Bachelor of Engineering in Energy Engineering
(334 New Curriculum)

Unless otherwise specified, all are 3-unit term courses. Please check CUSIS for the most up-to-date information.)

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.

Enrollment Requirement: Not for students who have taken ESTR1000.

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.

Enrollment Requirement: Not for students who have taken CSCI1030 or 1110 or 1120 or 1130 or 1510 or 1520 or 1530 or 1540 or ESTR1002 or 1100 or 1102.

ENGG2600 Technology, Society and Engineering Practice *(applicable to 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.

Enrollment Requirement: Not for students who have taken ESTR2008.

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 *(not applicable to students admitted in 2016-17 and thereafter)*
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 *(applicable to students admitted in 2012-13 & 2013-14)*
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
Elements and Compounds, Atomic Structure, Theories of Chemical Bonding, Periodic Properties, Gases, liquids, solids, and solutions, Chemical Equilibrium, Acids and bases, Oxidation and Reduction, Thermochemistry, Thermodynamics, Electrochemistry, Chemical Kinetics, Materials, Properties of Polymers, Nuclear Chemistry, Metallurgy.

Enrollment Requirement: For New Curriculum Students.

ENGG1310 Engineering Physics: Electromagnetics, Optics and Modern Physics
This is an introductory calculus-based engineering physics course covering topics in electromagnetics, optics and modern physics. Topics in electromagnetics include: electric and magnetic properties, Coulomb's law, Gauss' law, electromagnetic energy and forces, Biot-Savart law, electromagnetic fields and Maxwell's equations, propagation of plane electromagnetic waves. Topics in optics include: optical interference, interferometers, optical diffraction. 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. Contents will be supplemented by discussions on applications relevant to engineering.

Enrollment Requirement: Not for students who have taken ENGG2520, ESTR2006 or ESTR1003.

ENGG2520 Engineering Physics II *(applicable to students admitted in 2014-15 or before)*
This is an introductory calculus-based engineering physics course covering topics in electromagnetism and modern physics. 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. 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. Contents will be supplemented by discussions on applications relevant to engineering.

Enrollment Requirement: Not for students who have taken ESTR2006.

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.

Add Consent: Department Consent Required.
Enrollment Requirement: 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.

Enrollment Requirement: 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.

Enrollment Requirement: For New Curriculum Students.

PHYS1110 Engineering Physics: Mechanics and Thermodynamics

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.

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.

Enrollment Requirement: Not for students who have taken ESTR1004. Pre-requisite: MATH1510.

ENGG2420 Complex Analysis and Differential Equations for Engineers

Complex analysis: analytic functions and Cauchy Riemann; complex integration, Cauchy principal value; elementary complex valued functions: exponential functions, Euler's formula, trigonometric and hyperbolic functions, logarithm and general powers; power series, Taylor series and convergence tests.

ODE: classification of differential equations; 1st order ordinary differential equations; 2nd order ordinary differential equations. Partial differential equations.

Enrollment Requirement: Not for students who have taken ENGG2460 or ESTR2000 or ESTR2010.

ENGG2430 Probability and Statistics for Engineers
Fundamental probability concepts: probability and events; expectation, variance, moments, 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. Statistics: estimation, sample size and applications.

Enrollment Requirement: Not for students who have taken ESTR2002, ESTR2005 and ENGG2450.

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 Fundamental of Electric Circuits
Basic circuit laws and theorems, mesh and nodal analysis, superposition and source transformation; analysis of operational amplifier circuits and their applications; concept of phasor and impedance; AC analysis, power factor correction, maximum power transfer; introduction to transient analysis; three-phase circuits; basic magnetic principles and electrical equivalent circuits; inductors and transformers; basic electromechanical principles.

Enrollment Requirement: Not for students who have taken ELEG1110.

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.

ENER2020 Renewable Energy Technologies
The effort of securing more sustainable, reliable, and affordable energy supplies is among the most challenges faced in this century. This course focuses on scientific and engineering fundamentals of renewable energy resources and conversion technologies. The subject-specific lectures will be provided in more depth to cover these topics: global energy sources, thermodynamics for renewable energy, solar energy, wind energy, hydro power, bioenergy, geothermal, fuel cell, and design, modeling and analysis of energy systems.

Enrollment Requirement: Not for students who have taken MAEG3090.

ENER3030 Engineering Materials
Fundamentals of materials including atomic bonding; crystal structures, defects; mechanical properties of materials, phase diagram; overview of metals, alloys, ceramics, polymers, semiconductors and composites; electrical, optical, magnetic, and thermal properties of materials; materials selection and design considerations for engineering technologies. Applications of materials to energy engineering, mechanical engineering, medical engineering, and others will be discussed.

Enrollment Requirement: Not for students who have taken ESTR3402

MAEG2030 Thermodynamics
Fundamental concepts. Pure substance. Work and heat. First and second laws of thermodynamics. Entropy. Elementary power and refrigeration cycles. Applications to air conditioning and internal combustion engines.

Enrollment Requirement: Not for students who have taken ESTR2402.

SEEM2540 Energy and Environmental Economics and Management
Application of economics principles in energy supply and demand; local and global energy markets. Energy planning, forecasting, and demand management; design of power networks, use of optimization tools. Control of emissions; carbon auditing and trading. Environmental economics and sustainable development. Ecological economic analysis and sustainable resource management. Impact of government policies: taxation, regulation and deregulation. Impact of new technologies.

Research Component Courses

ENER4998 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.

ENER4999 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.

Enrollment Requirement: Pre-requisite: ENER4998.

Major Elective Courses

Core Electives

CHEM4280 Chemistry in Biofuel *(2 units)*

Biofuel, namely fuel produced through chemical engineering processes of biomass, represents a major alternative and sustainable source of energy. The course covers review of organic chemistry and physical chemistry; structures and combustion energy of fuel molecules; related biochemistry and enzymology; biochemical conversion processes; ethanol production from carbohydrate-based biomass; biodiesel production from lipid-based biomass; hydrogen and methane production from organic and waste products; fermentation and alkane production; chemical engineering processes of biofuel production; biofuel economics, policies, and research and development; field trip to bioenergy farm. A guest lecture from a practitioner on biofuel production industry is scheduled. Students are required to run experiments for a project and to design their own solutions to solve problems met in biofuel industry.

EEEN3010 Building Automation and Control *(applicable to students admitted from 2013-14 to 2015-16)*

This course introduces various mechanical systems of modern buildings: heating, ventilation, and air-conditioning (HVAC), lighting, electrical, plumbing, fire, security, and elevator, and presents the physical principles, signals and functions of the instrumentations, and control equipments involved. This course also includes the building automation systems (BAS), which ensure the proper configuration, operations, troubleshooting, and performance of the overall building based on gathered information and control strategies. Basic concepts of control system, communication network and protocols will also be presented.

Enrollment Requirement: Pre-requisite: MAEG2030/ESTR2402 or with the consent of the course instructor.

ELEG3601 Introduction to Electric Power Systems

This is an introductory course on electric power systems and electrical to mechanical energy conversion. Electric power systems have become increasingly important as a way of transmitting and transforming energy in industrial, military and transportation uses. They are also at the heart of alternative energy systems, including wind and solar electric, geothermal and small-scale hydroelectric generation. This course covers fundamentals of energy-handling electric circuits, power electronic circuits such as inverters, and electromechanical apparatus; modeling of magnetic field devices and description of their behavior using appropriate models; analysis of power electric circuits, magnetic circuits, and elements of linear and rotating electric machinery; models of synchronous, induction, and DC machinery; the interconnection of electric power apparatus and operation of power systems.

Enrollment Requirement: Prerequisite: ELEG2202 and ENGG2520, or with consent of the instructor.

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.
Enrollment Requirement: Not for students who have taken ESTR4400. Prerequisite: MAEG3030 or with the consent of the course 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.

Enrollment Requirement: Not for students who have taken ESTR4402. Prerequisite: ELEG2202 and ENER2020; or ELEG2202 and ELEG3201/ESTR3200.

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.

Enrollment Requirement: Not for students who have taken ESTR4404.

ENER4040 Energy Storage and Distribution *(applicable to students admitted in 2014-15 or before)*
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.

Enrollment Requirement: Not for students who have taken ESTR4406. Prerequisites: ENER2010 and ENER2020 or with the consent of the course instructor.

ENER4050 Energy Storage Devices and Systems
Fundamental principles, device and system designs of energy storage technologies: electrochemical energy storage (batteries, supercapacitors, fuel cells etc.), thermal energy storage (phase change), mechanical energy storage (flywheel and compressed air energy storage), hydrogen storage. The applications of energy storage technologies in supporting renewable energy sources for smart grid and green building applications. The applications of energy storage technologies in hybrid and all-electric vehicles technologies.

Enrollment Requirement: Not for students who have taken ENER4040, ESTR4406 or ESTR4422. Pre-requisite: ENER2010 and ENER2020 or with the consent of the course instructor.

ENER4060 Energy Distribution

Power system fundamental, control, and operation. The contents include selected topics from the following: power system components and overview, review of basic circuit elements, AC circuit analysis and phasor representation, nodal analysis, complex power, active and reactive power, power factor and power triangle, reactive power compensation, balanced 3-phase system analysis, Y-connection and delta-connection, transformer modelling and analysis, per-unit analysis, transient stability and analysis, voltage stability and control, frequency stability and control, power flow analysis, economic dispatching, optimal power flow problem, unit commitment problem, electricity market, power plant planning, demand forecast, smart grid, energy storage system, renewable generation and utilization, and electric vehicle integration.

Enrollment Requirement: Not for students who have taken ENER4040, ESTR4406 or ESTR4424. Pre-requisite: ELEG2202.

ESSC2800 Introduction to Environmental Engineering *(applicable to students admitted in 2014-15 & 2015-16)*

This is a multidisciplinary course introducing the fundamental physical, chemical and biological principles necessary for understanding the natural and built environments, with an emphasis on reliable water and food supplies, pollution mitigation, waste management, energy resources, climate change, and sustainable development. Examples of engineering solutions to tackle some of these resource and environmental issues are presented. Field trips are included to illustrate interesting case studies. Topics include: conservation principles for mass, energy and momentum in the environmental systems; basic environmental chemistry, hydrology and ecology; risk assessment; and basic principles of water resource engineering, solid waste treatment, noise pollution, air pollution control, climate change adaptation and mitigation, and the interplay between energy consumption and the environment.

Enrollment Requirement: Pre-requisite: MATH1010 or 1510 or 1520.

MAEG4030 Heat Transfer

Basic concepts. Steady and transient heat conduction. Natural and forced convection. Radiation. Numerical methods.

Enrollment Requirement: Not for students who have taken ESTR4412.

MAEG4080 Introduction to Combustion

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.

Enrollment Requirement: Pre-requisite: MAEG2030 or ESTR2402. Not for students who have taken ESTR4420.

Non-Core Electives

ARCH2421 Introduction to Building Technology *(applicable to students admitted in 2015-16 and before)*

An empirical introduction to building technology, emphasizing the relation between natural phenomena and building form. Organized around physical modelling projects, with supporting lectures. Addresses thermal comfort, solar movement and shading, and transfer of loads through tension and compression.

ARCH3424 Building Technology III: Environmental Technology *(applicable to students admitted in 2013-14 and thereafter)*

This course introduces the fundamental concepts of passive environmental design. It examines the effect on buildings and their occupants of environmental conditions of light, temperature, air movement and sound. Case studies are used to review both traditional and current approaches of representative building types in more depth.

Add Consent: Department Consent Required
Drop Consent: Department Consent Required

ARCH5431 Topical Studies in Building Technology *(applicable to students admitted in 2013-14 and thereafter)*

These elective courses investigate topics and issues in the specific field of building technology. Each specific elective is designed to allow the students to gain in-depth knowledge and ability to discourse or execute the theory and practice of the particular field. Each semester, there will be different sections of electives offered with specific course descriptions for students to choose from.

Enrollment Requirement: For students of Master of Architecture and BSSc (Architectural Studies) and Energy and Environmental Engineering

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.

Enrollment Requirement: Not for students who have taken CSCI1120 or 1520 or 1540 or ESTR1100.

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.

Enrollment Requirement: Not for students who have taken ESTR2102 or CSCI2520; Pre-requisite: CSCI1110 or 1120 or 1130 or 1510 or 1520 or 1530 or 1540 or ENGG1110 or ESTR1100 or ESTR1102 or ESTR1002 or its equivalent. For senior-year entrants, the prerequisite will be waived.

ELEG3207 Introduction to Power Electronics
Single-phase and three-phase electrical systems; principles and methods of electric power conversion; semiconductor power switches; rectifiers with different loads; power factor correction circuits; DC-to-DC converters of different topologies in continuous-current and discontinuous-current modes; controls and electrical isolations; switch-mode DC power supplies; DC-to-AC inverters; power electronics in clean energy generation systems.

Enrollment Requirement: Prerequisite: ELEG2202 or with the consent of the instructor.

ENER3020 Energy Utilization and Human Behaviour
This course emphasizes the intersection between energy consumption and human/corporate/economic activities. The course follows a grid structure in its organisation. The grid's horizontal lines are about energy consumption, involving electricity use, and direct burning of fuels including combustion engines, boilers, stoves, etc. The vertical lines are about human activities, involving major economic sectors including the industrial, transport, commercial, and residential ones. The intersections between the grid's horizontal lines and vertical lines are the lecture topics. Each lecture has discussion over three aspects: (1) how energy is utilized; (2) what factors are affecting energy consumption in intensity and in total; and (3) how human behaviour could be changed for energy conservation and pollution control.

Enrollment Requirement: Not for students who have taken ESTR3400.

ENGG1820 Engineering Internship *(1 unit)*
The objective of the course is to enable students to have a basic understanding of the practical aspects of the engineering profession. Prior to the enrolment of this course, students must have completed not less than 8 weeks of full-time internship approved by the Faculty of Engineering. To be qualified for award of the subject credit, the student must submit a report, within the semester of enrolment, summarizing what he or she has done and learnt during the internship, together with a testimonial from the corresponding employer. Pass or fail of the course will be determined by the professor-in-charge, based on the report and the testimonial submitted.

Student may look for internship opportunities at the Placement and Internship Program (PIP) website administered by Centre for Innovation and Technology of the Faculty, or from any other sources available to him or her. Students are recommended to seek professor-in-charge's comment on internship undertaken before enrolling in the course.

Work-Study, the 12-month internship program organized by the Faculty, is a valid internship satisfying the requirements of ENGG1820.

Advisory: For year 2 or above Engineering Majors students. (new curriculum)

ENSC2270 Introduction to Environmental Science
This course deals with the relationships between living organisms, resources and environment. The basic multidisciplinary concepts of sustainable development, human population and health risk, conservation of resources, climate change, environmental degradation, pollution control, biodiversity, solid waste and waste water management, etc, will be introduced. Case studies and field trips are included to illustrate various environmental issues using a multidisciplinary approach.

ENSC3230 Principles of Environmental Protection and Pollution Control
This course discusses from a multidisciplinary viewpoint the anthropogenic causes of environmental degradation and the various approaches to environmental protection and pollution control. Students are introduced the concept of sustainability in environmental protection, economic measures and voluntary approach in environmental management, control and treatment technologies, and their comparative effectiveness in the abatement of various types of pollution. Management programmes and control strategies in tackling local environmental problems are illustrated.

Enrollment Requirement: 1. Prerequisite: ENSC2270 or permission of the instructor. 2. Not for students who have taken GRMD3202.

ENSC4240 Environmental Impact Assessment
This course discusses the techniques and procedures of evaluating environmental consequences arising from human activities, with focus on their application in Hong Kong as prescribed under the Hong Kong Environmental Impact Assessment Ordinance, and its Technical Memorandum. Students are encouraged to take the laboratory course (ENSC4242) together with the lecture in order to have a better integration of theories and practical experiences on the subject.

Enrollment Requirement: Prerequisite: ENSC2270 and BIOL2210.

ESSC2020 Climate System Dynamics *(applicable to students admitted in 2013-14 and thereafter)*
This course presents an integrated introduction to the climate system, stressing the dynamics of the atmosphere and its physical and chemical interactions with the hydrosphere, biosphere and geosphere. The course applies basic scientific and mathematical principles to explain the history, current state and future projection of weather and climate, natural hazards (e.g., typhoons, floods), and global climate change in the context of natural variability and anthropogenic influence. Topics include Earth's energy balance, climate feedback, convection and clouds, general circulation of the atmosphere and ocean, biogeochemistry and global carbon cycle, roles of vegetation and ecosystems, and historical and future climate change. Student taking this course are expected to have taken PHYS1111, CHEM1070 and MATH1010 or equivalent.

Enrollment Requirement: Not for students who have taken ESGS2101.

ESSC4240 Air Pollution Science and Engineering *(applicable to students admitted from 2013-14 to 2015-16)*
This course will cover a variety of topics related to air pollution science and engineering. Topics include: indoor and outdoor air quality (including particulate matters (PM) and gases pollutants); air pollution measurement and statistics; air quality meteorology and dispersion models; principles and challenges of air pollution control and measurement.

GRMD2404 Energy and Society
The historical evolution of the human society is significantly affected by how we consume energy. Our modern society is built on modern energy consumption patterns. However, rising energy consumption also raises serious environmental challenges that are detrimental to human beings and our planet Earth. Accordingly, one critical goal of energy development is to maximize the positive impacts and to minimize the negative impacts of energy consumption. After discussing the role of energy consumption in a society, this course will analyze how energy consumption and the environment affect each other. Students will then be guided through various levels of a society, from individuals, households, communities, to cities, countries and the world in general discussion and case studies on how energy is consumed. Recognizing the importance of energy conservation as a key solution, this course will further examine two major barriers, particularly the behavior and efficiency gaps, to understand how we could achieve the goal. An open and especially active mind is a must for success in this course.
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GRMD3203 Urban Environmental Problems
This course examines the nature of noise, air and water pollution problems in cities and discusses how these pollutants and the provision of open/green space can affect urban livability. Particular emphasis is placed on the use of prediction models to assist environmental assessment and planning.

GRMD4202 Hydrology and Water Resources
This course aims to offer students a broad exposure to the basic concepts and principles of hydrological science and thus to help them understand various technical and policy issues in water resources management. Focus is placed on all components of the hydrological cycle and the integration of hydrological processes for understanding runoff generation mechanisms at the hillslope and watershed scales. The concept and analysis of water balance are emphasized throughout the course. Principles and techniques of water resources management are also introduced, along with

case studies in mainland China and Hong Kong.

GRMD4204 Environmental Planning and Assessment

The course introduces and examines the theories, processes and methodologies of environmental planning and assessment as important tools and instruments for minimizing human impacts on the environment and achieving environmental sustainability through good governance. Environmental planning plays a vital role in urban design and the formulation of land use and other planning strategies in order to mitigate the effects of human activities on air, water, land, and ecological systems, and to promote sustainable use of energy, water and other natural resources. While the coverage is broad and comprehensive, emphasis will be placed on the two most prominent tools, i.e. Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA), in terms of their origins, legal and regulatory requirements, and practices around the world. After introducing the conceptual framework and theoretical foundation of environmental assessment, specific methods and techniques (both qualitative and quantitative) will be introduced for students to understand the procedures and systems and gain the technical skills for practical applications. Environmental planning considerations and impact assessment will be examined for different sectors (industry, commercial, transportation, etc.) and multiple environmental media (air, water, solid waste, and noise) at difference spatial scales (local, regional, and national). Although a global perspective and comparative approach will be adopted throughout the course, examples and case studies of mitigating and managing environmental impacts through planning and assessment will mainly come from Hong Kong and mainland China.

MAEG2020 Engineering Mechanics

Equations of equilibrium. Friction. Moments of inertia. Kinematics and kinetics of particles. Energy and momentum methods of particles. Kinematics and dynamics of rigid bodies. Energy and momentum methods for rigid bodies.

Enrollment Requirement: Not for students who have taken ESTR2400.

MAEG3010 Mechanics of Materials

Linear elasticity. Stress and strain. Stress-strain relations. Loading and deformation. Statically indeterminate problems. Torsion. Shear forces and bending moments. Stresses in beams. Deflections of beams.

MAEG3030 Fluid Mechanics

Nature of fluids. Fluid statics. Integral and differential equations of fluid flows. Conservation of mass, momentum and energy. Dimensional analysis. Internal flow. External flow. Applications of fluid mechanics in engineering systems.

MAEG3050 Introduction to Control Systems

Mathematical modelling and linear approximation of engineering systems. Laplace transform. Transfer function and block diagram representation. Characteristics of feedback systems. Performance specifications. Routh-Hurwitz stability criterion. Root locus design. Frequency response design. Nyquist criterion. Utilization of computer-aided analysis and design software.

Enrollment Requirement: Not for students who have taken ESTR3406.

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.

MAEG4020 Finite Element Modelling and Analysis

Finite element method. Computational procedures. Basic elements. Shape functions. Formulation techniques. Boundary conditions. Modelling considerations. Implementation of finite elements. Software use. Engineering applications.

Enrollment Requirement: Not for students who have taken ESTR4410.