Bachelor of Engineering in Mechanical and Automation Engineering  
(334 New Curriculum)

(Unless otherwise specified, all are 3-unit term courses)

Faculty Package

ENGG1100 Introduction to Engineering Design
This is a hands-on project-based course which introduces the basic engineering concepts, experimental skills and design methodology needed for the design and construction of a hardware based system. Students will work in small groups on a practical project in which they will apply the design methodology introduced to them in lectures in a design project. The project work will involve defining milestones, identifying the constraints and requirements, defining the requirement specifications of the design, making and evaluating different possible designs by carrying out experiments to obtain data for refining the design, prototyping of the final design and testing of the system built in the project.

ENGG1110 Problem Solving By Programming
This is a software project course. Students will learn fundamental programming concepts. They will choose project(s) from the engineering disciplines. Through the project(s), students will acquire the skills to define problems and specifications, to perform modelling and simulation, to develop system prototypes, to carry out verification, validation, and performance analysis. (Not for students who have taken CSCI1030 or 1110 or 1120 or 1130 or 1510 or 1520 or 1530 or 1540.)

ENGG2600 Technology, Society and Engineering Practice (applicable for students admitted in 2012-13 & 2013-14)
Impact of technology on society; introduction to engineering as a profession (different engineering fields, professional societies and registration, soft skills for working in a team); engineering design and innovation; introduction to intellectual property (copyright, trademarks, registered design and patents); engineering project management; product safety; professional ethics; liability and responsibility; workplace safety; environmental impact and market requirements; case studies and experience sharing from industry; global energy policies and standards; industrial and professional workshops or seminars as required by the Major programme.

ENGG2601 Technology, Society and Engineering Practice (2 units)
Impact of technology on society; introduction to engineering as a profession (different engineering fields, professional societies and registration, soft skills for working in a team); engineering design and innovation; introduction to intellectual property (copyright, trademarks, registered design and patents); engineering project management; product safety; professional ethics; liability and responsibility; workplace safety; environmental impact and market requirements; case studies and experience sharing from industry; global energy policies and standards.

ENGG2602 Engineering Practicum (1 unit)
Industrial and professional workshops or seminars as required by the Major programme.  
(Students majoring in ELEG or BMEG are required to consult their department regarding arrangement of the industrial/professional workshop before they register for the course.)
Foundation Science Courses

CHEM1070 Principles of Modern Chemistry
This is a foundation course to give a comprehensive overview of 21st Century chemistry for science students. The topics include the electronic structures of atoms and molecules, their roles in chemical bonding and the properties of matters; acid/base reactions; oxidation/reduction reactions; the laws of thermodynamics and their applications in chemical equilibrium; and an introduction to organic chemistry.
The basic principles are applied in the discussion of global issues such as the pollution of air and water; the greenhouse effect; the ozone hole; the urgency and the difficulty in finding sustainable energy sources; the use of green materials for manufacturing consumer products; and the benefits and abuses of drugs.

CHEM1280 Introduction to Organic Chemistry and Biomolecules
This course provides an overview of the important roles of organic functional groups in forming biomolecules. Under themes of common interests and practical importance, this course will provide students with an understanding of the relevant basic principles of organic chemistry to explore the formation, structures and chemical properties of biomolecules. Selected fundamental concepts in chemical bonding and stereochemistry relevant to the understanding of biomolecules will be highlighted.

CHEM1380 Basic Chemistry for Engineers

ENGG2520 Engineering Physics II
This is an introductory calculus-based engineering physics course covering topics in modern physics and electromagnetism. Topics in modern physics include: Wave-particle duality, momentum and energy of photons and electrons, electronic states and energy bands, electrical conduction in metals and semiconductors. Topics in electricity and magnetism include: Coulomb’s law, electric field, electric flux, Gauss’ law, electric potential, capacitance, electrostatic energy and forces, Biot-Savart Law, magnetic dipole, magnetic field, inductance, magnetic energy and forces, electromagnetic fields and Maxwell’s equations, propagation of plane electromagnetic waves. Contents will be supplemented by discussions on applications relevant to engineering. (Prerequisite: PHYS1110 or with instructor's approval.)

LSCI1001 Basic Concepts in Biological Sciences
This foundation course is designed for students who have not taken science courses with a biology component at the senior secondary school level. It presents our current understandings on cells and molecules of life, genetics and evolution, organisms and environment, and health and diseases. Those students who have successfully completed this course will have a solid foundation for studying more advanced courses in life sciences. (Department Consent Required. Not for students who have taken LSCI1002 or 1003.)
LSCI1003 Life Sciences for Engineers
This course gives engineering students exposure to some of the basic and essential concepts in biology and biotechnology. Topics include cell structure and energy metabolism, DNA structure and replication, protein structure and function, genetic engineering, stem cell and tissue regeneration, neural biology, cardiovascular system, muscle and skeletal system of animals, microbes and microbial biotechnology. The overall aim of this course is to introduce students with the fundamental ideas and concepts in life sciences especially those with relevance to engineering studies. (Not for students who have taken LSCI1001.)

PHYS1003 General Physics for Engineers
This non-calculus-based course covers some essential concepts in mechanics, heat, electricity and magnetism. It is designed for engineering students without having studied HKDSE physics or Combined Science with a physics component to get an overview on what physics is about. Selected topics include: Newton’s laws of motion, Archimedes’ principle, fluid flow, temperature and heat, laws of thermodynamics, electric field and potential, current and circuits, and electromagnetic waves. This course cannot be taken by students with HKDSE Physics or Combined Science with a physics component. (For New Curriculum Students.)

PHYS1110 Engineering Physics I
This is an introductory calculus-based engineering physics course covering topics in mechanics and thermodynamics. Topics include: Use of vectors in mechanics, force and motion, free-body diagrams, work and energy, potential energy and conservation of energy, momentum and impulse, torque, essential ideas in rotation, equilibrium, gravitation, ideal fluids, oscillations, waves and sound, elementary concepts of thermodynamics and heat transfer mechanisms. Contents will be supplemented by discussions on applications relevant to engineering. The course is suitable for Engineering students with HKDSE physics or Combined Science with a physics component, or with permission of instructor. (For New Curriculum Students.)

Foundation Mathematics Courses

ENGG1410 Linear Algebra and Vector Calculus for Engineers
Linear algebra: matrices, matrix addition, matrix multiplication, inverses, special matrices; vector spaces, basis and dimension, linear independence, rank, determinants; linear transformations, projection, orthogonality, systems of linear equations, Gaussian elimination, LU decomposition; eigenvalues and eigenvectors. Vector calculus: 3-D vector space and algebra; vector differential calculus, gradient, divergence, curl; vector integral calculus, Green's theorem, Gauss's theorem, Stoke's theorem.

ENGG2420 Complex Analysis and Differential Equations for Engineers
ENGG2430 Probability and Statistics for Engineers
Fundamental probability concepts: probability and events; expectation, variance, moments, characteristic functions, moment generating functions; single variate distributions. Multivariate probability: conditional probability, joint probability; Bayes’ Theorem; conditional expectation, covariance; multivariate distributions, functions of random variables. Central limit theorems, law of large number. Random process: definition, stationary and ergodic random processes, Gaussian random processes, white noise. Statistics: estimation, sample size and applications.

MATH1510 Calculus for Engineers
This course is designed for engineering students who need to acquire skills in calculus as a crash introduction to the mathematics used in engineering. The course emphasizes on the technique of computation without theoretical discussion. Students are expected to have mathematics background equivalent to HKDSE with Extended Module I or II.

Major Required Courses

ELEG2202 Circuits and Devices I
Basic circuit laws and theorems; mesh and nodal analysis, superposition and source transformation. Phasor, impedance and AC analysis. Introduction to three-phase circuits. P-N junction diode, bipolar transistor and MOS transistor: terminal I-V characteristics and circuit models; diode rectifiers; single-stage transistor amplifiers: biasing and small signal analysis. Operational amplifier and its applications. (Not for students who have taken ELEG1110.)

MAEG2020 Engineering Mechanics

MAEG2030 Thermodynamics

MAEG3010 Mechanics of Materials

MAEG3020 Manufacturing Technology
Overview of manufacturing engineering, engineering materials, metal forming processes, machining processes, plastic injection molding processes, and assembly. Hands-on experiments/projects. (Equivalent to ACEG2060.)
MAEG3050 Introduction to Control Systems

ENGG4010 Final Year Project I
The course is designed to provide students with an opportunity to carry out, under the supervision of an academic staff, an independent project with research elements in engineering.

ENGG4020 Final Year Project II
The course is designed to provide students with an opportunity to carry out, under the supervision of an academic staff, an independent project with research elements in engineering.

Major Elective Courses

CSCI1020 Hands-on Introduction to C++ (1 unit)
This course aims to provide an intensive hands-on introduction to the C++ programming language. Topics include the basic C++ language syntax, variable declaration, basic operators, program flow and control, defining and using functions, file and operating system interface. Specific key features of the C++ programming language such as object-oriented methodology, class templates, encapsulation, inheritance, polymorphism, etc. will be highlighted. (Not for students who have taken CSCI1120 or 1520 or 1540.)

CSCI1040 Hands-on Introduction to Python (1 unit)
This course aims to provide an intensive hands-on introduction to the Python scripting language. Topics include the basic Python language syntax, variable declaration, basic operators, programme flow and control, defining and using functions, file and operating system interface. Specific key features of the Python scripting language such as object-oriented support, high level dynamic data types, embedding within applications etc. will be highlighted.

CSCI1050 Hands-on Introduction to MATLAB (1 unit)
This course aims to provide an intensive hands-on introduction to MATLAB programming. Topics include using the MATLAB interactive environment, variables, operators, expressions, control structures, arrays and matrix operations, defining and using functions, plotting graphs, using Simulink, etc.

CSCI2100 Data Structures
The concept of abstract data types and the advantages of data abstraction are introduced. Various commonly used abstract data types including vector, list, stack, queue, tree, and set and their implementations using different data structures (array, pointer based structures, linked list, 2-3 tree, B-tree, etc.) will be discussed. Sample applications such as searching, sorting, etc., will also be used to illustrate the use of data abstraction in computer programming. Analysis of the performance of searching and sorting algorithms. Application of data structure principles. (Not for students who have taken CSCI2520; Prerequisite: CSCI1110 or 1120 or 1130 or its equivalent. For 2nd-year entrants, the prerequisite will be waived.)
CSCI2120 Introduction to Software Engineering (2 units)
This course aims to introduce students to software engineering concepts. Software life cycles and processes: requirements analysis and specifications; design techniques, functional design, object oriented design; implementation methodology, software testing and maintenance; application of CASE tools; documentation. Software Engineering laboratory: a series of exercises to practise the principles of software engineering. (Not for students who have taken CSCI3100 or IERG3080 or ENGG3820. Prerequisite: CSCI1110 or 1120 or 1130 or 1510 or 1520 or 1530 or 1540 or (MATH2210 and 2220] or PHYS2351 or its equivalent.)

CSCI2800 Numerical Computation
This course aims at introducing the computational techniques on numerical methods. Course contents include computational error analysis; algorithms for roots finding; solutions of linear and non-linear equations, and their sensitivity to computational errors; constrained and unconstrained optimization; curve fitting; applications examples. (Prerequisite: CSCI1110 or 1120 or 1130 or 1510 or 1520 or 1530 or 1540 or its equivalent.)

CSCI3170 Introduction to Database Systems
Concepts and principles of database management systems. Subjects include: basic concepts, system structures, data models, database languages (SQL in particular), relational database normalization, file systems, indexing, query processing, concurrency control and recovery schemes. (Prerequisite: CSCI2100 or 2520. For 2nd-year entrants, the prerequisite will be waived.)

DSME1030 Economics for Business Studies I
This course is a general introduction to the theory of price in a market economy. Topics include basic economic concepts, the theory of demand, production and cost, the operation of firms in competitive, oligopolistic and monopolistic markets, costs and benefits of government intervention in market economy, and introduction to game theory and informational economics. Analytical approach is used whenever appropriate. Applications on practical business problems are emphasized. (Not for students who have taken ECON2011 or ECON3011.)

[or SEEM2440 Engineering Economics]
Principles of engineering economy. Value and cost; cash flows. Economic analysis of alternatives, technological, social and human factors. Models involving allocation and scheduling of resources. Analytical techniques for evaluating industrial projects. Relationship between economics of technical choice and industrial productivity. Basic financial accounting concepts; accounting cycle; financial statements. (Not for students who have taken SEEM2510.)

ELEG2401 Introduction to Embedded Systems
Introduction to microcomputer systems and to the concept of memory. Fundamentals of microcontroller unit, instructions and assembly programming. Input/Output. Interrupt. Timer and counter. Serial communication. Interfacing. Application to step motor. C programming for MCU. (Not for students who have taken ELEG3230; Prerequisite: ELEG2201 or with the consent of the instructor.)
**ELEG3101 Medical Instrumentation and Sensors**
Fundamental concepts of the design of instrumentation and sensor. Electrode theory. Wireless electrodes. Transducers. Biosensors. Applications of microprocessor system for measurements. Micro-controller based measurement systems. The origins and measurements of bioelectric, ultrasonic and bioacoustic signals. Application examples: electro-bioimpedance measurements, cochlear implant devices, functional electric stimulators, drug delivery systems, etc. Electrical safety and hazard. (Not for students who have taken ELEG3240.)

**ENER2010 Energy Technologies and the Environment**
In a modern society, our living standard strongly correlates with our energy consumption rate. The rapid rise of energy use after WWII has caused the degradation of our environment as well as adverse health effects in human populations. Furthermore, the steady rise of recent global average temperature and its correlation with the atmospheric CO2 concentration is particularly alarming. This course provides an overview of the present energy industry and their environmental impact. Fossil fuel is our main energy source today. Therefore, coal, petroleum and natural gas are emphasized. Their formation, exploration, reserve distribution, production, transport, refinement, final consumption, waste disposal and the carbon cycle are studied. The mechanical structure, configuration and efficiency of various fossil-fueled power plants and automobile engines are described. The life cycle assessment method is used to evaluate their requirement on water withdraw and consumption, carbon footprint and their relationship to global warming. Nuclear power plants provide approximately 20% of our electricity without producing greenhouse gases. Their operating principle, the biological effects of ionizing radiations, the radioactive waste problem, the nuclear weapon proliferation concerns, the risk of large scale accidents like Chernobyl (1986) and Fukushima (2011), and different nuclear policies adopted by various governments are discussed. These lead to the need of renewable energy sources for sustainable developments. The current status of solar, wind, biomass, hydropower, and geothermal energies are briefly presented as an introduction to the next course on renewable energy technologies.

Note: Calculus is NOT a prerequisite. However, high school level of physics, chemistry and mathematics are required.

*[or ENGG1500 Introduction to Energy and Environment]*
*Introduction to the power generation and energy resources: including fossil fuels, nuclear power and renewable energy (such as hydro power, solar power, wind power, biomass and biofuels, and geothermal power). Energy supply, utilization and sustainability. Impact on the environment.*

**ENER2020 Renewable Energy Technologies**
Fuel cells, biofuel, solar power, wind power, hydro power, geothermal and thermoelectric conversion. Energy storage and distribution. Energy recycling. Design, modeling and analysis of energy systems. (Exclusion = Not for students who have taken MAEG3090.)

**ENER3030 Engineering Materials**
Atomic bonding; crystal structures; mechanical behaviors of materials; phase diagrams; overview of metals, alloys, ceramics, polymers, and composites; electrical, optical, magnetic, and thermal properties of materials; semiconductive materials and fundamentals of solid state physics.
ENER4010 Kinetic Energy Harvesting Devices and Systems
Principles of energy harvesting from wind, wave, water flow and vibration. Component and system design. Control and power conditioning circuits. Modeling and performance analysis and optimization. Applications. Hands-on project. (Prerequisite: MAEG3030 or with consent of the instructor.)

ENER4020 Solar Energy and Photovoltaic Technology
Introduction to solar energy technologies; semiconductors for photovoltaics; working principle and performance evaluation of photovoltaic cells (PVs); photovoltaic technologies (crystalline PVs, thin-film PVs, and organic and nanostructure based PVs); solar panel system design; cost aspects, market development and environmental impact of photovoltaic industry. (Prerequisite: ELEG2202 Circuits and Devices I AND ENER2020 Renewable Energy Technologies, or ELEG2202 Circuits and Devices I AND ELEG3201 Circuits and Devices II)

ENER4030 Nuclear Energy and Risk Assessment
Nuclear physics - elementary quantum theory; nuclear forces; shell structure of the nucleus; alpha, beta, and gamma radioactive decays; nuclear reactions; fission and fusion. Nuclear power plant design - nuclear power plant layout; reactor dynamics; reactor start up and process control, waste treatment. Risk management - assessment and management of nuclear safety; radiation, exposure and environment; safety assessment.

ENER4040 Energy Storage and Distribution
Introduction to energy storage technologies: electrical energy storage (battery, supercapacitor etc.), thermal energy storage (phase change), mechanical energy storage (flywheel and compressed air energy storage), hydrogen storage for fuel cells. Infrastructure for energy distribution; smart grid; charging systems for electric vehicles and fuel cell vehicles. (Prerequisite: ENER2010, 2020 or with consent of the instructor.)

ENGG1820 Engineering Internship (1 unit)
The objective of this course is to enable students to have a better understanding of the practical aspects of the engineering industries. Prior to the enrolment of this course, students must have completed at least 8 weeks summer internship or work-study placement approved by the Faculty of Engineering. Students are brought together to share their experience and knowledge learnt. The workplace etiquette, employer expectations and business organization will be discussed. In addition, industrial trends, practices, issues and professionalism will be explored.

ENGG2020 Digital Logic and Systems
Digital concepts; number systems; operations and codes; logic gates; Boolean algebra and logic simplification; combinational logic; functions of combinational logic; flip-flops and related devices; counters; finite state machines; programmable logic devices - programming and sequential logic applications; memory and storage; integrated circuit technologies. (Not for students who have taken ELEG2120.)
ENGG5402 Advanced Robotics
Lagrange formulation of robot dynamics, Newton-Euler equations; motion control, force control, visual servoing, grasping analysis, object manipulation; sensors and sensor networks, medical robotics, advanced topics in recent development of robotic theory and applications. (Equivalent to MAEG5010 or BMEG5100.) (For students in MSc Mechanical and Automation Engineering or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in Mechanical and Automation Engineering; Not for students who have taken MAEG5010 or BMEG5100)

[Equivalent to MAEG5010 Advanced Robotics]
Lagrange formulation of robot dynamics, Newton-Euler equations; motion control, force control, visual servoing, grasping analysis, object manipulation; sensors and sensor networks, advanced topics in recent development of robotic theory and applications. (Equivalent to ACE5030) (For students in PhD Automation and Computer-Aided Engineering; or For students in MPhil-PhD Mechanical and Automation Engineering; For students in MSc Mechanical and Automation Engineering; or For students in UG Mechanical and Automation Engineering.)

ENGG5403 Linear System Theory & Design
Review on linear algebra; Linear system model and properties; State space representation: equivalent systems, canonical forms, realization, discrete-time systems; Stability: definitions, Lyapunov Theorem; Controllability and Observability: Grammians, canonical decomposition, sampling effects; Minimal realizations; State-Feedback and State-estimators: regulation and tracking, state estimator feedback, reduced-order estimator, multivariable system; Pole placement and Model Matching. (Equivalent to MAEG 5020.) (For students in MSc Mechanical and Automation Engineering or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in Mechanical and Automation Engineering; Not for students who have taken MAEG5020 or MAEG5725)

[Equivalent to MAEG5020 Topics in Linear Control Systems]
Advanced topics in recent development of linear control theory and its applications. The detailed course contents may be changed from year to year depending on the current development. (Equivalent to ACEG5050.) (For students in PhD Automation and Computer-Aided Engineering or MPhil-PhD Mechanical and Automation Engineering or MSc Mechanical and Automation Engineering or UG Mechanical and Automation Engineering; Not for students who have taken MAEG5725.)

ENGG5404 Micromachining and Microelectromechanical Systems
Broad overview of microfabrication and microelectromechanical systems. Introduction to basic micromaching techniques such as photolithography, isotropic and anisotropic wet etching, dry etching, physical and chemical vapor deposition, electroplating, metrology, statistical design of experiments, MEMS release etching, stiction, and MEMS device testing. Review of MEMS microsensors, microactuators and microstructures. Topics include accelerometers, pressure sensor, optical switches, cantilever beams, thin-film stress test structures and bulk micromachining test structures. Fundamentals of central dogma of molecular biology, cell and tissue biology. Principles of transduction and measurements of molecules, cells and tissues. (For students in MSc BMEG and MAEG; or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in BMEG or MAEG; Not for students who have taken BMEG5120, MAEG5050 or MAEG5750)

[Equivalent to MAEG5050 MEMS and Nano-Robotics]
Dominant physical phenomena in the Micro/Nano worlds. Micro and Nano scale robotics and assembly. (Equivalent to ACE5090) (For students in PhD Automation and Computer-Aided Engineering or MPhil-PhD Mechanical and Automation Engineering or MSc Mechanical and Automation Engineering or UG Mechanical and Automation Engineering; Not for students who have taken MAEG5750)

**ENGG5405 Theory of Engineering Design**
Introduction of engineering design and design procedure, design innovation and TRIZ, axiomatic design, nature’s design and complex systems, design analysis (modeling and simulation), statistical analysis, design optimization, statistical design optimization, Design for Six Sigma (DFSS). Practical examples of design and applications, such as pendulum, bicycle, windmill and propulsion. (Equivalent to MAEG5100.) (For students in MSc Mechanical and Automation Engineering or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in Mechanical and Automation Engineering; Not for students who have taken MAEG5100.)

*Equivalent to MAEG5100 Advanced Engineering Design and Optimization*

To provide in-depth understanding of the principles and tools of engineering system design, statistical optimization methods, Design for Six Sigma (DFSS), TRIZ, and complex system design. (For students in PhD Automation and Computer-Aided Engineering; or For students in MPhil-PhD Mechanical and Automation Engineering; or For students in MSc Mechanical and Automation Engineering; or For students in UG Mechanical and Automation Engineering.)

**MAEG1010 Introduction to Robot Design**

**MAEG2010 Computer-Aided Drafting (2 units)**
Introduction to concepts and skills needed to sketch and create 2D drawings and 3-D models. Introduction to CAD systems. A series of projects for students to learn and practice using various CAD packages for modelling, engineering drawing, animation and analysis. (Not for students who have taken ACEG1060.)

**MAEG3030 Fluid Mechanics**

**MAEG3040 Mechanical Design**

**MAEG3060 Introduction to Robotics**
motion planning. (Equivalent to ACEG2140.)

**MAEG3070 Fundamentals of Computer-Aided Design**

Elements of interactive graphics in CAD/CAM. Mathematical bases and manipulation of curves and surfaces: parametric cubic curve, Bezier and NURBS curve, ruled surface, sweep surface, Coon’s bilinear surface, Hermite surface, Bezier and NURBS surfaces. Introduction to geometric and solid modeling: constructive solid geometry, boundary representation. Visualization for engineering simulation. Applications in design and manufacturing.

**MAEG3080 Fundamentals of Machine Intelligence**


**MAEG3920 Engineering Design and Applications**

The course includes a project for students to practice the following topics: engineering design process, innovation and design basics, CAD and CAE tools and applications, prototyping (mechanical workshop), prototyping (electronics workshop), quality and inspection. (Equivalent to ACEG2160.)

**MAEG4010 Computer-Integrated Manufacturing**


**MAEG4020 Finite Element Modelling and Analysis**


**MAEG4030 Heat Transfer**


**MAEG4040 Mechatronic Systems**


**MAEG4050 Modern Control Systems Analysis and Design**

Continuous and discrete domain state space representations: transition matrix; stability; controllability and observability; pole placement control; state estimator. Emulation designs. Discrete design. Case studies. (Equivalent to ACE3010.)
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<thead>
<tr>
<th>Course Code</th>
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<th>Description</th>
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<tbody>
<tr>
<td>MAEG4080</td>
<td>Introduction to Combustion</td>
<td>Fundamentals of combustion science: combustion kinetics; thermochemistry; flame dynamics and stability; pollutant formation. Internal combustion engine: operation of internal combustion engines; combustion theory for engine design; engine performance; fuel requirements; heat transfer; frictions; fuel properties; environmental impact. (Pre-requisite: MAEG2030)</td>
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<td>Advanced Robotics</td>
<td>Lagrange formulation of robot dynamics, Newton-Euler equations; motion control, force control, visual servoing, grasping analysis, object manipulation; sensors and sensor networks, advanced topics in recent development of robotic theory and applications. (Equivalent to ACE5030) (For students in PhD Automation and Computer-Aided Engineering; or For students in MPhil-PhD Mechanical and Automation Engineering; For students in MSc Mechanical and Automation Engineering; or For students in UG Mechanical and Automation Engineering.)</td>
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<td>Lagrange formulation of robot dynamics, Newton-Euler equations; motion control, force control, visual servoing, grasping analysis, object manipulation; sensors and sensor networks, advanced topics in recent development of robotic theory and applications. (Equivalent to MAEG5010 or BMEG5100.) (For students in MSc Mechanical and Automation Engineering or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in Mechanical and Automation Engineering; Not for students who have taken MAEG5010 or BMEG5100)</td>
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<tr>
<td>MAEG5020</td>
<td>Topics in Linear Control Systems</td>
<td>Advanced topics in recent development of linear control theory and its applications. The detailed course contents may be changed from year to year depending on the current development. (Equivalent to ACEG5050.) (For students in PhD Automation and Computer-Aided Engineering or MPhil-PhD Mechanical and Automation Engineering or MSc Mechanical and Automation Engineering or UG Mechanical and Automation Engineering; Not for students who have taken MAEG5010 or BMEG5100)</td>
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<td>MAEG5725</td>
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<td>Lagrange formulation of robot dynamics, Newton-Euler equations; motion control, force control, visual servoing, grasping analysis, object manipulation; sensors and sensor networks, advanced topics in recent development of robotic theory and applications. (Equivalent to MAEG5010 or BMEG5100.) (For students in MSc Mechanical and Automation Engineering or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in Mechanical and Automation Engineering; Not for students who have taken MAEG5010 or BMEG5100)</td>
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<td>MAEG5020</td>
<td>Topics in Linear Control Systems</td>
<td>Advanced topics in recent development of linear control theory and its applications. The detailed course contents may be changed from year to year depending on the current development. (Equivalent to ACEG5050.) (For students in PhD Automation and Computer-Aided Engineering or MPhil-PhD Mechanical and Automation Engineering or MSc Mechanical and Automation Engineering or UG Mechanical and Automation Engineering; Not for students who have taken MAEG5010 or BMEG5100)</td>
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<td>MAEG5725</td>
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<td>Lagrange formulation of robot dynamics, Newton-Euler equations; motion control, force control, visual servoing, grasping analysis, object manipulation; sensors and sensor networks, advanced topics in recent development of robotic theory and applications. (Equivalent to MAEG5010 or BMEG5100.) (For students in MSc Mechanical and Automation Engineering or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in Mechanical and Automation Engineering; Not for students who have taken MAEG5010 or BMEG5100)</td>
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MAEG5030 Topics in Computer-Aided Geometric Design
Advanced topics in recent development of computer-aided geometric design. The detailed course contents may be changed from year to year depending on the current development. (Equivalent to ACEG5010.) (For students in PhD Automation and Computer-Aided Engineering; or For students in MPhil-PhD Mechanical and Automation Engineering; or For students in MSc Mechanical and Automation Engineering; or For students in UG Mechanical and Automation Engineering.)

MAEG5040 Computer Vision
Camera models. Stereo vision, camera calibration and stereo calibration. Shape from motion, camera motion estimation and motion tracking. Shape from boundary. Active range sensing. Early vision. Multimedia applications like image transfer and image mosaic construction. Industrial applications. (Equivalent to ACEG5020.) (For students in PhD Automation and Computer-Aided Engineering or MPhil-PhD Mechanical and Automation Engineering or MSc Mechanical and Automation Engineering or UG Mechanical and Automation Engineering; Not for students who have taken MAEG5720.)

MAEG5050 MEMS and Nano-Robotics
Introduction to MEMS/NEMS devices. Micro/Nano fabrication techniques. MEMS/ NEMS design methodology. Experimental methods for Micro/Nano devices. Applications for MEMS/NEMS. Dominant physical phenomena in the Micro/Nano worlds. Micro and Nano scale robotics and assembly. (Equivalent to ACE5090) (For students in PhD Automation and Computer-Aided Engineering or MPhil-PhD Mechanical and Automation Engineering or MSc Mechanical and Automation Engineering or UG Mechanical and Automation Engineering; Not for students who have taken MAEG5750.)

[Equivalent to ENGG5404 Micromachining and Microelectromechanical Systems]
Broad overview of microfabrication and microelectromechanical systems. Introduction to basic micromachining techniques such as photolithography, isotropic and anisotropic wet etching, dry etching, physical and chemical vapor deposition, electroplating, metrology, statistical design of experiments, MEMS release etching, stiction, and MEMS device testing. Review of MEMS microsensors, microactuators and microstructures. Topics include accelerometers, pressure sensor, optical switches, cantilever beams, thin-film stress test structures and bulk micromachining test structures. Fundamentals of central dogma of molecular biology, cell and tissue biology. Principles of transduction and measurements of molecules, cells and tissues. (For students in MSc BMEG and MAEG; or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in BMEG or MAEG; Not for students who have taken BMEG5120, MAEG5050 or MAEG5750)

MAEG5060 Computational Intelligence
Concepts, models, methods, and applications of computational intelligence. Topics include neural networks, support vector machines, fuzzy systems, simulated annealing, genetic algorithms, and their applications to control, robotics, automation, manufacturing, and transportation. (For students in PhD Automation and Computer-Aided Engineering or MPhil-PhD Mechanical and Automation Engineering or MSc Mechanical and Automation Engineering or UG Mechanical and Automation Engineering; Not for students who have taken MAEG5735.)
**MAEG5070 Nonlinear Control Systems**
Ordinary differential equation description of nonlinear state space systems. Phase plane analysis. Linearization. Concepts of stability. Lyapunov theory. LaSalle theory. Limit cycles. Feedback linearization. Sliding mode control. Backstepping. (Equivalent to ACE5100) (For students in PhD Automation and Computer-Aided Engineering; or For students in MPhil-PhD Mechanical and Automation Engineering; or For students in MSc Mechanical and Automation Engineering; or For students in UG Mechanical and Automation Engineering.)

**MAEG5080 Smart Materials and Structures**
Overview of smart materials technology. Characteristics of smart materials such as piezoelectric materials, magnetorheological fluids, and shape memory alloys. Smart actuators and sensors. Structural modelling and design. Dynamics and control for smart structures. Integrated system analysis. Applications in biomedical devices, precision machinery, transportation, and buildings. (Equivalent to ACEG5120.) (For students in PhD Automation and Computer-Aided Engineering or MPhil-PhD Mechanical and Automation Engineering or MSc Mechanical and Automation Engineering or UG Mechanical and Automation Engineering; Not for students who have taken MAEG5760.)

**MAEG5090 Topics in Robotics**
One or more of the following topics will be discussed in the class. Advanced robot control: adaptive control; cooperative robot control; underactuated robot control; multi-finger hand control. Mobile robot: obstacle avoidance; learning; control; and mobile manipulators. Space robotics: dynamics; control; telescience. Human and robot interaction: interface; learning skills. Biorobotics: robots and intelligent systems for medical, healthcare, and laboratory automation and clinic surgery. Robot motion planning: configuration space; search algorithm; potential field, and sensor-based motion planning. (Equivalent to ACE5110) (For students in PhD Automation and Computer-Aided Engineering; or For students in MPhil-PhD Mechanical and Automation Engineering; or For students in MSc Mechanical and Automation Engineering; or For students in UG Mechanical and Automation Engineering.)

**MAEG5100 Advanced Engineering Design and Optimization**
To provide in-depth understanding of the principles and tools of engineering system design, statistical optimization methods, Design for Six Sigma (DFSS), TRIX, and complex system design. (For students in PhD Automation and Computer-Aided Engineering; or For students in MPhil-PhD Mechanical and Automation Engineering; or For students in MSc Mechanical and Automation Engineering; or For students in UG Mechanical and Automation Engineering.)
[Equivalent to ENGG5405 Theory of Engineering Design]
Introduction of engineering design and design procedure, design innovation and TRIZ, axiomatic design, nature’s design and complex systems, design analysis (modeling and simulation), statistical analysis, design optimization, statistical design optimization, Design for Six Sigma (DFSS). Practical examples of design and applications, such as pendulum, bicycle, windmill and propulsion. (Equivalent to MAEG5100.) (For students in MSc Mechanical and Automation Engineering or MPhil-PhD programmes under Faculty of Engineering; or For undergraduate students in Mechanical and Automation Engineering; Not for students who have taken MAEG5100.)
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<tr>
<td>MAEG5110</td>
<td>Quantum Control</td>
<td>Mathematics foundation: Hilbert spaces; manifolds; groups; Lie groups and Lie algebras. Physics foundation: quantum phenomena; states and operators; observables and measurement; quantum dynamics. Quantum control systems: modeling; controllability and observability; optimal quantum control. (For students in PhD Automation and Computer-Aided Engineering; or For students in MPhil-PhD Mechanical and Automation Engineering; or For students in MSc Mechanical and Automation Engineering; or For students in UG Mechanical and Automation Engineering.)</td>
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<tr>
<td>MGNT1010</td>
<td>Introduction to Business</td>
<td>This course aims at providing an introduction to the general concepts of business. It describes the economic, political, social and cultural environment in which managers and organizations function. Major topics include: the framework of business, the basic business functions, managerial functions and other selected business considerations. (Not for Integrated BBA Majors or other BAF Majors or students who have taken UGEC2750.)</td>
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<tr>
<td>MGNT4090</td>
<td>Technology and Innovation Management</td>
<td>Today’s uncertain, ambiguous and fast changing business environment means that managers must be able to find creative solutions to problems and implement them effectively. This course is concerned with developing insights and skills related to that vital task. It will examine the process of developing technology and innovation in organizations and introduce students to methods for developing creativity at the individual, group and organizational levels. It will examine the process of putting innovative ideas into practice. Finally, it will consider the organizational context - in terms of structure, culture, and management style - which can either inhibit or facilitate innovation and new technology. (Prerequisite: HTMG1010 or MGNT1020.)</td>
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<tr>
<td>SEEM2440</td>
<td>Engineering Economics</td>
<td>Principles of engineering economy. Value and cost; cash flows. Economic analysis of alternatives, technological, social and human factors. Analytical techniques for evaluating industrial projects. Relationship between economics of technical choice and industrial productivity. Basic financial accounting concepts; accounting cycle; financial statements. (Not for students who have taken SEEM2510.) [or DSME1030 Economics for Business Studies I]</td>
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<tr>
<td>SEEM3450</td>
<td>Engineering Innovation and Entrepreneurship</td>
<td>Factors that drive continuous creative product innovation. Study of processes of creating, assessing and pursuing product opportunities. Evaluation of new product ideas and risk assessment of commercialization. Product development strategies in industrial marketing. Understanding the behaviour of buyer. Formulation and implementation of innovative marketing strategy and business plan. (Prerequisite: SEEM2440 or 2450 or with the approval of the course instructor.)</td>
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**SEEM3490 Information Systems Management**
In-depth discussion of the challenges, techniques and technologies associated with the management of IT in a competitive environment. The linkage of IT to business strategy and business process re-engineering. Type of information systems: MIS, DSS, TPS. Development process. Information system planning. Systems project management and control. IT acquisition, budgeting and deployment. Performance evaluation and auditing. Operations management. Privacy and security. (Prerequisite: SEEMG3430 or with the approval of the course instructor.)

**SEEM3500 Quality Control and Management**
Quality planning, control and improvement. Sampling theory. Statistical quality control theory applied to production operations. Specification and control charts for monitoring production systems. Quality engineering - the Taguchi Method. Quality control issues of manufacturing and service industry. Case studies of quality control problems in industry. Use of computer aids. Introduction to ISO 9000. (Prerequisite: SEEM2430 or with the approval of the course instructor.)