

Bachelor of Engineering in Energy and Environmental 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.

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

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.

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

EEEN2020 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.

EEEN3010 Building Automation and Control

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.

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.

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.

ESSC2800 Introduction to Environmental Engineering

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.

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.

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.

SEEM2540 Energy and Environmental Economics and Management (w.e.f. 1-7-2016)

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 (6 units)

EEEN4998 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.

EEEN4999 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: EEEN4998.

Major Elective Courses

Core Electives

ARCH3424 Building Technology III: Environmental Technology

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

EEEN3030 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 ENER3030 or ESTR3402.

EEEN4020 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 ENER4020 or ESTR4402. Prerequisite: 1. ELEG2202 and EEEN2020/ENER2020 or 2. ELEG2202 and ELEG3201/ESTR3200

ESSC4240 Air Pollution Science and Engineering

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.

Non-Core Electives

ARCH5431 Topical Studies in Building Technology

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

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.

CSC11020 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 CSC1120 or 1520 or 1540 or ESTR1100.

CSC11040 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.

CSC11050 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.

EEEN3020 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 ENER3020 or ESTR3400.

EEEN4010 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 ENER4010 or ESTR4400. Prerequisite: MAEG3030 or with the consent of the course instructor.

EEEN4030 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 ENER4030 or ESTR4404.

EEEN4050 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, ENER4050, ESTR4406 or ESTR4422. Pre-requisite: ENER2010 and ENER2020, or EEEN2020, or with the consent of the course instructor.

EEEN4060 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, ENER4060, ESTR4406 or ESTR4424. Pre-requisite: ELEG2202.

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.

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)

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

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.

ESSC3200 Atmospheric Dynamics

This course introduces observations of and physical principles governing the circulation of the Earth's atmosphere in relation to weather and climate. The topics covered include atmospheric composition and structure, convection, fundamentals of atmospheric motions, and the basic principles for weather and climate modeling. Physical principles covered include basic conservation laws, balanced flows, atmospheric thermodynamics, circulation and vorticity, atmospheric waves, and theories for various weather systems.

Enrollment Requirement: Not for students who have taken ESGS5014. Pre-requisite: ESSC2020, MATH2550 or permission of instructor.

ESSC3220 Atmospheric Chemistry

This course introduces the physical and chemical processes determining the composition for the atmosphere and its implications for climate, ecosystems, air pollution and human welfare. Topics covered include atmospheric structure, atmospheric chemistry models, atmospheric transport, chemical kinetics, stratospheric and tropospheric chemistry, chemistry of aerosols, biogeochemical cycles, as well as critical environmental issues including stratospheric ozone depletion, acid rain, photochemical smog, and climate change.

Enrollment Requirement: Not for students who have taken ESGS5014. Pre-requisite: CHEM1070 or permission of instructor.

ESSC3320 Hydrogeology

This course introduces the physical and chemical principles of hydrogeology. Concepts of surface and groundwater hydrology, as well as quantitative modelling of groundwater flow and contaminant transport are covered. Special topics on the coupling of hydrologic and geologic processes will also be addressed, with examples from tectonics, petroleum geology, geothermics, and global change.

Enrollment Requirement: Not for students who have taken ESGS5006. Pre-requisite: ESSC2010 or permission of instructor.

ESSC3600 Understanding Our Biosphere

This course introduces the basic concepts of the biosphere, biodiversity, conservation and restoration. Topics include: Organic production and nutrient cycling within the biosphere, oceanic currents and the global conveyor belts, physical and biological interactions, global and historical patterns of biodiversity, ecological factors controlling biodiversity, measurement and maintenance of biodiversity, habitat conservation and protected areas, as well as ecosystem degradation and restoration.

Enrollment Requirement: Not for students who have taken ESGS4005. Pre-requisite: ESSC2020.

ESSC3800 Global Environmental Change

This course surveys the critical problems of global environmental change, including long-term and short-term aspects. Long-term environmental change focuses on Earth evolution such as global tectonics, varying sedimentation environments during the interaction between continental and oceanic lithospheres, carbon cycle, mountain building and volcanic eruptions, and their impacts on regional climate. Short-term environmental change covers climate change, global warming, ozone depletion, deforestation, desertification, and human impacts. The observations and scientific basis for their interpretation are presented in the context of the earth system, by examining its essential components and their interactions. This provides the scientific context for a critical discussion of the social, economic and political implications of global change.

Enrollment Requirement: Pre-requisite: ESSC2010 and 2020, or permission of instructor.

ESSC4540 Remote Sensing – Principles and Applications

This course introduces the principles of remote sensing, including electromagnetic waves and radiation, optical, microwave, and non-imaging remote sensing. It also presents key concepts and examples on remote sensing applications in Earth system science, such as the atmosphere, lithosphere, hydrosphere, cryosphere, and global changes.

Enrollment Requirement: Not for students who have taken ESGS4002. Pre-requisite: MATH1010 (or similar 1000-level mathematics) and PHYS1001 (or similar 1000-level physics), or permission of instructor.

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.

GRMD3202 Environmental Management

This course critically examines the interrelations between human activities and the environment, analyses the nature and roots of environmental problems, evaluates the effectiveness of various environmental management options and discusses the complexities of environmental policy-making.

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.

GRMD3403 Methods for Resource Evaluation and Planning

This course introduces basic methods of resource evaluation and planning, giving special emphasis to cost-benefit analysis and economic policies for the management of natural resources. The course covers the different approaches developed by practitioners to give an economic value to environmental assets, discussing the theoretical underpinnings and methodological constraints of each approach, with examples from around the world. To strengthen understanding, the students are given the opportunity to carry out the economic evaluation of an environmental amenity in Hong Kong. The course also considers the problems of resource management, with a review of the methods developed by economists to encourage a more sustainable use of our natural resources.

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 different 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.

GRMD4401 Energy Resources

Modern energy consumption and supply are a key foundation of our modern economy and society. After introducing energy consumption patterns and major influential factors, this course discusses major energy types, including coal, oil, natural gas, nuclear, hydro, wind, solar, biomass, and electricity from the perspectives of resources, production, technologies, policy, economic and social development. After taking the course, students will acquire comprehensive knowledge of various energy resources, their consumption and supply. Learning activities are designed to train students to

think critically about the pros and cons of each energy type.

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.

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.

PHYS4420 Physics in Meteorology

This course provides an introduction to the physical principles in meteorology, weather observation and forecasting. Topics include: physics of fluids; dynamic meteorology; atmospheric thermodynamics; atmospheric physics (cloud and lightning); weather systems and phenomena; weather observation, analysis and forecasting; climate change. Trips to Hong Kong Observatory headquarters/ outstations will be arranged to acquaint students with the operation of meteorological instruments and the real-life practice of weather analysis and forecasting. Students are advised to take PHYS3011 and 4011 before taking this course.