

# MECHANICAL ENGINEERING

## SYLLABUSES

This syllabus applies to students admitted in the academic year 2012-13.

### Definitions and Terminology

Each course offered by the Department of Mechanical Engineering 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 introductory courses whereas advanced courses include Levels Two and Three courses.

A *Discipline Core Course* is a compulsory course which a candidate must pass in the manner provided in the Regulations. A *Project Course* is also a compulsory course which a candidate must pass. A *Breadth Course* is a Level 1, Level 2 or Level 3 course that is offered normally as an optional course for the curriculum. A *Depth Course* is a Level 3 course offered as an optional course for the curriculum. *Elective course* is a course offered by the Department of Mechanical Engineering, other departments under the Faculty of Engineering, or by other faculties.

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### The Curriculum

The curriculum comprises of 180 credits of courses as follows:

- (a) 24 credits from General Engineering courses, including:
  - (i) either ENGG1002 Computer programming and applications (6 credits) or ENGG1016 Computer programming and applications I (6 credits); AND
  - (ii) either ENGG1003 Mathematics I (6 credits) or ENGG1004 Mathematics IA (3 credits) and ENGG1005 Mathematics IB (3 credits); AND
  - (iii) ENGG1018 Introduction to mechanical engineering (6 credits); AND
  - (iv) Any one General Engineering course offered by other departments of the Faculty of Engineering (6 credits)
- (b) Discipline Core courses: 72 credits
- (c) 12 credits of Project
- (d) 45 credits of Elective courses
- (e) University requirements (21 credits), including:
  - (i) CAES1513 Professional and technical written communication for engineers (3 credits)<sup>1</sup>
  - (ii) CAES1515 Professional and technical oral communication for engineers (3 credits)
  - (iii) CENG1001 Practical Chinese language course for engineering students (3 credits)<sup>2</sup>
  - (iv) 12 credits of courses from the University Common Core Curriculum, selecting no more than one course from each Area of Inquiry
- (f) 6 credits of Breadth course

To complete the degree curriculum, a candidate must pass at least a total of 180 credits, including all the courses listed under (a) to (f) and satisfy any other requirements as stipulated in the University or Faculty of Engineering regulations.

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<sup>1</sup> Students pursuing BEng/BBA should take CAES1907 in lieu of CAES1513.

<sup>2</sup> "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 CENG10xx 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 language course in lieu".

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## 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.

## Order of Study

There are no course prerequisites but lower level courses should preferably be taken before higher level courses.

## **First Year**

The first-year syllabuses shall normally include the following courses:

### General Engineering Courses (Total 24 credits)

Either

ENGG1002 Computer programming and applications (6 credits); or  
ENGG1016 Computer programming and applications I (6 credits); AND

Either

ENGG1003 Mathematics I (6 credits) or  
both ENGG1004 Mathematics IA (3 credits) and ENGG1005 Mathematics IB (3 credits); AND

ENGG1018 Introduction to mechanical engineering (6 credits); AND

Any one General Engineering Courses (6 credits) from the following:

ENGG1006	Engineering for sustainable development
ENGG1007	Foundations of computer science
ENGG1009	Industrial management and logistics
ENGG1011	Introduction to biomedical engineering
ENGG1015	Introduction to electrical and electronic engineering

### Discipline Core Courses (Total 24 credits)

MECH1004 Drawing and elements of design and manufacture (6 credits)  
MECH1005 Fundamentals of electrical and electronic engineering (6 credits)  
MECH1013 Engineering mechanics (6 credits)  
MECH1014 Thermofluids (6 credits)

### UG5 requirements (Total 9 credits)

CAES1513 Professional and technical written communication for engineers (3 credits)  
CAES1515 Professional and technical oral communication for engineers (3 credits)  
CENG1001 Practical Chinese language course for engineering students (3 credits)

### Optional Elective Course (Total 6 credits)

MECH1018 Engineering training (6 credits) (Summer semester)

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## Second Year

The second-year syllabuses shall normally include the following courses:

Discipline Core Courses (Total 48 credits)

MECH2002 Engineering thermodynamics (6 credits)  
MECH2005 Design and manufacture (6 credits)  
MECH2006 Electrical and electronic engineering (6 credits)  
MECH2007 Mathematics II (6 credits)  
MECH2008 Mechanics of fluids (6 credits)  
MECH2009 Mechanics of solids (6 credits)  
MECH2018 Dynamics and control (6 credits)  
MECH2419 Properties of materials (6 credits)

UG5 requirements (Total 12 credits)

2 University Common Core Courses (12 credits)

Optional Elective Courses (Total 6 credits)

MECH2017 Industrial training (6 credits) (Summer semester)

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## Third Year

The third-year syllabuses shall normally include the following courses:

Project (Total 12 credits)

MECH4429 Integrated capstone experience (12 credits)

Breadth Course (Total 6 credits)

MECH3010 Engineering and technology management (6 credits)

Elective Courses (45 credits)

Students are required to complete 45 credits of Elective courses in the following manner:

- (i) Elective Breadth/Depth Courses (up to 45 credits)
- (ii) Elective MSc(Eng) Courses (up to 6 credits)
- (iii) Free Elective Courses (up to 12 credits)

Elective Breadth/Depth Courses (Up to 45 credits from the following)

BBSE2001	Utility services (6 credits)
BBSE2008	Air conditioning and refrigeration engineering (6 credits)
BBSE3003	Fire protection engineering (6 credits)
BBSE3009	Project management and engineering economics (6 credits)
CIME2001	Water and air quality: concepts and measurement (6 credits)
CIVL3111	Municipal and industrial waste treatment (6 credits)
CIVL3115	Solid and hazardous waste management (6 credits)
CIVL3122	Wind engineering (6 credits)
MECH1018	Engineering training (6 credits)

MECH2016	Fundamentals of aeronautical engineering (6 credits)
MECH2017	Industrial training (6 credits)
MECH3002	Air pollution control (6 credits)
MECH3004	Automatic control (6 credits)
MECH3007	Computer-aided design and manufacture (CAD/CAM) (6 credits)
MECH3009	Energy conversion systems (6 credits)
MECH3011	Heat transfer (6 credits)
MECH3012	Product design and development (6 credits)
MECH3014	Materials for engineering applications (6 credits)
MECH3015	Applied stress and strength analysis (6 credits)
MECH3021	Viscous flow(6 credits)
MECH3023	Building energy management and control systems (6 credits)
MECH3428	Research experience for undergraduates (6 credits)
MECH4428	Sound and vibration (6 credits)
MEDE3001	Tissue Engineering (3 credits)
MEDE3003	Biomaterials (3 credits)
MEDE3005	Transport phenomena in biological systems (6 credits)
MEDE3007	Molecular and cellular biomechanics (6 credits)

Elective MSc(Eng) courses (Up to 6 credits)

MECH6010	Service behavior of materials (3 credits)
MECH6023	Power plant technology (3 credits)
MECH6024	Applied mathematics for engineers (3 credits)
MECH6033	Energy conservation and management (3 credits)
MECH6044	Energy and carbon audit (3 credits)
MECH6045	Nanotechnology: fundamentals and applications (3 credits)
MECH6046	Microsystems for energy, biomedical and consumer electronics applications (3 credits)

Free Elective Courses (Up to 12 credits)

Any other elective courses as approved by the department (up to 12 credits)

## Course Descriptions

### Level One

#### **MECH1004. Drawing and elements of design and manufacture (6 credits)**

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.

Written examination (0%), Continuous assessment (100%), Practical work (0%)

#### **MECH1005. Fundamentals of electrical and electronic engineering (6 credits)**

Basic circuit principles; steady-state A.C. circuit theory; magnetic circuits; transformers; bipolar junction transistors; field effect transistors; direct-current motors; solid-state controller for D.C. motors; combinational logic circuits.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH1013. Engineering Mechanics (6 credits)**

Stress and strain; bending of beams; deflection of beams; thin-walled pressure vessels; kinematics of particles with different forms of acceleration; mechanisms; simple and epicyclic gear trains; momentum and energy conservation, application of kinetic principles to particles and vehicles with mass variation, velocity-dependent resistance and the action of central forces; undamped and damped free vibration

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH1014. Thermofluids (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH1018. Engineering training (6 credits)**

Instrumentation; computation fluid dynamics; programmable logic controller; basic electrical engineering; design and model making; machining and metrology; machining practice; seminars on safety, against corruption, engineering profession and other contemporary issues.

Written examination (0%), Continuous assessment (0%), Practical work (100%)

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**ENGG1002. Computer programming and applications (6 credits)**

**ENGG1003. Mathematics I (6 credits)**

**ENGG1004. Mathematics IA (3 credits)**

**ENGG1005. Mathematics IB (3 credits)**

**ENGG1006. Engineering for sustainable development (6 credits)**

**ENGG1007. Foundations of computer science (6 credits)**

**ENGG1009. Industrial management and logistics (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)**

**ENGG1018. Introduction to mechanical engineering (6 credits)**

For course descriptions, please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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

**CENG9001. Practical Chinese for engineering students (3 credits)**

For course descriptions, please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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**CAES1513. Professional and technical written communication for engineers (3 credits)**

The focus of this course is the function and importance of professional and technical communication in English and specifically understanding and using written English. Topics include accessing, abstracting, analyzing, organizing and summarizing information; making effective grammatical and lexical choices; technical report writing; small-scale project design and implementation. Assessment is wholly by coursework.

Assessment: 100% continuous assessment

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**CCXXxxxx University Common Core Curriculum course (6 credits)**

**CCXXxxxx University Common Core Curriculum course (6 credits)**

2 University Common Core Curriculum Courses from different Areas of Inquiry. Please refer to the University Common Core Curriculum Courses for details.

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**Level Two**

**BBSE2001. Utility services (6 credits)**

Characteristics and design of different utility service installations; cold, hot and flushing water supply systems; steam supply; sanitary and storm water drainage systems; vertical transportation system; communication systems; security and alarm.

Written examination (65%), Continuous assessment (20%), Practical work (15%)

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**BBSE2008 Air conditioning and refrigeration engineering (6 credits)**

Air conditioning systems; psychrometry; thermal comfort; load and energy calculations; air-side systems; fan design and other major components; air duct design; space air diffusion; water-side systems; piping system design; pump design and operation; indoor air quality; mechanical and natural ventilation; ventilation efficiency; refrigerants and refrigeration systems; refrigeration cycles and principles; design of refrigeration systems; refrigeration system components and performance.

Written examination (65%), Continuous assessment (20%), Practical work (15%)

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**MECH2002. Engineering thermodynamics (6 credits)**

IC engines; steam and gas power plants; refrigeration; jet propulsion; gas mixture; psychrometry and air-conditioning; introduction to heat transfer and combustion.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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

Material selection; joining and fastening; jigs and fixtures design; power transmission system design; CNC machining; rapid prototyping.

Written examination (0%), Continuous assessment (100%), Practical work (0%)

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**MECH2006. Electrical and electronic engineering (6 credits)**

Analog electronics; sequential logic circuits; digital-to-analog and analog-to-digital converters; introduction to microcontrollers; three-phase power systems; induction motors; synchronous motors; step motors; solid-state controllers for A.C. motors.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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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.

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH2008. Mechanics of fluids (6 credits)**

Navier-Stokes equations; pipe and channel viscous flows; lubrication; two-dimensional potential flows; boundary layer flows; dimensional analysis.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH2009. Mechanics of solids (6 credits)**

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.

Written examination (75%), Continuous assessment (15%), Practical work (10%)

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**MECH2016. Fundamentals of aeronautical engineering (6 credits)**

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

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH2017. Industrial training (6 credits)**

Training in industry for a nominal period of at least six weeks during the summer vacation of the second Year of study.

Written examination (0%), Continuous assessment (0%), Practical work (100%)

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**MECH2018. Dynamics and control (6 credits)**

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.

Written examination (70%), Continuous assessment (10%), Practical work (20%)

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**MECH2419. Properties of Materials**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**CIME2001. Water and air quality: concepts and measurement (6 credits)**

Water quality and water pollution; standard methods of water and wastewater examination; air quality and air pollution control principles; measurement techniques in air pollution.

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

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**Level Three****BBSE3003. Fire protection engineering (6 credits)**

Fire behavior and characteristics; compartment fires; fire hazards; automatic fire detection and alarm systems; automatic fixed water-based and gas-based fire extinguishing systems; special fire extinguishing systems; portable fire extinguishers; smoke production; smoke management and control systems; staircase pressurization systems; building evacuation; LPC rules; HKFSD and NFPA codes; prescriptive and performance-based approaches; fire risk management.

Written examination (65%), Continuous assessment (20%), Practical work (15%)

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**BBSE3009. Project management and engineering economics (6 credits)**

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.

Written examination (70%), Continuous assessment (30%), Practical work (0%)

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**MECH3002. Air pollution control (6 credits)**

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.

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH3004. Automatic control (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH3007. Computer-aided design and manufacture (CAD/CAM) (6 credits)**

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.

Written examination (70%), Continuous assessment (30%), Practical work (0%)

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**MECH3009. Energy conversion systems (6 credits)**

Energy calculations; solar thermal power plant; energy storage solar photovoltaic systems; wind energy systems; nuclear energy and power plants; nuclear waste management; urban waste.

Written examination (70%), Continuous assessment (20%), Practical work (10%)

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**MECH3010. Engineering and technology management (6 credits)**

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.

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH3011. Heat transfer (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH3012. Product design and development (6 credits)**

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.

Written examination (60%), Continuous assessment (40%), Practical work (0%)

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**MECH3014. Materials for engineering applications (6 credits)**

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.

Written examination (85%), Continuous assessment (15%), Practical work (0%)

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**MECH3015. Applied stress and strength analysis (6 credits)**

Theory of elasticity; plastic analysis; finite element methods for two- and three-dimensional continua; rectangular plate bending; fracture mechanics.

Written examination (70%), Continuous assessment (15%), Practical work (15%)

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**MECH3021. Viscous flow (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH3023. Building energy management and control systems (6 credits)**

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.

Written examination (70%), Continuous assessment (20%), Practical work (10%)

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**MECH3428 Research experience for undergraduates (6 credits)**

A dissertation or report on a topic consisting of engineering design; laboratory experiments; and analytical investigation.

Written examination (0%), Continuous assessment (0%), Practical work (100%)

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### **MECH4428 Sound and vibration (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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### **MECH4429 Integrated capstone experience**

Students undertake a group design project under supervision from September to April of the following year.

Written examination (0%), Continuous assessment (0%), Practical work (100%)

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### **MECH6010. Service behaviour of materials**

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

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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### **MECH6023. Power plant technology (3 credits)**

Sources of energy; types of power plants; portable combustion engines; Brayton cycle; gas turbines; Rankine cycle; steam power plants; nuclear power plant; solar farm; wind turbines; thermoelectric energy.

Written examination (70%), Continuous assessment (30%), Practical work (0%)

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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.

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH6033. Energy conservation and management (3 credits)**

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

Written examination (70%), Continuous assessment (30%), Practical work (0%)

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**MECH6044. Energy and carbon audit (3 credits)**

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

Written examination (60%), Continuous assessment (40%), Practical work (0%)

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**MECH6045. Nanotechnology: fundamentals and applications (3 credits)**

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

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH6046. Microsystems for energy, biomedical and consumer electronics applications (3 credits)**

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

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**CIVL3022. Wind engineering (6 credits)**

**CIVL3015. Solid and hazardous waste management (6 credits)**

**CIVL3011. Municipal and industrial wastewater treatment (6 credits)**

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

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**MEDE3001 Tissue Engineering (3 credits)**

**MEDE3003 Biomaterials (3 credits)**

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

**MEDE3007 Molecular and cellular biomechanics (6 credits)**

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

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# MECHANICAL ENGINEERING (BUILDING SERVICES ENGINEERING)

## SYLLABUSES

This syllabus applies to students admitted in the academic year 2012-13.

### Definitions and Terminology

Each course offered by the Department of Mechanical Engineering 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 introductory courses whereas advanced courses includes Levels Two and Three courses.

A *Discipline Core Course* is a compulsory course which a candidate must pass in the manner provided in the Regulations. A *Project Course* is also a compulsory course which a candidate must pass. A *Breadth Course* is a Level 1, Level 2 or Level 3 course that is offered normally as an optional course for the curriculum. A *Depth Course* is a Level 3 course offered as an optional course for the curriculum. *Elective course* is a course offered by the Department of Mechanical Engineering, other departments under the Faculty of Engineering, or by other faculties.

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### The Curriculum

The curriculum comprises of 180 credits of courses as follows:

- (a) 24 credits from General Engineering courses, including:
  - (i) either ENGG1002 Computer programming and applications (6 credits) or ENGG1016 Computer programming and applications I (6 credits); AND
  - (ii) either ENGG1003 Mathematics I (6 credits) or ENGG1004 Mathematics IA (3 credits) and ENGG1005 Mathematics IB (3 credits); AND
  - (iii) ENGG1018 Introduction to mechanical engineering (6 credits); AND
  - (iv) Any one General Engineering course offered by other departments of the Faculty of Engineering (6 credits)
- (b) 90 credits of Discipline Core courses
- (c) 12 credits of Project
- (d) 27 credits of Elective courses
- (e) University requirements (21 credits), including:
  - (i) CAES1513 Professional and technical written communication for engineers (3 credits)<sup>3</sup>
  - (ii) CAES1515 Professional and technical oral communication for engineers (3 credits)
  - (iii) CENG1001 Practical Chinese language course for engineering students (3 credits)<sup>4</sup>
  - (iv) 12 credits of courses from the University Common Core Curriculum, selecting no more than one course from each Area of Inquiry
- (f) 6 credits of Breadth course

To complete the degree curriculum, a candidate must pass at least a total of 180 credits, including all the courses listed under (a) to (e) and satisfy any other requirements as stipulated in the University or

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<sup>3</sup> Students pursuing BEng/BBA should take CAES1907 in lieu of CAES1513

<sup>4</sup> "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 CENG10xx 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 language course in lieu".

Faculty of Engineering regulations.

### 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.

### Order of Study

There are no course prerequisites but lower level courses should preferably be taken before higher level courses.

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### **First Year**

The first-year syllabuses shall normally include the following courses:

General Engineering Courses (Total 24 credits)

Either

ENGG1002 Computer programming and applications (6 credits); or  
ENGG1016 Computer programming and applications I (6 credits); AND

Either

ENGG1003 Mathematics I (6 credits) or  
both ENGG1004 Mathematics IA (3 credits) and ENGG1005 Mathematics IB (3 credits); AND

ENGG1018 Introduction to mechanical engineering (6 credits); AND

Any one General Engineering Courses (6 credits) from the following:

ENGG1006	Engineering for sustainable development
ENGG1007	Foundations of computer science
ENGG1009	Industrial management and logistics
ENGG1011	Introduction to biomedical engineering
ENGG1015	Introduction to electrical and electronic engineering

Discipline Core Courses (Total 24 credits)

MECH1004 Drawing and elements of design and manufacture (6 credits)  
MECH1005 Fundamentals of electrical and electronic engineering (6 credits)  
MECH1013 Engineering mechanics (6 credits)  
MECH1014 Thermofluids (6 credits)

UG5 requirements (Total 9 credits)

CAES1513 Professional and technical written communication for engineers (3 credits)  
CAES1515 Professional and technical oral communication for engineers (3 credits)  
CENG1001 Practical Chinese language course for engineering students (3 credits)

Optional Elective Course (Total 6 credits)

BBSE1012 Engineering training (6 credits) (Summer semester)



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## Second Year

The second-year syllabuses shall normally include the following courses:

Discipline Core Courses (Total 48 credits)

BBSE2001 Utility services (6 credits)  
BBSE2007 Electrical power supply services and lighting engineering (6 credits)  
BBSE2008 Air conditioning and refrigeration engineering (6 credits)  
MECH2002 Engineering thermodynamics (6 credits)  
MECH2007 Mathematics II (6 credits)  
MECH2008 Mechanics of fluids (6 credits)  
MECH2018 Dynamics and control (6 credits)  
MECH2419 Properties of materials (6 credits)

UG5 requirements (Total 12 credits)

2 University Common Core Courses (12 credits)

Optional Elective Courses (Total 6 credits)

BBSE2006 Industrial training (6 credits) (Summer semester)

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## Third Year

The third-year syllabuses shall normally include the following courses:

Project (Total 12 credits)

MECH4429 Integrated capstone experience (12 credits)

Breadth Course (Total 6 credits)

MECH3010 Engineering and technology management (6 credits)

Discipline Core Courses (18 credits)

BBSE3003 Fire protection engineering (6 credits)  
BBSE3009 Project management and engineering economics (6 credits)  
MECH3023 Building energy management and control systems (6 credits)

Elective Courses (27 credits)

Students are required to complete 27 credits of Elective courses in the following manner:

- (i) Elective Breadth/Depth Courses (up to 27 credits)
- (ii) Elective MSc(Eng) courses (up to 6 credits)
- (iii) Free Elective Course (up to 6 credits)

Elective Breadth/Depth Courses (Up to 27 credits)

BBSE1012 Engineering training (6 credits)

BBSE2006 Industrial training (6 credits)  
MECH2016 Fundamentals of aeronautical engineering (6 credits)  
MECH3002 Air pollution control (6 credits)  
MECH3004 Automatic control (6 credits)  
MECH3007 Computer-aided design and manufacture (CAD/CAM) (6 credits)  
MECH3009 Energy conversion systems (6 credits)  
MECH3011 Heat transfer (6 credits)  
MECH3012 Product design and development (6 credits)  
MECH3014 Materials for engineering applications (6 credits)

MECH3021 Viscous flow (6 credits)  
MECH3428 Research experience for undergraduates (6 credits)  
MECH4428 Sound and vibration (6 credits)

Elective MSc(Eng) courses (Up to 6 credits)

MECH6010 Service behavior of materials (3 credits)  
MECH6023 Power plant technology (3 credits)  
MECH6024 Applied mathematics for engineers (3 credits)  
MECH6033 Energy conservation and management (3 credits)  
MECH6044 Energy and carbon audit (3 credits)  
MECH6045 Nanotechnology: fundamentals and applications (3 credits)  
MECH6046 Microsystems for energy, biomedical and consumer electronics applications (3 credits)

Free Elective Courses (Up to 12 credits)

Any other elective courses as approved by the department (up to 12 credits)

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### **Minor Programmes**

From 2010-11 academic year, candidates from other than the Department of Mechanical Engineering may pursue a Minor in Mechanical Engineering or Minor in Mechanical Engineering – Building Services Engineering. Candidates who are interested in pursuing minor in Mechanical Engineering must satisfy the following prerequisites:

- Passed HKALE Pure Mathematics and
- Passed HKAL/AS Physics/Engineering Science

### **Minor in Mechanical Engineering**

Candidates are required to complete a total of 36 credits of courses comprising:

(a) Introductory courses (12 credits)

Students are required to complete:

MECH1013 Engineering mechanics (6 credits)  
MECH1014 Thermofluids (6 credit units)

(b) Advanced Elective courses (24 credits)

Students must complete 24 credits of advanced elective courses to be chosen from the following list:

MECH1004	Drawing and elements of design and manufacture (6 credits)
MECH2002	Engineering thermodynamics (6 credits)
MECH2005	Design and manufacture (6 credits)
MECH2008	Mechanics of fluids (6 credits)
MECH2009	Mechanics of solids (6 credits)
MECH2018	Dynamics and control (6 credits)
MECH2419	Properties of materials (6 credits)

### Minor in Mechanical Engineering – Building Services Engineering

Candidates are required to complete a total of 36 credits of courses comprising:

(a) Introductory courses (12 credits)

Students are required to complete:

MECH1013	Engineering mechanics (6 credits)
MECH1014	Thermofluids (6 credit units)

(b) Advanced Elective courses (24 credits)

Students must complete 24 credits of advanced elective courses to be chosen from the following list with at least 12 credits of courses selected from those with course code BBSExxxx:

MECH2002	Engineering thermodynamics (6 credits)
MECH2008	Mechanics of fluids (6 credits)
BBSE2001	Utility services (6 credits)
BBSE2007	Electrical services and lighting engineering (6 credits)
BBSE2008	Air conditioning and refrigeration engineering(6 credits)
BBSE3003	Fire protection engineering (6 credits)
MECH3023	Building energy management and control systems (6 credits)

### Double –Degree in BEng/BBA

Candidates pursuing studies for the double-degree 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
	<b>Total</b>	<b>54</b>

Candidates pursuing studies for the double-degree in BEng/BBA curriculum are granted exemptions from the following courses:

<b>Courses in the BEng curriculum to be exempted</b>	<b>Business courses to be completed</b>
CAES1513 Professional and technical written communication for engineers (3 credits)	CAES1907 Business communication (3 credits)
Two Elective courses in Mechanical Engineering (total 12 credits) (1) BBSE3009 Project management and engineering economics (6 credits) (2) MECH3010 Engineering and technology management (6 credits)	BUSI1003 Introduction to management information system (6 credits) and BUSI1007 Principles of management (6 credits)
Two Elective Courses (6 12 credits)	Any two other courses (12 credits)

## **COURSE DESCRIPTIONS**

### **Level One**

#### **BBSE1012. Engineering training (6 credits)**

Instrumentation; computation fluid dynamics; drawing practice; construction safety and building work practice; assembly and testing (air & water); assembly and testing (electrical); seminars on safety, against corruption, engineering profession and other contemporary issues.

Written examination (0%), Continuous assessment (0%), Practical work (100%)

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#### **MECH1004. Drawing and elements of design and manufacture (6 credits)**

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.

Written examination (0%), Continuous assessment (100%), Practical work (0%)

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#### **MECH1005. Fundamentals of electrical and electronic engineering (6 credits)**

Basic circuit principles; steady-state A.C. circuit theory; magnetic circuits; transformers; bipolar junction transistors; field effect transistors; direct-current motors; solid-state controller for D.C. motors; combinational logic circuits.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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#### **MECH1013. Engineering Mechanics (6 credits)**

Stress and strain; bending of beams; deflection of beams; thin-walled pressure vessels; kinematics of particles with different forms of acceleration; mechanisms; simple and epicyclic gear trains; momentum and energy conservation, application of kinetic principles to particles and vehicles with mass variation, velocity-dependent resistance and the action of central forces; undamped and damped free vibration

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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#### **MECH1014. Thermofluids (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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- ENGG1002. Computer programming and applications (6 credits)**
- ENGG1003. Mathematics I (6 credits)**
- ENGG1004. Mathematics IA (3 credits)**
- ENGG1005. Mathematics IB (3 credits)**
- ENGG1006. Engineering for sustainable development (6 credits)**
- ENGG1007. Foundations of computer science (6 credits)**
- ENGG1009. Industrial management and logistics (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)**
- ENGG1018. Introduction to mechanical engineering (6 credits)**

For course descriptions, please refer to the General Engineering Courses in the syllabus for the degree of BEng for details.

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- CAES1515. Professional and technical oral communication for engineers (3 credits)**
- CENG9001. Practical Chinese for engineering students (3 credits)**

For course descriptions, please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

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**CAES1513. Professional and technical written communication for engineers (3 credits)**

The focus of this course is the function and importance of professional and technical communication in English and specifically understanding and using written English. Topics include accessing, abstracting, analyzing, organizing and summarizing information; making effective grammatical and lexical choices; technical report writing; small-scale project design and implementation. Assessment is wholly by coursework.

Assessment: 100% continuous assessment

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- CCXXxxxx University Common Core Curriculum course (6 credits)**
- CCXXxxxx University Common Core Curriculum course (6 credits)**

2 University Common Core Curriculum Courses. Please refer to the University Common Core Curriculum Courses for details.

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**Level Two**

**BBSE2001. Utility services (6 credits)**

Characteristics and design of different utility service installations; cold, hot and flushing water supply systems; steam supply; sanitary and storm water drainage systems; vertical transportation system; communication systems; security and alarm.

Written examination (65%), Continuous assessment (20%), Practical work (15%)

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**BBSE2006. Industrial training (6 credits)**

Training in industry for a nominal period of at least six weeks during the summer vacation of the second Year of study.

Written examination (0%), Continuous assessment (0%), Practical work (100%)

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**BBSE2007 Electrical services and lighting engineering (6 credits)**

Electrical power systems and motors; electricity market, system planning and design; electrical power supply and distribution; standby generators and power supplies; introduction and lighting basic concepts; light sources and luminaires; lighting design principles and process; lighting energy management.

Written examination (65%), Continuous assessment (20%), Practical work (15%)

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**BBSE2008 Air conditioning and refrigeration engineering (6 credits)**

Air conditioning systems; psychrometry; thermal comfort; load and energy calculations; air-side systems; fan design and other major components; air duct design; space air diffusion; water-side systems; piping system design; pump design and operation; indoor air quality; mechanical and natural ventilation; ventilation efficiency; refrigerants and refrigeration systems; refrigeration cycles and principles; design of refrigeration systems; refrigeration system components and performance.

Written examination (65%), Continuous assessment (20%), Practical work (15%)

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**MECH2002. Engineering thermodynamics (6 credits)**

IC engines; steam and gas power plants; refrigeration; jet propulsion; gas mixture; psychrometry and air-conditioning; introduction to heat transfer and combustion.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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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.

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH2008. Mechanics of fluids (6 credits)**

Navier-Stokes equations; pipe and channel viscous flows; lubrication; two-dimensional potential flows; boundary layer flows; dimensional analysis.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH2016. Fundamentals of aeronautical engineering (6 credits)**

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

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH2018. Dynamics and control (6 credits)**

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.

Written examination (70%), Continuous assessment (10%), Practical work (20%)

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**MECH2419 Properties of Materials**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**Level Three****BBSE3003. Fire protection engineering (6 credits)**

Fire behavior and characteristics; compartment fires; fire hazards; automatic fire detection and alarm systems; automatic fixed water-based and gas-based fire extinguishing systems; special fire extinguishing systems; portable fire extinguishers; smoke production; smoke management and control systems; staircase pressurization systems; building evacuation; LPC rules; HKFSD and NFPA codes; prescriptive and performance-based approaches; fire risk management.

Written examination (65%), Continuous assessment (20%), Practical work (15%)

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**BBSE3009. Project management and engineering economics (6 credits)**

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.

Written examination (70%), Continuous assessment (30%), Practical work (0%)



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**MECH3002. Air pollution control (6 credits)**

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.

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH3004. Automatic control (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH3007. Computer-aided design and manufacture (CAD/CAM) (6 credits)**

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.

Written examination (70%), Continuous assessment (30%), Practical work (0%)

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**MECH3009. Energy conversion systems (6 credits)**

Energy calculations; solar thermal power plant; energy storage solar photovoltaic systems; wind energy systems; nuclear energy and power plants; nuclear waste management; urban waste.

Written examination (70%), Continuous assessment (20%), Practical work (10%)

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**MECH3010. Engineering and technology management (6 credits)**

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.

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH3011. Heat transfer (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH3012. Product design and development (6 credits)**

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.

Written examination (60%), Continuous assessment (40%), Practical work (0%)

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**MECH3014. Materials for engineering applications (6 credits)**

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.

Written examination (85%), Continuous assessment (15%), Practical work (0%)

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**MECH3021. Viscous flow (6 credits)**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH3023. Building energy management and control systems (6 credits)**

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.

Written examination (70%), Continuous assessment (20%), Practical work (10%)

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**MECH3428 Research experience for undergraduates**

A dissertation or report on a topic consisting of engineering design; laboratory experiments; and analytical investigation.

Written examination (0%), Continuous assessment (0%), Practical work (100%)

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**MECH4428 Sound and vibration**

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.

Written examination (80%), Continuous assessment (10%), Practical work (10%)

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**MECH4429 Integrated capstone experience**

Students undertake a group design project under supervision from September to April of the following year.

Written examination (0%), Continuous assessment (0%), Practical work (100%)

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**MECH6010. Service behaviour of materials**

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

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH6023. Power plant technology (3 credits)**

Sources of energy; types of power plants; portable combustion engines; Brayton cycle; gas turbines; Rankine cycle; steam power plants; nuclear power plant; solar farm; wind turbines; thermoelectric energy.

Written examination (70%), Continuous assessment (30%), Practical work (0%)

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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.

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH6033. Energy conservation and management (3 credits)**

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

Written examination (70%), Continuous assessment (30%), Practical work (0%)

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**MECH6044. Energy and carbon audit (3 credits)**

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

Written examination (60%), Continuous assessment (40%), Practical work (0%)

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**MECH6045. Nanotechnology: fundamentals and applications (3 credits)**

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

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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**MECH6046. Microsystems for energy, biomedical and consumer electronics applications (3 credits)**

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

Written examination (80%), Continuous assessment (20%), Practical work (0%)

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