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Faculty Package

ENGG1100 Introduction to Engineering Design (3 units)

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.(Not for students who have taken ESTR1000.)

ENGG1110 Problem Solving By Programming (3 units)

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 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

ENGG1310 Engineering Physics: Electromagnetics, Optics and Modern Physics (3 units)

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. (Not for students who have taken ENGG2520, ESTR2006 or ESTR1003.)

PHYS1110 Engineering Physics: Mechanics and Thermodynamics (3 units)

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.

CHEM1280 Introduction to Organic Chemistry and Biomolecules (3 units)

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 (3 units)

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. (This course is offered for students admitted to the 4-year curriculum.)

CSCI1120 Introduction to Computing Using C++ (3 units)

Computer-oriented problem-solving methods and algorithm development; object oriented programming concepts; concepts of abstract data types; simple data structures; illustrative applications. The C++ programming language will be used. (Not for students who have taken ESTR1100 or 1102 or CSCI1020 or 1110 or 1130 or 1510 or 1520 or 1530 or 1540. Equivalent to CSCI1111 offered in 2007-08 and before.)

LSCI1001 Basic Concepts in Biological Sciences (3 units)

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. (Not for students who have taken LSCI1002 or 1003.)

LSCI1003 Life Sciences for Engineers (3 units)

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.)

Foundation Mathematics Courses

ENGG1410 Linear Algebra and Vector Calculus for Engineers (3 units)

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. (Not for students who have taken ESTR1004. Pre-requisite: MATH1510.)

ENGG2420 Complex Analysis and Differential Equations for Engineers (3 units)

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. (Not for students who have taken ENGG2460 or ESTR2000 or ESTR2010.)

ENGG2450 Probability and Statistics for Engineers (3 units)

Probability theory: population, sample spaces and events, counting, axioms of probability, conditional probability, Bayes' Theorem, discrete distributions, continuous distributions, joint distributions, expectation and decision making, random processes. Statistical inference: sampling distributions, point estimation, confidence interval, hypothesis testing, chi-square

goodness-of-fit test. Introduction to regression analysis: linear regression. (Not for students who have taken ESTR2002 or ESTR2005 or ENGG2430.)

MATH1510 Calculus for Engineers (3 units)

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

ELEG2201 Digital Circuits and Systems (3 units)

Digital system concepts, numbering systems and codes. Boolean algebra, logic gates and logic circuit elements. Logic function minimization. Combinational logic circuit and sequential logic circuit design. Synchronous and asynchronous sequential machine design procedures. Implementation technology: NMOS and CMOS circuits; PLD, PLA, PAL, CPLD, and FPGA. Introduction to CAD tools and VHDL. (Not for students who have taken ELEG2120 or ENGG2020.)

ELEG2202 Fundamental of Electric Circuits (3 units)

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. (Not for students who have taken ELEG1110.)

ELEG2401 Introduction to Embedded Systems (3 units)

Introduction to microcomputer systems and to the concept of memory. Fundamentals of micro-controller 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.)

ELEG3201 Circuits and Devices II (3 units)

Fundamental semiconductor physics: electrons and holes, energy band diagram, Fermi energy, intrinsic and doped semiconductors, drift and diffusion currents. Physics of P-N junctions, bipolar and MOS transistors. Device performance measures: current efficiency, transit frequency and intrinsic gain. Frequency response of transistor amplifiers. Filters. Feedback principles, stability and frequency compensation. Oscillators. (Not for students who have taken ELEG2110 or ESTR3200; Prerequisite: ELEG2202 or with the consent of the instructor.)

ENGG2030 Signals and Systems (3 units)

Basics of signals and systems; continuous-time and discrete-time signals and systems; Fourier series and Fourier transform for analysis of signals and systems; characterization of systems; linear time-invariant systems and their characteristics; sampling; Laplace transform; z transform. (Not for students who have taken IERG2051.)

ENGG2310 Principles of Communication Systems (3 units)

Review of linear system theory and probability. Overview of communication systems. Amplitude modulation and angle modulation. Sampling and quantization. Pulse modulation and transmission. Digital modulation and detection. Modulators and demodulators. Effect of noise in communication. Introduction to information theory and error control coding. Case studies of communication systems.(Not for students who have taken ESTR2300.)

ELEG4998 Final Year Project I (3 units)

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.

ELEG4999 Final Year Project II (3 units)

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. (Prerequisite: ELEG4998.)

Major Elective Courses

BMEG3101 Medical Instrumentation and Design [Group A Elective] (3 units)

Fundamental concepts of the design of medical instrumentation and sensor. The origins and measurements of bioelectric and ultrasonic signals. Electrical safety and hazard. Application examples: Electrocardiography (ECG) measurements, pulse oximetry, biosensors cochlear implant devices, functional electric stimulators, drug delivery systems, etc. A design project of a medical device to enhance students engineering design skill and problem solving skill. (Not for students who have taken ELEG3101 or ESTR3210.)

BMEG3420 Medical Robotics [Group A Elective] (3 units)

Introduction to medical robotics, mechanical structures and dynamics, robotic sensing and control, human-robot interface, surgical robotic systems, rehabilitation robotic systems, micro-scale robotic medical devices, state-of-the-art in medical robotics.

CSCI1020 Hands-on Introduction to C++ [Group A Elective] (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.)

CSCI1030 Hands-on Introduction to Java [Group A Elective] (1 unit)

This course aims to provide an intensive hands-on introduction to the Java programming language. Topics include the basic Java language syntax, variable declaration, basic operators, program flow and control, defining and using functions, file and operating system interface. Specific key features of the Java programming language such as object-oriented methodology, class templates, encapsulation, inheritance, polymorphism, etc. will be highlighted. (Not for students who have taken CSCI1130 or 1530.)

CSCI1040 Hands-on Introduction to Python [Group A Elective] (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 [Group A Elective] (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 [Group A Elective] (3 units)

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 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.)

CSCI2120 Introduction to Software Engineering [Group A Elective] (3 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.)

ELEG3202 Analog Integrated Circuits [Group A Elective] (3 units)

Non-ideal opamp. Transistor amplifier design. Opamp design. Feedback analysis. Stability and frequency compensation. Noise analysis. Current source. Bandgap voltage reference. Linear regulator. Data converter. Filter. (Not for students who have taken ELEG3210. Prerequisite: ELEG2202 or with the consent of the instructor.)

ELEG3203 Electromagnetic Fields and Waves [Group A Elective] (3 units)

Review of vector differential operators and stationary electric and magnetic fields. Maxwell's equations and time-varying fields. Scalar and vector potentials. Wave equations. Two and three dimensional boundary value problems. Plane waves. Transmission lines and waveguides. Basic concept of field analysis of antennas. Numerical methods in electromagnetics. Students are advised to take necessary vector calculus before taking this course. (Not for students who have taken ELEG3310.)

ELEG3204 Wireless Technology and Systems [Group A Elective] (3 units)

Wireless systems and international communication standards. Antenna fundamentals. Design principles of Dipole antenna, Monopole antenna, Reflector antenna, Patch antenna and Antenna arrays. Practical antennas for mobile communication system. Antenna measurement techniques. Wave propagation basics: free space path loss, atmospheric absorption and multi-path fading. Introduction to modern wireless technologies: radar, satellite and RFID systems. (Not for students who have taken ELEG3330 or ESTR3202.)

ELEG3205 Modern Digital Circuit Design [Group A Elective] (3 units)

Digital circuit technology trends, implementation methods, design flow techniques and tools (e.g. Verilog); packaging, testing; advanced devices and design flow; IC related technologies. (Not for students who have taken ELEG3220.)

ELEG3207 Introduction to Power Electronics [Group A Elective] (3 units)

Single-phase and three-phase electrical systems; principles and methods of electric power conversion; semiconductor power switches; rectification of utility input; DC-to-DC converters; switch-mode DC power supplies; synthesis of AC voltages for motor drives and uninterruptible power supplies; power factor correction circuits; power electronics in clean energy generation systems. (Pre-requisite: ELEG2202.)

ELEG3301 Principles of Semiconductor Devices [Group A Elective] (3 units)

Review of electron and photon properties. Electrons in 1-D potential well and potential barrier. Fundamentals: hydrogen atoms, bonds, crystal structures, concept of band theory of solids, effective mass, and the Fermi energy. Conduction in semiconductors: intrinsic extrinsic, drift, mobility, diffusion, recombination, Hall effect. Junctions: metal/semiconductor, p/n, breakdown, MOS capacitor. Brief introduction to transistors: MOSFET, JFET. Brief introduction to IC fabrication: layer formation, photolithography, layout. (Not for students who have taken ELEG2510 or ESTR3204.)

ELEG3302 Fundamentals of Photonics [Group A Elective] (3 units)

Review of ray optics. Wave and beam optics. Fourier optics: optical image formation, holography and holographic storage. Polarization optics and liquid crystal display technology. Light emitting diodes. Optical resonators and lasers. Optical interconnects and switches. Applications: optical fiber communications and fiber sensors, optical consumer products. (Not for students who have taken ELEG3010.)

ELEG3303 Introduction to Optical Communications [Group A Elective] (3 units)

Development of fiber communications. Optical fibers and their properties. LED and Laser sources. Power launching and Coupling. Optical detectors and receivers. Repeaters, Regenerators, and Optical amplifiers. Introduction to Optical Communication Systems. Time-division-multiplexing (TDM) and Wavelength-division-multiplexing (WDM) communications. Optical networks. Ultrafast and nonlinear fiber optics. Recent developments in optical communication technology. (Not for students who have taken ELEG3320 or ESTR3206.)

ELEG3503 Introduction to Digital Signal Processing [Group A Elective] (3 units)

DTFT and DFT. Z-transform and inverse Z-transform. Stability and causality of DT systems. Inverse systems. Impulse response and frequency response. Transient-state response and steady-state response. Design and realization of FIR filters. Students are advised to take ENGG2030 before taking this course. (Not for students who have taken ELEG3410. Prerequisite: ENGG2030 or consent of the instructor.)

ELEG3601 Introduction to Electric Power Systems [Group A Elective] (3 units)

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.(Pre-requisite: ELEG2202 and ENGG2520, or with consent of the instructor.)

ELEG3700 Electronic Product Design and Development [Group A Elective] (2 units)

This course aims to provide basic training and hands-on experience on electronic product design and development. Topics to be learnt include information search; project planning; design methodology; selection of components; prototyping; testing procedures; trouble shooting; and documentation. The course will consist of lectures (basic training) and laboratory practice relating to the development of electronic products with pre-defined specifications.

ELEG3910 Undergraduate Research in Electronic Engineering [Group A Elective] (2 units)

Students will conduct research study of a topic in Electronic Engineering under the supervision of a teaching staff. (Not for students who have taken ENGG3920.)

ENGG3802 Introduction to Engineering Entrepreneurship [Group A Elective] (1 unit)

The 1-unit course will introduce engineering entrepreneurship and provide the key basic concepts needed in the preparation of technical proposals and business plans. The course will introduce students to analytical process of evaluating new ideas, and metrics to compare ideas with existing approaches in the market. The course will include in class discussion of forecasts based on market size estimates, cashflow analysis and technical development plans. The course objective is to prepare students to develop and present their innovative technical ideas that have potential for practical development as a preliminary entrepreneurship project in the following semester in ENGG3803. In addition to a formal written proposal to describe their ideas, students will also be asked to present their proposal to the course instructor. Shortlisted proposals will be invited to a second presentation where a panel of experienced engineering entrepreneurs select proposals for further development.

ENGG3803 Engineering Entrepreneurship Development Project [Group A Elective] (2 units)

The 2-unit course is project based. Students will be provided with individual or small group project supervision to help them implement their project proposal from ENGG3802. The objective of the course is to provide an initial technical implementation showing the technical feasibility of the proposal. The focus is carry out practical prototyping, simulations and/or computer coding and build a pre-alpha proof of concept demonstration via initial computer software or design/building of the critical hardware subsystems. At the end of the course, students will present their work to a panel of assessors in a project competition, and those shortlisted will be assessed by a panel including external entrepreneurs who may consider the successful projects for possible continuation (eg as the final year project or capstone project of their major programme). (Pre-requisite: ENGG3802 with Grade B+ or above or with consent of instructor.)

IERG3310 Computer Networks [Group A Elective] (3 units)

OSI reference model. Overview of TCP/IP. Local area networks and wide area networks. Network layer and protocols. Transport layer and protocols. Examples of application layer protocols such as HTTP. Network security: firewall, SSL, and

private and public keys encryption systems. One term project on client-server programming to create a web server and proxy. (Not for students who have taken CSCI4430.)

DSME1030 Economics for Business Studies I [Group A Elective] (3 units)

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.)

SEEM2440 Engineering Economics [Group A Elective] (3 units)

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 or ESTR2500.)

BMEG4103 Biomedical Modelling [Group B Elective] (3 units)

Basic physiologic systems: neuromuscular system, auditory system, pulmonary-cardiovascular system, etc. Bioelectric phenomena: action potentials, cellular membrane models, volume conductor models, ECG, EMG, EEG, etc. Biomedical modelling: lumped element model, bio-impedance and otoacoustic emissions. Topics in bio-modelling of recent interest. (Not for students who have taken ELEG4190.)

ELEG4201 CMOS Integrated Circuits [Group B Elective] (2 units)

Modern circuit design techniques used in current CMOS integrated circuits. CMOS digital integrated circuits: static and dynamic logic, transmission gate intensive logic, switching characteristic of static logic, I/O buffer, SRAM. (Not for students who have taken ELEG4260.)

ELEG4203 Radio Frequency Electronics [Group B Elective] (2 units)

Introduction to transmission line theory. Smith chart. Design principles of impedance matching. Microstrip lines. S-parameters. Microwave network analysis. Microwave CAD tools. Design principles of microwave passive circuits. Microwave measurement techniques. (Not for students who have taken ELEG4320 or ESTR4206.)

ELEG4204 Advanced Radio Frequency Circuit Design [Group B Elective] (2 units)

Microwave active devices. Device modeling. High frequency packaging. Design principles of microwave active circuits. Noise analysis. Linearity study of RF systems. Students are advised to take ELEG4203 before taking this course. (Not for students who have taken ELEG4320 or ESTR4208.)

ELEG4205 Power Converter Circuits [Group B Elective] (2 units)

Introduction to power conversion. Bandgap and Zener voltage references. Linear regulators and low-dropout regulators. Charge pump. Switched-mode power regulators. (Not for students who have taken ELEG4210. Prerequisite: ELEG3202 or consent of the instructor.)

ELEG4301 Physics and Technology of Semiconductor Devices [Group B Elective] (2 units)

Review of semiconductor physics and MOSFET transistors. Advanced silicon based devices and technologies: NMOS, CMOS, CCD, TFT, SOI. Introduction to junction devices: bipolar junction transistors, tunnel diodes, heterojunction and quantum-well devices. Silicon based memory technologies: DRAM, floating gate MOSFET, flash memory. Introduction to photonic devices: light emitting devices (LEDs), semiconductor lasers, photodetectors, solar cells. Introduction to organic electronics: organic light emitting diodes (OLEDs), organic thin film transistors. (Not for students who have taken ELEG4510 or ESTR4210.)

ELEG4302 Microoptics [Group B Elective] (2 units)

Fundamentals of microoptics: Fraunhofer and Fresnel diffractions, spatial and temporal coherence, polarization, interferometers and thin film filters; microlens performance: diffraction limit and aberrations, scaling from macro to micro components; refractive microoptics: GRIN optics, microprisms and micromirrors; diffractive microoptics: fabrication techniques, examples of diffractive optical elements, modelling of diffractive optics; Case studies of microoptics applications in beam shaping, optical data discs and optical imaging. (Not for students who have taken ELEG4580.)

ELEG4501 Digital Signal Processing and Applications [Group B Elective] (2 units)

Review on discrete-time signals and sampling; Analysis of discrete-time system; Discrete Fourier transform and fast Fourier transform; Time-frequency analysis of signals; Design and realization of digital filters; Basics of statistical signal processing; Optimal filter design. DSP applications and case studies. (Not for students who have taken ELEG4410 or ESTR4212. Prerequisite: ELEG3503 or consent of the instructor.)

ELEG4502 Digital Image Processing [Group B Elective] (2 units)

Light and Image Capture, Human Visual System, Mathematics for 2D digital signals, Image Analysis, Image Enhancement, Constrained and Unconstrained Image Restoration, Image Coding Theory. (Not for students who have taken ELEG4430.)

ELEG4503 Modern Communication Systems [Group B Elective] (2 units)

Introduction to communication systems; Cellular communications; Fading effect of radio communication channels; Spread spectrum and OFDM; Advanced concepts: MIMO, cognitive radio, co-operative communications; Modern communication standards: GSM, ADSL, Bluetooth, WLAN, WiMax, LTE. (Not for students who have taken ELEG4310 or IERG4100.)

ELEG5101 Advanced Medical Instrumentation and Biosensors [Group B Elective] (3 units)

Review on physiological measurements and medical devices; electrodes and transducers for biomedical measurements; physiological monitoring and therapeutic devices; drug delivery systems; body sensor networks (BSN) and body area networks (BAN); wearable sensors and systems; e-textile devices. Medical imaging modalities: MRI, CT, PET, SPECT, ultrasound, etc.; bio-imaging: molecular imaging, cell imaging, etc. Selected topics of current interests in biomedical sensors. (For ELEG RPG students, ELEG and BMEG undergraduate major and minor students as elective course; Not for students who have taken ELEG5110.)

ELEG5210 CMOS Analog Integrated Circuits [Group B Elective] (3 units)

Review MOS device properties and electrical models. Basic analog circuit building blocks including simple and cascode current sources, active loads, common source and common drain amplifiers, DC biasing networks, and differential amplifiers. Review MOS device properties and electrical models. Basic analog circuit building blocks including simple and cascode current sources, active loads, common source and common drain amplifiers, DC biasing networks, and differential amplifiers. Analog sub-systems building blocks including CMOS OTA, OCA, comparators. Selected topics in CMOS RF circuits. (For ELEG RPG & TPG students, ELEG undergraduate major and minor students as elective course; Prerequisite: ELEG3210; Not for students who have taken ELEG5723.)

ELEG5280 Analog-Digital ASIC Design [Group B Elective] (3 units)

Analog-digital ASIC design: technology trends, integration requirements, design skills and methodologies; Characteristics of modern IC technologies; Layout and Matching; Noise in electronic circuits; Coupling and isolation; Synthesis of basic cells: operational transconductance amplifiers, comparators, voltage and current references; Design of analog-digital integrated circuits at the building block and system level: continuous-time and sampled-data filters, Nyquist-rate A/D and D/A converters, oversampled A/D converters. (For ELEG major and minor undergraduate and ELEG RPg and TPg students as elective course; Not for students who have taken ENGG5201 or ELEG5201.)

ELEG5301 Photonic Integrated Circuits [Group B Elective] (3 units)

Theory of optical waveguides. Design techniques for optical waveguides. Numerical methods (FDTD, BPM etc) for optical waveguide simulations and their limitations. The use of commercial simulation and CAD layout tools to design optical waveguide devices such as directional couplers and splitters. Coupling techniques and losses in optical waveguides. Nonlinear effects and their applications. Optical modulators and optical interconnects. Recent trends and applications. (For

ELEG RPG students, ELEG undergraduate major and minor students as elective course; Not for students who have taken ELEG4520.)

ELEG5302 Biophotonics [Group B Elective] (3 units)

Review of physical properties of light. Optical sources and detectors. Interaction between light and biological materials. Introduction to cell and tissues, DNA and protein. Photo-absorption, emission and spectroscopy. Bio-imaging principles and techniques. Modeling of light-tissue interaction. Light-activated therapy. Micro-array technology. Laser tweezers. Emerging biophotonic technologies. (For ELEG RPG students, ELEG and BMEG undergraduate major and minor students as elective course; Not for students who have taken ELEG5521.)

ELEG5303 Flexible Electronics – Physics and Technology [Group B Elective] (3 units)

Review of semiconductor fundamentals: electron and hole, Fermi energy, generation and recombination, p-n junction, hopping, field-effect. Introduction to organic and polymeric semiconductors: morphology, molecular packing, conformation, electronic structures, optical and electrical properties. Application of organic/polymeric thin films: OLEDs, OTFTs, PLEDs, photodetectors and sensors. Fabrication methods for flexible electronics: sputtering, CVD, VPD, inkjet printing, screen printing, roll-to-roll printing, spraying coating, etc. Introduction to OLED/PLED based display technology: passive matrix OLED and active matrix OLED display techniques. Basic principles of photovoltaic devices: absorption, photo-electric conversion, conversion efficiency, loss mechanism, carrier collection, device characterization. Introduction to solar cell technology: monocrystalline solar cells; dye-sensitized solar cells; organic solar cells. (For ELEG RPG students, ELEG undergraduate major and minor students as elective course; Prerequisite: ELEG3301 or ELEG4301 or with the consent of the instructor.)

ELEG5491 Introduction to Deep Learning [Group B Elective] (3 units)

This course provides an introduction to deep learning. Students taking this course will learn the theories, models, algorithms, implementation and recent progress of deep learning, and obtain empirical experience on training deep neural networks. The course starts with machine learning basics and some classical deep models (including convolutional neural network, deep belief net, and auto-encoder), followed by optimization techniques for training deep neural networks, implementation of large-scale deep learning, multi-task deep learning, transferred deep learning, recurrent neural networks, applications of deep learning to computer vision and speech recognition, and understanding why deep learning works. The students taking are expected to have some basic background knowledge on calculus, linear algebra, probability, statistics and random process as a prerequisite.(For ELEG UG (under 4-Year Undergraduate Curriculum) and ELEG RPG students as elective; Not for students who have taken ELEG5040.)

ELEG5501 Speech and Audio Processing [Group B Elective] (3 units)

Wave acoustics; Principles of sound production and sound perception; Production of speech and music signals; Fundamentals of discrete-time signal processing; Time-domain and frequency-domain methods of speech processing; Linear predictive analysis of speech; Properties of music and other audio signals; Periodicity and harmonics; Pitch extraction; Speech and audio coding techniques; Introduction to speech and music synthesis. (For ELEG RPG students, ELEG undergraduate major and minor students as elective course; Not for students who have taken ELEG5420.)

ELEG5502 Video Coding Technology [Group B Elective] (3 units)

Introduction: television standards, digital image representation, statistical models, basic lossless and lossy coding techniques; advanced coding techniques: wavelet coding, synthetic-natural hybrid coding, post-processing techniques; image coding standards: JPEG, JPEG 2000; video coding standards: H.261, H.263, MPEG1, MPEG2, MPEG4; HDTV standard.

ELEG5550 Micro- and Nano-Fabrication Laboratory [Group B Elective] (3 units)

This course covers principles and practice of state-of-the-art nanofabrication technology. These nanofabrication techniques are the foundation to build integrated devices and circuits with feature size below 100 nm and are widely employed in various areas such as nanoelectronics, nanophotonics, nanomechanics, and microfluidics. Students will learn to use the fabrication and characterization equipment available in the public cleanroom of the faculty of engineering. The top-down nanofabrication processes, such as lithography, etching, and thin-film deposition, etc. will be addressed.

EEEN4020/ ENER4020 Solar Energy and Photovoltaic Technology [Group B Elective] (3 units)

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. (Not for students who have taken ESTR4402. Pre-requisites: ELEG2202 and ENER2020; or ELEG2202 and ELEG3201/ESTR3200.)

ENGG5202 Pattern Recognition [Group B Elective] (3 units)

This course provides an introduction to the important concepts, theories and algorithms of pattern recognition. The topics cover Bayesian decision theory, maximum likelihood and Bayesian parameter estimation, support vector machine, boosting, nonparametric pattern recognition methods, and clustering. It also includes applications of pattern recognition in different fields. Students taking this course are expected to have the background knowledge of calculus, linear algebra, probability and random process as a prerequisite. Pre-requisite: ELEG3410 or with the consent of the instructor. (For ELEG major and minor undergraduate as elective course; For students in MPhil-PhD programmes under Faculty of Engineering; Prerequisite: ELEG 3410 or with the consent of the instructor; Not for students who have taken ELEG5503 or ELEG5410.)

ENGG5281 Advanced Microwave Engineering [Group B Elective] (3 units)

Topics will be selected from the following: Linearization techniques for RF power transmitters, high frequency circuit packaging, microwave filter design, LTCC/MCM technology, computer-aided design of microwave circuits, electromagnetic simulation. (For ELEG major and minor undergraduate as elective course; For students in MPhil-PhD programmes under Faculty of Engineering or MSc Electronic Engineering; Not for students who have taken ELEG5205 or ELEG5310.)