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

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

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

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

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

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

MSc 1 Admission requirements

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

(a) comply with the General Regulations;

(b) comply with the Regulations for Taught Postgraduate Curricula;

(c) hold
- (i) a Bachelor's degree of this University in a relevant field; or
- (ii) a relevant qualification of equivalent standard from this University or from another university or comparable institution accepted for this purpose; and
- (iii) in respect of the courses of study leading to the degree of Master of Science in Engineering in the fields of Innovative Design and Technology and Microelectronic Science and Technology, a Bachelor’s degree in Engineering or related Science discipline;
- (iv) in respect of the courses of study leading to the degree of Master of Science in civil engineering, a Bachelor’s degree in related disciplines, such as Environmental Engineering, Chemical Engineering, Mechanical Engineering, Environment-related Sciences, Computer Science, Mathematics or Statistics; and

(d) satisfy the examiners in a qualifying examination if required.

MSc 2 Qualifying Examination

(a) A qualifying examination may be set to test the candidate's academic ability or his/her ability to follow the curriculum prescribed. It shall consist of one or more written papers or their equivalent and may include a dissertation.

(b) A candidate who is required to satisfy the examiners in a qualifying examination shall not be permitted to register until he/she has satisfied the examiners in the examination.

MSc 3 Period of Study

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

MSc 4 Curriculum Requirements

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

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

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

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

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

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

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

MSc 5 Dissertation or project report

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

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

MSc 6 Selection of Courses

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

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

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

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

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

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

MSc 7 Assessment

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

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

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

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

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

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

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

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

MSc 8 Grading system

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

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

MSc 9 Discontinuation of Studies

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

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

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

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

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

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

MSc 10 Advanced Standing

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

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

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

MSc 11 Award of Degree

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

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

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

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

MSc 12 Assessment results

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

Subject to the University's approval

MSC(ENG) IN MECHANICAL ENGINEERING

(Applicable to students admitted to the curriculum in the academic year 2023-24 and thereafter)

Definition and Terminology

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

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

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

Curriculum Structure

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

Course Category	No. of Credits
Discipline Courses	Not less than 30
Elective Courses	Not more than 18
Capstone Experience	24
Total	72

The curriculum provides advanced postgraduate education in the fields of energy and power; environmental engineering; material technology; theoretical mechanics and computer integrated design and manufacturing to graduates in engineering or related science.

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

Focus

A student may choose to claim any of the following two Focuses, provided that he/she must have completed the courses required under the corresponding Focus.

(I) Robotics, Drones and Control (MECH7010, IDAT7213, MECH7017 and either MECH6046 or MECH6047)

- MECH7010 Contemporary robotics
- IDAT7213 UAV design, navigation and control
- MECH7017 Robotic Control
- MECH6046 Microsystems for energy, biomedical and consumer electronics applications
- MECH6047 Finite element analysis in mechanics

(II) Railway system and management (MECH7014, MECH7015, MECH7016 and either MECH6010 or MECH6026)

- MECH7014 Railway engineering – metro and high-speed rail
- MECH7015 Rail accident investigation and derailment
- MECH7016 Railway project management
- MECH6010 Service behaviour of materials
- MECH6026 Computational fluid dynamics

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

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

List A discipline courses

MECH6010. Service behaviour of materials (6 credits)

The aims of this course are: (1) to study the relevant physical basis for the understanding and prediction of the service behaviour, such as creep, fracture, fatigue and corrosion, of materials in industrial applications; and (2) to provide the knowledge to engineers the microstructure in such a way that the service behaviour of materials can be improved.

Topics include: 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.

MECH6026. Computational fluid dynamics (6 credits)

This course aims to provide practicing engineers and researchers who are learning about Computational Fluid Dynamics (CFD) for the first time with the basic knowledge of numerical techniques and applications of CFD to solve engineering problems.

Topics include: fundamental concepts and equations of fluid dynamics; finite-difference method for solving partial differential equations (stability, consistency, convergence, accuracy and efficiency, and solution of system of algebraic equations); simplified models for fluid flow (wave equation) and heat transfer (heat equation); grid generation; turbulent diffusion and shear flow dispersion; numerical solution of transport equations (mass; momentum and energy transport); applications involving the built environment, air pollution, atmospheric diffusion and dissipation, power-plant design, land-air- and marine-vehicle design; etc.

MECH6034. Computer-aided product development (CAPD) (6 credits)

This course will focus on main technologies related to computer-aided product development, including popular product development methodologies, computer-aided design, haptic shape modelling, reverse engineering, additive manufacturing and rapid tooling. The specific course objectives are: (1) to have a good understanding of popular product development methodologies, product development processes; (2) to understand major technologies that can be used to assist product development at different phases; (3) to be able to apply the computer-aided product development technologies to develop a simple product; and (4) to understand the constraints of manufacturing and cost in product development.

Topics include: product development methodologies; basic product manufacturing technologies; design for manufacturing; product costing and value engineering; solid modelling techniques; reverse engineering; additive manufacturing.

MECH6045. Nanotechnology: fundamentals and applications (6 credits)

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

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

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

MECH7010. Contemporary robotics (6 credits)

This course aims to explore the major technologies related to modern robotic systems, including the components and working principle of robots, automatic and computer-aided control, kinematics and control of mobile robots including drones and driverless cars, soft robots, etc.

The specific course objectives are: (1) to have a comprehensive understanding of robotic systems in terms of their system configurations, working principles, historical evolutions, and applications; (2) to understand the mathematical foundations, designs, data processing, and real-time control of various sensing and actuation units which comprise a robotic system; (3) to study the robot kinematics modelling, sensing, estimation, and control; (4) to explore the challenges and trends in contemporary robotic research, and the future directions for application of robotic components.

MECH7011. Applied thermodynamics and power plant technology (6 credits)

This course is focused on understanding the operating principles of power plants for the generation of electric power. The course objectives are to: (1) provide students with the working principles of various types of power plants, including fossil fuels, nuclear fuels and renewable energy; and (2) enable students to understand the thermodynamic principles, emission controls, environmental impact, cycle analysis, component design, plant operation and control technologies of power plant.

Topics include: sources of energy; thermodynamic properties of states; 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.

Students who have taken and passed MECH6023. will not be allowed to take MECH7011.

List B discipline courses

MECH6017. Noise and vibration (6 credits)

This course aims to provide an integrated treatment for vibration system, noise radiation and the available control methods in engineering. Upon completing this course, the students are expected to:
(1) explain the basic characteristics of a simple vibration system; (2) understand the mechanism of noise radiation by structural vibration or turbulent flow, and its impact on human hearing; and (3) offer solution to typical noise and vibration problems. The following are covered in the course: (i) fundamentals of vibration and its control, (ii) human hearing and environmental noise sources and their mitigation, (iii) noise control.

Topics include: fundamentals of single- and multiple degree of freedom systems; vibration modes and finite element analyses; vibration measurement; vibration isolation; sound radiation by vibration and flow; human hearing; environmental legislation and guidelines; sound propagation and duct acoustics; noise absorption and reflection; control of noise at the source.

MECH6018. Atmospheric environment modelling (6 credits)

This course aims to: (1) provide rigorous and comprehensive treatment of various modelling methodologies on the atmospheric environment and air pollution dispersion; and (2) introduce the state-of-the-art of various modelling packages for use in industry.

Topics include: foundations of atmospheric dynamics, models of winds, atmospheric turbulence modelling, boundary layer climate, air pollution in the boundary layer and atmospheric dispersion modelling.

MECH6019. Sources and control of air pollution (6 credits)

This course aims to: (1) provide understanding of the natural and anthropogenic sources of air pollution; and (2) introduce ways to prevent, control and minimize pollution by application of various control practices.

Topics include: concepts and procedures in basis of air pollution, air pollutant transport, sources of air pollutants, control of gaseous pollutants, control of particulate matter, atmospheric dispersion modelling.

MECH6024. Applied mathematics for engineers (6 credits)

This course aims to introduce some advanced knowledge of computational and statistical analysis and methods and provide the students with the ability to apply computational and statistical methods to solve engineering problems.

Topics include: statistical and numerical methods in engineering; hypothesis testing; estimation of parameters and confidence intervals; correlation coefficient; direct and iterative methods for systems of equations; optimization; numerical analysis.

EMEE6004. Energy conservation and management (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Energy Engineering curriculum.

MECH6039. Biomaterials and tissue engineering (6 credits)

This course aims to: (1) equip students with a broad knowledge of biomaterials science and engineering and also tissue engineering; (2) have an in-depth understanding of various types of biomaterials currently in clinical use; (3) learn various techniques for developing, analysing and testing new biomaterials; and (4) make students aware of prosthetic medical device regulations and standards for materials and devices; to learn the most recent developments in the biomaterials and tissue engineering field and also future trends.

Topics include: definitions and fundamentals in biomaterials science and engineering; classification for biomaterials; criteria for biomaterials; bioceramics; metallic biomaterials; bioactive ceramic coatings; biomedical polymers; biomedical composites; analytical and testing techniques for developing new biomaterials; long-term performance of biomaterials; degradation of biomaterials in the human body environment; tissue engineering: principles, methods and applications; standards and regulatory issues; new trends in R & D of biomaterials and tissue engineering.

EMEE6005. Renewable energy technology I: Fundamental (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Energy Engineering curriculum.

EMEE6006. Renewable energy technology II: Advanced (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Energy Engineering curriculum.

EMEE6007. Energy and carbon audit (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Energy Engineering curriculum.

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

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

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

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

MECH6047. Finite element analysis in mechanics (6 credits)

This course aims to: (1) introduce the basic concepts and procedures in finite element analysis; (2) introduce the methods of analysis using the finite element method for mechanics problems in engineering; and (3) provide hands-on experience on conducting various mechanics analyses by using a state-of-the-art finite element software.

Topics include: concepts and procedures in finite element analysis; elasticity analysis of truss, beam, plane and plate problems; thermo-mechanical analysis; modal analysis; direct integration methods for dynamic analysis; geometric and material nonlinear analyses; contact analysis; hands-on experience of finite element analysis.

MECH6048. Dissertation (24 credits)

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

MECH7012. Principles of engineering management (6 credits)

The focus of this course is on the basic principles, methods, and functions of engineering management. An overview of systems engineering is provided, with coverage on the design and management of an enterprise as an integrated system. The course objectives are: (1) acquire the essential principles of engineering management and understand how to apply these principles in daily practice in industry; and (2) understand and apply methods for managing the operations of engineering companies in the global business environment.

Topics include: systems engineering; core concepts and tools for the management of operations: operations planning and control functions, ERP systems; contemporary topics and approaches in engineering management: supply chain, green management, ethics, corporate social responsibility and compliance, risk and crisis management.

MECH7013. Gas engineering (6 credits)

This course is mainly related to gas engineering theories and technologies that are commonly used in our society in various applications such as power and gas utilities, as well as domestic and commercial heating appliances. The world gas and energy market will be firstly highlighted to indicate the importance of the gas as a clean fuel. Then, operation principles of basic gas production, gas transportation systems and gas utilization systems, their advantages, and major drawbacks will be taught. The environmental and safety aspects due to the production, transportation and utilization of the gaseous fuels will also be included in the course.

MECH7014. Railway engineering – metro and high-speed rail (6 credits)

The aim of this module is to provide students with an understanding of key subject matters in railway engineering, which include (i) railway services; (ii) metro trains and high speed trains, and its key components; (iii) wheel-rail interaction and traction drives; (iv) metro and high speed train traction and control; (v) signaling systems for metro and high speed rail; (vi) track works, overhead line and railway infrastructures; (vii) high-speed rail and metro station and platform design; and (viii) railway risk assessment, safety management and business management. Students enrolled in the module are expected to have prior understanding of basic mechanical engineering principles.

MECH7015. Rail accident investigation and derailment (6 credits)

The module aims to provide students with a sound understanding of the rail accident investigation processes and derailment engineering mechanism and technologies. The course covers 5 main areas – the rail accident investigation practices worldwide and its processes, wheel-rail interaction, derailment engineering, asset management and case studies of well-known Hong Kong and international rail accidents. Students enrolled in the module are expected to have knowledge and understanding of basic mechanical engineering principles.

MECH7016. Railway project management (6 credits)

The module aims to provide students with a sound understanding of key project management skills for railway engineering projects. The course covers 6 main areas which include (i) Roles of project managers; (ii) Project life cycle; (iii) Project financial accounting and its key subjects; (iv) Contract administration, tender preparation and engineering design; (v) NEC contracts and (vi) Project risk management, quality management and railway business management. Students enrolled in the module are expected to have knowledge and understanding of basic mechanical engineering principles.

MECH7017. Robotic Control (6 credits)

This course focuses on the fundamental principles of modeling, analysis, and control applied to robotics, utilizing both conventional and modern approaches. The course objectives are: (1) to equip students with the skills to employ various modeling methods for characterizing different types of robots; and (2) to foster a comprehensive understanding of control schemes for robotic systems. Topics include: Frequency domain analysis; Nyquist stability criterion; linear control system design; state-space analysis of multivariable linear system; controllability and observability; stability analysis; control of robotic systems.

MECH7020. Autonomous Drones (6 credits)

This course aims to explore the key techniques of a small-scale, unmanned aerial vehicle (UAV), including sensor calibration, navigation systems, and advanced control techniques. The specific course objectives are as follows: 1) To have an overall understanding of UAVs: system configurations and applications. 2) To study the modelling, motion planning and nonlinear control techniques for small-scale UAVs, such as nonlinear dynamic inversion and optimal control. 3) To understand the common navigation techniques in modern small-scale UAVs, such as GPS / IMU navigation, visual-inertial navigation, and light detection and ranging (lidar) navigation. 4) To conduct experiments on state-of-the-art navigation and control techniques for actual UAVs.

This course covers the following topics: UAV configuration; UAV materials; innovative design methodology; dynamics and modeling; motion planning; path planning and obstacle avoidance; classic UAV control; modern UAV control; optimal and nonlinear control; navigation; state estimation; sensor fusion; visual odometry and lidar odometry; Simultaneous localization and Mapping (SLAM).

MECH7021. Field and Services Robotics (6 credits)

This course covers the following topics: localization; map representation; 3D sensing, path planning and navigation; wheeled and legged robotic design and locomotion, gait planning and balance; hand and arm movement; grasping and manipulation; teleoperation; safety and robustness. Case studies on robots for agriculture, mining, search and rescue will be provided.

CIVL6002. Advanced finite elements (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Geotechnical Engineering curriculum.

IDAT7213. UAV design, navigation and control (6 credits)

For descriptions, see the syllabus of the MSc(Eng) in Innovative Design and Technology.

Cross-listed Undergraduate courses

The following cross-listed undergraduate courses, which are not counted for the fulfilment of the curriculum requirements and the classification of award of the degree of MSc(Eng) in Mechanical Engineering, are provided to make up the academic discrepancy and strengthen mechanical engineering fundamentals for students from different academic background, e.g. overseas curricula or non-local universities. Students can take up to two (equivalent 12 credits) courses from the list below:

MECH4411. Heat transfer (6 credits)

This course is on the fundamental principles of heat transfer, covering heat conduction, heat convection and heat exchangers. The course objectives are: (1) to provide an understanding of fundamental principles of heat transfer; and (2) to enable students to use the fundamental principles for conducting thermal analysis and design of engineering problems. At the end of this course, students who fulfill the requirements of this course will be able to: (1) demonstrate an understanding of the principles that govern heat transfer processes; (2) analyze heat-transfer problems quantitatively; and (3) identify relevant engineering solutions in thermal systems.

Topics include: Fourier's law; heat-conduction equation; thermal conductivity; conduction; fins; basic convection principles; laminar and turbulent heat transfer in tubes and over plates; Reynolds analogy; types of heat exchangers; overall heat-transfer coefficient; log mean temperature difference; effectiveness-NTU method; heat exchanger design.

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

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MECH4415. Applied stress and strength analysis (6 credits)

The aims of this course are to: (1) formulate three-dimensional theory of elasticity and introduce the theory of plasticity; (2) introduce analytical and numerical methods for solving practical engineering problems; and (3) introduce theories of fracture and fatigue and their applications to practical engineering problems.

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

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

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MECH4421. Viscous flow (6 credits)

This course aims to: (1) elucidate the advanced dynamics of liquids and gases, including steady and unsteady solutions of the Navier-Stokes equations, (2) perform a study on the properties, mass flux and momentum flux of a boundary layer, (3) explain the basic mechanics of a compressible fluid flow and applications to aerodynamics, (4) discuss the ideas of surface tension and stability in simple multiphase flows; To derive the Plateau-Rayleigh instability as the basic governing model for the linear stability of droplet formation, and (5) understand the complex flow patterns behind bluff bodies, mechanisms associated with vortex shedding and drag force; To characterize the low Reynolds number flow around a sphere and to measure viscosity using the Stokes' drag formula, and (6) introduce elementary concepts of turbulence.

Topics include: continuity and Navier-Stokes equations; Laminar boundary layers; Surface tension; Elementary concepts of compressible flows and shock waves; stability theory; flow behind bluff bodies; low Reynolds number flows and turbulent flows.

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

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Course approved for reimbursement from the Continuing Education Fund (CEF) (applicable to Hong Kong Residents only)

MECH6034. Computer-aided product development (CAPD) (6 credits)

MECH7012. Principles of engineering management (6 credits)