits) |
| MEDE1003 | Introduction to engineering materials (3 credits) |
| | |
| either | |
| ENGG1002 | Computer programming and applications (6 credits) |
| or | |
| ENGG1016 | Computer programming and applications I (6 credits) |

[3]Students pursuing the studies of double degrees in BEng/BBA are allowed a waiver from taking these courses, the credits of which will be replaced by the required courses in Finance, HRM or Marketing major offered by the Faculty of Business and Economics to satisfy the Medical Engineering Curriculum requirement.

either
ENGG1003 Mathematics I (6 credits)
or
ENGG1004 Mathematics IA (3 credits) and
ENGG1005 Mathematics IB (3 credits)

**UG5 Requirements (Total 21 credits)**
CAES1511 Professional and technical communication for medical engineering students[1] (3 credits)
CAES1515 Professional and technical oral communication for engineers (3 credits)
CENG1001 Practical Chinese language course for engineering students[2] (3 credits)
Two Common Core Courses (12 credits)

**Engineering Training (Total 3 credits)**
MEDE1010 Engineering training[3] (3 credits)

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**SECOND YEAR**

**Core Engineering Courses (Total 57 credits)**
ELEC1401 Computer organization and microprocessors (6 credits)
MECH2007 Mathematics II (6 credits)
MEDE0002 Life science II (Cell Biology & Physiology) (6 credits)
MEDE2001 Biomechanics for medical engineering (6 credits)
MEDE2002 Electromagnetics in biomedicine (6 credits)
MEDE2004 Biomaterials I (3 credits)
MEDE2005 Thermofluids for medical engineering (6 credits)
MEDE2007 Medical imaging (6 credits)
MEDE2008 Integrated project (6 credits)
MEDE2201 Signals and linear systems (6 credits)

**Complementary Studies Course (Total 6 credits)**
MEDE2814 Engineering management and society[3] (6 credits)

**Professional Training (Total 3 credits)**
MEDE2010 Professional training[3] (3 credits)

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**THIRD YEAR**

**Core Engineering Courses (Total 18 credits)**
MEDE3002 Medical engineering final year project (12 credits)
LIFE2004 Life sciences III (Physiology) (6 credits)

**Compulsory Courses (Select 24 credits from the following courses)**
MEDE2006 Statistical planning and analysis for biomedical studies (3 credits)
MEDE2009 Biophotonics (6 credits)
MEDE3001 Tissue engineering (3 credits)
MEDE3003 Biomaterials II (3 credits)
MEDE3005 Transport phenomena in biological systems (6 credits)
MEDE3006 Medical devices (3 credits)
MEDE3007 Molecular and cellular biomechanics (6 credits)

**Elective Course in Medical Engineering[3] (Total 9 credits)**
**Recommended Elective Course**

| | |
|---|---|
| MECH6040 | Foundations of nanotechnology (3 credits) |
| ELEC6067 | Magnetic resonance imaging (MRI) technology & applications (3 credits) |
| ELEC6079 | Biomedical ultrasound (3 credits) |
| ELEC6081 | Biomedical signals and systems (3 credits) |
| BIOC3608 | Introduction to bioinformatics (6 credits) |
| ELEC2815 | Economics, finance and marketing for engineers (6 credits) |

**Additional Elective Course**

***Group A: Biomechanics, Biomaterials, Tissue Engineering***

| | |
|---|---|
| MECH2001 | Applied dynamics (3 credits) |
| MECH2004 | Control (3 credits) (cannot be taken with ELEC2205) |
| MECH2005 | Design and manufacture (6 credits) |
| MECH6024 | Applied mathematics for engineers (3 credits) |

***Group B: Medical Electronics and Biomedical Imaging***

| | |
|---|---|
| ELEC2204 | Digital signal processing (6 credits) |
| ELEC2205 | Control and instrumentation (6 credits) (cannot be taken with MECH2004) |
| ELEC2302 | Digital system design (6 credits) |
| ELEC2601 | Human computer interaction (6 credits) |
| ELEC3222 | Robotics (6 credits) |
| ELEC3225 | Digital imaging processing (6 credits) |
| CSIS0278 | Introduction to database management systems (6 credits) |

The list of Elective courses in Medical Engineering is updated regularly and some courses may not be offered every year. Students are encouraged to consult the Programme Director or other teachers in Medical Engineering for advice on planning their curriculum, especially in the third-year. Due to the interdisciplinary nature of the Medical Engineering Programme, students may be permitted to take courses outside the list of Medical Engineering elective courses subject to the approval of the Programme Director.

**Double degrees in BEng/BBA option**

Candidates pursuing studies for the double degrees in BEng/BBA curriculum are required to satisfy all the requirement of the above BEng curriculum and pass 54 credits of courses as listed below:

| Course Code | Course | Credits |
|---|---|---|
| BUSI1002 | Introduction to accounting | 6 |
| BUSI1003 | Introduction to management information system | 6 |
| BUSI1004 | Marketing | 6 |
| BUSI1007 | Principles of management | 6 |
| ECON1001 | Introduction to economics I | 6 |
| FINA1003 | Corporate finance | 6 |
| BUSI0027 | Management accounting I | 6 |
| | Business Electives (Any 2 courses in Finance, HRM or Marketing major) | 12 |

| | | |
|---|---|---|
| | ***Total*** | **54** |

Exemption rule for students pursuing the BEng/BBA double degrees option:

For students pursuing the double degrees in BEng/BBA option, they are deemed to have satisfied the following courses:

6 credits of Complementary Studies
9 credits of Elective course in Medical Engineering
3 credits of Engineering training and
3 credits of Professional training
3 credits of Compulsory course

after they have successfully completed all the courses from the following list:

| Course Code | Course | Credits |
|---|---|---|
| BUSI1002 | Introduction to accounting | 6 |
| BUSI1003 | Introduction to management information systems | 6 |
| BUSI1004 | Marketing | 6 |
| BUSI1007 | Principles of management | 6 |
| ECON1001 | Introduction to economics I | 6 |
| FINA1003 | Corporate finance | 6 |
| BUSI0027 | Management accounting I | 6 |

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**COURSE DESCRIPTIONS**

**Level One**

**ENGG1002. Computer programming and applications (6 credits)**
**ENGG1003. Mathematics I (6 credits)**
**ENGG1004. Mathematics IA (3 credits)**
**ENGG1005. Mathematics IB (3 credits)**
**ENGG1010. Foundations of engineering mechanics (6 credits)**
**ENGG1011. Introduction to biomedical engineering (6 credits)**
**ENGG1015. Introduction to electrical and electronic engineering (6 credits)**
**ENGG1016. Computer programming and applications I (6 credits)**

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

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**MEDE0001. Life science 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

**MEDE1003. Introduction to engineering materials (3 credits)**

Elements of atomic structure and bonding; crystal structure; metals, ceramics and polymers; defects; solidification; plastic deformation and fracture; recrystallization; phase diagrams; alloy properties; service behaviour of plastics and metals.

Assessment: 10% practical work, 90% examination

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**CAES1511. Professional and technical communication for medical engineering students (3 credits)**

This course focuses on students developing technical and professional spoken English skills. Throughout the course, the students will give a series of presentations which will help them to improve skills such as accessing, abstracting, analyzing, organizing and summarizing information; asking questions and negotiating meanings; making effective grammatical and lexical choices and using visual aids to ensure meaning is clear. The presentation give the students an opportunity to develop the skills to talk about general issues in Engineering in the Hong Kong context, engineering theories and their practical applications and also requires them to present a detailed exploration of one aspect of engineering related to their chosen major. Assessment is wholly by coursework.

Assessment: 100% continuous assessment

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**CAES1515. Professional and technical oral communication for engineers (3 credits)**

This course focuses on students developing technical and professional spoken English skills. Throughout the course, the students will give a series of presentations which will help them to improve skills such as accessing, abstracting, analyzing, organizing and summarizing information; asking questions and negotiating meanings; making effective grammatical and lexical choices and using visual aids to ensure meaning is clear. The presentations give the students an opportunity to develop the skills to talk about general issues in Engineering in the Hong Kong context, engineering theories and their practical applications and also requires them to present a detailed exploration of one aspect of engineering related to their chosen major.

Assessment: 100% continuous assessment

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**CENG1001. Practical Chinese language course for engineering students (3 credits)**

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

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**MEDE1010. Engineering training (3 credits)**

The focus of this course is on practical training. It helps students to appreciate the processes and technologies through demonstrations and hands-on experience. The topics include computer-aided drafting; design; modeling and prototyping; CNC machining principles;

metrology equipment; materials processing; strain gauging; virtual instrumentation; microcontroller applications.

Assessment: 100% continuous assessment

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**12 credits of courses from the Common Core Curriculum**

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**Level Two**

**ELEC1401. Computer organization and microprocessors (6 credits)**

Integer and floating point number representations; brief introduction to digital circuits; memory cells and systems; 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; exception handling; assembler, linker and loader.

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**MECH2007. Mathematics II (6 credits)**

Complex variables; Fourier series and Fourier transforms; partial differential equations; introduction to probability and statistics; elementary numerical analysis.

Assessment: Please refer to the information provided by the Department of Mechanical Engineering

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**MEDE0002. Life science II (Cell Biology and Physiology) (6 credits)**

This course introduces cell and tissue functions that impact on physiology of the human body. Topics include chromosome structure and gene expression; plasma membrane and subcellular organelles; cytoskeleton and cell movement; extracellular matrix and cell-matrix interactions; tissue organization; homeostasis involving the cardiovascular, respiratory, musculoskeletal and nervous systems.

Assessment: 25% continuous assessment, 75% examination

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**MEDE2001. Biomechanics for medical engineering (6 credits)**

Kinematic analysis of linkage mechanisms; stress and strain; bending and deflection of of beams. Human musculoskeletal system; biomechanical analysis of the human musculoskeletal system; bone fracture & fixation; biomechanics of the spine; selected topics in biomechanics; biomechanical analysis of the human gait and motion.

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

**MEDE2002. Electromagnetics in biomedicine (6 credits)**

The aim of this course is two fold. First, fundamental physics and mathematics in electricity and magnetism are reviewed. Vector analysis is included. Second, emphasis is placed on the biological aspects of electromagnetism and the biomedical applications of electromagnetism.

Assessment: 10% practical work, 15% continuous assessment, 75% examination

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**MEDE2004. Biomaterials I (3 credits)**

Definitions in biomaterials science and engineering; history of biomaterials science; review of engineering materials; structure and properties of biological materials; processing, structures and properties of biomaterials; tissue engineering; analytical and testing techniques for developing new biomaterials; interaction between human body environment and biomaterials.

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

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**MEDE2005. Thermofluids for medical engineering (6 credits)**

Concepts and definitions; thermodynamic properties; heat and work; first law of thermodynamics; fluid kinematics; constitutive relations; blood rheology; continuity and momentum equations; dimensional analysis, similarity and modeling; solute fluxes in mixture; Fick's law; bio-mass transport.

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

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**MEDE2007. Medical imaging (6 credits)**

Provides an introduction to the clinical non-invasive techniques in studying the functional and pathological aspects of the human body. This course will introduce the principles of conventional (x-ray and ultrasound) and modern (Computer Assisted Tomography – CAT; Magnetic Resonance Imaging – MRI; and Positron Emission Tomography – PET) imaging techniques applied to biological tissues and in medical diagnoses and the interpretations of these images. It will also briefly introduce the hospital PACS (picture archiving computer system) and emerging medical imaging technologies.

Assessment: 15% continuous assessment, 85% examination

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**MEDE2008. Integrated project (6 credits)**

A group project consisting of guided design and implementation of a medical engineering application. This project offers students in small teams an opportunity to integrate their knowledge in engineering techniques and know-how, as well as project management, following a disciplined engineering process, to achieve the final goal.

Assessment: 100% practical work

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**MEDE2201. Signals and linear systems (6 credits)**

Linear time-invariant systems; continuous-time signals; convolution; frequency response; time-domain and frequency-domain representation of discrete-time signals and systems; continuous and discrete Fourier transform; *z*-transform; A/D and D/A conversion; sampling and reconstruction; digital filters; examples in biomedial engineering applications.

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

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**MEDE2814. Engineering management and society (6 credits)**

Social responsibility, environmental and safety issues, professional conduct and responsibility, engineering management, decision making processes, project management, leadership, marketing, market analysis, marketing plan, new media marketing, contract law, law of tort, professional negligence and intellectual property law.

Assessment: 30% continuous assessment, 70% examination

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**MEDE2010. Professional training (3 credits)**

Assessment: 100% continuous assessment

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**Level Three**

**MEDE3002. Medical engineering final year project (12 credits)**

A dissertation or report on a topic consisting of design, experimental or analytical investigations. Six hours of lecturing will be introduced to discuss topics on (1) biomedical literature search; (2) experimental designs to address medical problems or questions; (3) data analysis and interpretation; and (4) medical engineering report preparation and presentation.

Assessment: 100% continuous assessment

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**LIFE2004. Life Sciences III (Physiology) (6 credits)**

This course focuses on human physiology and pathophysiology. Topics include heart and cardiovascular system and disorders; brain and neurological system and disorders; musculoskeletal system and disorders; respiration and breathing mechanics and will be illustrated with examples of quantitative analyses, where relevant.

Assessment: 30% continuous assessment, 70% examination

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**MEDE2006. Statistical planning and analysis for biomedical studies (3 credits)**

To understand the principles and concepts in statistical methodology commonly used for biomedical investigations; to apply the statistical tools in planning for biomedical studies,

managing and analyzing data generated from these studies; to appreciate the principles and concepts for critical appraisal of biomedical literature

Assessment: 20% continuous assessment, 80% examination

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**MEDE2009. Biophotonics (6 credits)**

This is an introductory course in optics and photonics covering the basic concepts of ray optics, imaging system design, electromagnetic waves, propagation characteristics of light through media, Fourier optics, and other optical phenomena such as interference and diffraction. Modern topics in photonics such as optical waveguides, fiber optics, lasers are also discussed. Their applications in biomedical areas are also included, such as optical microscopy and spectroscopy for medical diagnosis, laser therapy, micro-endoscopy, and optical biosensing.

Assessment: 60% continuous assessment, 40% examination

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**MEDE3001. Tissue engineering (3 credits)**

To understand the basic composition of engineered tissues; appreciate the breadth and depth of the engineering considerations when designing tissue substitutes; introduce the current technological advances enabling the tissue engineering sectors and the future trends; review some real examples of engineered tissue, skin and cartilage as the only marketed products and candidates in R&D stage; outline other key issues such as safety and regulations.

Assessment: 20% practical work, 80% examination

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**MEDE3003. Biomaterials II (3 credits)**

Medical devices and tissue replacement; medical device regulations; standards; ethical issues; medical device evaluation; hard tissue replacement; soft tissue replacement; new trends and emerging technologies.

Assessment: 20% continuous assessment, 80% examination

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**MEDE3005. Transport phenomena in biological systems (6 credits)**

Basic fluid flow problems in biomechanics; non-Newtonian rheology; flow in porous media; conservation of mass, momentum and energy; diffusion; diffusion with convection; Taylor dispersion; hemodialysis; biomedical and biotechnological applications.

Assessment: 30% continuous assessment, 70% examination

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**MEDE3006. Medical devices (3 credits)**

Provides a practical introduction to various medical devices in modern healthcare industries, including the basic principals and applications of commonly used medical instruments and devices, monitoring and analysis equipment, therapeutic equipment, software systems, and the

safety and regulatory issues.

Assessment: 20% practical work, 40% continuous assessment, 40% examination

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**MEDE3007. 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) Introduction to intermolecular interactions (electrostatic force, van der Waals force); and (4) Mechanics of the cell (membrane elasticity, cell shape, cell adhesion).

Assessment: 40% continuous assessment, 60% examination

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**Elective Courses in Medical Engineering**

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**MECH6040. Foundations of nanotechnology (3 credits)**

Characteristic length scales, nanomaterials, nanostructures, physical properties of nanostructures, deposition techniques of nanofabrication, high resolution analysis and characterization, scanning probe methods, nanoindentation, deformation of nanostructures, mechanical behaviours of nanocrystalline solids, ultra-high strength of nanostructures, sensors, actuators, MEMS, NEMS, functional nanomaterials, nano-scale devices, modelling and computer-aided designs, bio-nanotechnology.

Assessment: Please refer to the information provided by the Department of Mechanical Engineering

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

Fundamentals of Nuclear Magnetic Resonance (NMR); introduction to MR imaging system; design principle of permanent and super-conducting magnets; RF antennas (probes), gradient coils, RF transmitter and receivers; signal processing and imaging reconstruction; basic pulse sequence design; advanced fast imaging methods; MR spectroscopy and MR imaging applications, including functional MRI in human brain functional research and clinical applications.

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 – Medical Imaging, or equivalent) is highly preferred.

Prerequisite: MEDE2007 Medical imaging
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)**

Biomedical signals, ECG, EEG, EMG, spectral analysis, time-frequency analysis, filtering, blind source separation, recognition.

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**BIOC3608. Introduction to bioinformatics (6 credits)**

This course will examine existing programs and services available on the World Wide Web for DNA and protein sequence analysis. Students will also learn how to use the sequence analysis EMBOSS package installed locally. The underlying principles of these analysis programs and services will be presented. Students will learn how to retrieve, analyse, and compare protein and DNA sequence similarities. A basic introduction to protein modeling will also be presented.

Assessment: Please refer to the information provided by the Department of Biochemistry

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**ELEC2815. Economics, finance and marketing for engineers (6 credits)**

Macroeconomics; microeconomics, financial management; accounting concepts and financial statements; cost and profit, technical analysis, cash flow, interest rate, bonds, Black-Scholes formula

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**MECH2001. Applied dynamics (3 credits)**

Advanced rotational motion; balancing of rotating and reciprocating masses; vibration isolation and control; vibration of multi degree-of-freedom in-line systems; free transverse vibration of beams.

Assessment: Please refer to the information provided by the Department of Mechanical Engineering

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**MECH2004. Control (3 credits)**

Modelling of physical systems; time response analysis of dynamical systems; feedback control systems; control system design and applications; stability; root locus method; analogue computer programming.

Assessment: Please refer to the information provided by the Department of Mechanical Engineering

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**MECH2005. Design and manufacture (6 credits)**

Materials selection; joining and fastening; mechanism design; tooling system design; power transmission systems; CNC machining; rapid prototyping.

Assessment: Please refer to the information provided by the Department of Mechanical Engineering

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**MECH6024. Applied mathematics for engineers (3 credits)**

Statistical and numerical methods in engineering; hypothesis testing; estimation of parameters and confidence intervals; correlation coefficient; direct and iterative methods for systems of equations; numerical analysis; finite difference and finite element schemes; wave propagation and vibration; normal modes.

Assessment: Please refer to the information provided by the Department of Mechanical Engineering

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**ELEC2204. Digital signal processing (6 credits)**

Applications of digital signal processing, discrete-time signal and system, design of digital filters, DFT and fast algorithms, digital signal processing using Mathlab, fundamentals of random signals, spectral estimation, adaptive signal processing, digital signal processors.

Prerequisite: MEDE2201 Signals and linear systems
Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**ELEC2205. Control and instrumentation (6 credits)**

Introduction to control systems; principles of feedback; root-locus method; frequency-response design methods; state-space methods; control system software; digital control; measurement systems; electromagnetic compatibility; data acquisition.

Co-requisite: MEDE2201 Signals and linear systems
Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**ELEC2302. Digital system design (6 credits)**

Digital system concepts and digital components; digital design using discrete and programmable devices; high speed digital system design considerations; Hardware Description Language (HDL); digital system structures; digital logic and memory testing; fault detection analysis and design; Design for Test (DFT) techniques.

Prerequisites: ELEC1611 Circuit theory and digital logic or (ELEC1301 Circuits & ELEC1303 Electronics)
Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**ELEC2601. Human computer interaction (6 credits)**

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.

Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**ELEC3222. Robotics (6 credits)**

Introduction to robot configurations; forward and inverse kinematics; robot dynamics and control; robot path planning and programming; robot applications; special topics in robotics.

Prerequisite: ELEC2205 Control and instrumentation
Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**ELEC3225. Digital imaging processing (6 credits)**

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.

Prerequisite: MEDE2201 Signals and linear systems
Assessment: Please refer to the information provided by the Department of Electrical and Electronic Engineering

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**CSIS0278. 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 and calculus, database design and normalization, database query languages, indexing schemes, integrity, concurrency control, query processing. This course may not be taken with BUSI0052.

Prerequisite: ELEC1501 Computer programming and data structures
Assessment: Please refer to the information provided by the Department of Computer Science

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