# *New courses for new programs 2006 onwards (updated on 26 Sept.2007)*

ELEC1111 Electrical and Telecommunications Engineering

***UOC:*** 6 ***HPW:*** 6 ***Session*** S1&S2 UnderGrad

***PreRequisit***

An introduction to the art and science of Electrical Engineering and Telecommunications, and the systems approach to engineering design. Examples of electrical and electronic devices, circuits and analogue and digital systems. Analogue circuit analysis. Digital electronics and combinatorial logic. Transformers, power sources and electrical energy systems including DC and AC motors. Feedback control. Telecommunications systems, including frequency, spectra, modulation and Internet systems. Safety standards.

ELEC2133 Analogue Electronics

***UOC:*** 6 ***HPW:*** 6 ***Session*** S1&S2 UnderGrad

***PreRequisit*** ELEC2132

Device physics of diodes, BJTs and MOSFETs. Nonlinear transistor models: Ebers-Moll, transport. Full and simplified models of BJTs and MOSFETs (inc. small-signal models). Zener and Schottky diodes. DC biasing, biasing using current sources, operating point, large-signal analysis. Linearisation, small-signal analysis. Input- and output impedances, power gain. Two-ports. Feed-back, effects of feed-back; stability and compensation techniques. Circuits with non-ideal op-amps. Common base, emitter and collector amplifiers; differential pairs. Multistage amplifiers, cascades, cascodes. AC response of 1-stage amplifiers, Miller effect. Non-linear circuits: oscillator, Schmitt trigger. A-D and D-A converter principles.

ELEC2134 Circuits and Signals

***UOC:*** 6 ***HPW:*** 6 ***Session*** S1&S2 UnderGrad

***PreRequisit*** Math1231 or math1241

Circuit elements - energy storage and dynamics. Ohm's Law, Kirchhoff's Laws, simplifying networks of series/parallel circuit elements. Nodal analysis. Thévenin and Norton equivalents, superposition. Operational amplifiers. Transient response in first-order RLC circuits. Solutions via solving differential equations. Transient response in second-order RLC circuits. State equations, zero input response, zero state response. Using MATLAB to solve state equations. Sinusoidal signal: frequency, angular frequency, peak value, RMS value, and phase. DC vs AC, average vs RMS values. AC circuits with sinusoidal inputs in steady state. Use of phasor and complex impedance in AC circuit analysis. AC power (real, re active, apparent), power factor, leading/lagging. Resonance. Transformers and coupled coils. Laplace transforms of signals and circuits. Network functions and frequency response. Periodic signals and Fourier series. Introduction to filter design. Introduction to nonlinear circuits and small signal analysis. Introduction to modulation.

ELEC2141 Digital Circuit Design

***UOC:*** 6 ***HPW:*** 6 ***Session*** S1&S2 UnderGrad

***PreRequisit*** ELEC1111

Introduction to modern digital logic design, combinational logic, switch logic and basic gates, Boolean algebra, two-level logic, regular logic structures, multi-level networks and transformations, programmable logic devices, time response. Sequential logic, networks with feedback, basic latches and flip-flops, timing methodologies, registers and counters, programmable logic devices. Finite state machine design, concepts of FSMs, basic design approach, specification methods, state minimization, state encoding, FSM partitioning, implementation of FSMs, programmable logic devices. Elements of computers, arithmetic circuits, arithmetic and logic units, register and bus structures, controllers/ sequencers, microprogramming. Experience with computer-aided design tools for logic design, schematic entry, state diagram entry, hardware description language entry, compilation to logic networks, simulation, mapping to programmable logic devices. Practical topics, non-gate logic, asynchronous inputs and metastability, memories: RAM and ROM, Implementation technologies and mapping problems expressed in words to digital abstractions.

ELEC2142 Embedded Systems Design

***UOC:*** 6 ***HPW:*** 6 ***Session*** S1&S2 UnderGrad

***PreRequisit*** ELEC2141 and COMP1921

An introduction to programmer model of computer organisation using assembly and machine language. Process of translation from high-level language to machine instructions. Number representation, computer arithmetic, instruction set architecture, I/O interfacing, I/O interrupts, programming interrupts, exceptions and their support in architecture. Memory management and protection and their support in architecture, the role of OS in handling exceptions. Multi-tasking and multi-threading environments. Use of interrupts for sampling, link-lists and circular buffers. D/A and A/D conversion and interfacing to the real physical world. Appreciation of the concepts learnt in the deployment of real-time systems.

ELEC3104 Digital Signal Processing

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1&S2 UnderGrad

***PreRequisit*** ELEC2132

Processing and analysis of continuous (analogue) and discrete-time (digital) signals. Sampling continuous signals: the sampling theorem, reconstruction, aliasing and the z-transform. Analogue filters: Butterworth, Chebyshev, elliptic and Bessel filters. Filter impulse and frequency responses, stability and digital oscillators. The discrete Fourier transform (DFT) and the fast Fourier transform (FFT). Fundamentals of the design and realisation of finite impulse response (FIR) and infinite impulse response (IIR) digital filters. Linear and non-linear phase. Mulirate processing.

ELEC3105 Electrical Energy

***UOC:*** 6 ***HPW:*** 5 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC2132 and ELEC3115

Electrical energy supply systems: transmission and distribution systems; Basic aspects of both the supply and utilization of electrical energy, with some emphasis on contemporary aspects of energy utilization including modern developments, energy efficiency and environmental aspects. Basic concepts used in power circuit analysis: phasors, leading/lagging, power, power factor, reactive power. Transformers: equivalent circuits, single and three-phase transformers, delta-wye connections, harmonics; Principles of energy conversion; Operating principles and analyses of DC, induction and synchronous machines; Introduction to power electronics: single- and three-phase switching of electrical power. DC-AC, DC-DC and AC-AC converters.

ELEC3106 Electronics

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1 UnderGrad

***PreRequisit*** ELEC2133 and ELEC2141

Non-ideal effects in electronic circuits and systems: Noise; device noise, external noise, CMRR, PSRR, mixed A/D. Distortion; non-linearity, dynamic range, saturation. Stability and performance sensitivity to parameter variations. Some simple design for stability and performance. Design optimisation. Power-supply distribution and decoupling. Mixed analogue/digital system design, including grounding and shielding. Device modelling in SPICE. Data sheet interpretation. Design of analogue and digital circuits and system components: Non-linear circuits; oscillators, PLLs, multipliers, AGCs, schmitt triggers. Introduction to filter design; active filters; op-amp. Sensors and actuators, PTAT; instrumentation amplifiers and signal conditioning. Low-level design and optimisation of digital CMOS gates. Gate delay, power dissipation, noise margins, fan-out. Introduction to integrated circuit design. Thermal consideration, power supplies, reliability, uC watchdongs.

ELEC3114 Control Systems

***UOC:*** 6 ***HPW:*** 5 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC2132

Recognition of what a control system is, and the distinction between simple and complex control systems. Analysis and design tools for dealing with simple control systems up to second order: Differential equations, Laplace transforms, transfer functions, poles and zeros, state space models, modeling, first and second order systems, stability, steady-state errors, root locus, Bode and Nyquist plots, transient response analysis and design, PID control, lead-lag compensation, simple frequency response techniques. Stabilising feedback control for transfer function and state-space models.

ELEC3115 Electromagnetic Engineering

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1 UnderGrad

***PreRequisit*** PHYS1231 and MATH2069

Review of vector calculus, Electric Fields: Coulomb's and Gauss's laws and Maxwell's equations, Electric potential, Laplace's and Poisson's equations; Magnetic Fields: Biot-Savart law, Vector potential and Ampere's law and Maxwell's equations;Application of Gauss's law; Solution of Poisson's and Laplace's equations for electric field; Boundary value problems and method of images; Dielectric materials, capacitance, electrostatic energy and forces, losses; Field and current density, conductance; Application of Ampere's law; Magnetic materials, inductance, coupling in magnetic circuits; Magnetic energy and forces.Application of Faraday's law, transformers; Skin effect and skin depth, hysteresis and eddy current losses. Electromagnetic spectrum. Time-varying fields and Maxwell's equations: forms, boundary conditions. Plane electromagnetic waves in lossless/lossy media: polarization, group velocity dispersion, energy flows, Poynting vector, reflection/refraction at boundary. Transmission lines: wave characteristics, impedance and matching.Waveguides: modal analysis of rectangular metallic waveguides. Antennas: antenna patterns and parameters, linear dipole, antenna array.

ELEC3117 Electrical Engineering Design

***UOC:*** 6 ***HPW:*** 5 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC2133

Design Project Management: Introduction to scheduling, costing, marketing, standards, patents, quality, safety, (electronic) manufacturing methods, engineering innovation, Report Writing and Oral Presentations. Design Methodology: Systematic desi gn procedures, design documentation. Designing for quality, manufacture, maintenance, minimum life cycle cost. Aspects of Electronic Design: Component selection, tolerances, passive component characteristics. Also EMC, earthing and PCB layout principles. Engineering Drawing and Graphical Communications: Projections, dimensioning and drawing interpretation. Group Project: Students are required to design and build an electrical engineering project. This process will include producing specifications, detailed design, prototype production and testing. The Design will be presented in a seminar and documented in two formal technical reports that also consider scheduling, marketing and business plans.

ELEC4120 Thesis A

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1&S2 UnderGrad

***PreRequisit*** ELEC3117 and 120 UOC

The thesis project topic area chosen by the student may be in any technical area covered by the interests and expertise of the academic staff of the School who will act as the project supervisors. In addition the course covers: Information literacy, Introduction to project management, project planning. Problem analysis and synthesis . Written and oral communications.

ELEC4121 Thesis B

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1&S2 UnderGrad

***PreRequisit*** ELEC4120

The project may require design and construction of laboratory equipment or hardware, development and use of computer software, experiments and teaching associated with these. A written thesis on the work performed is required at the end of the session and the student must attend and exhibit his/her thesis work at an Open Day in the School on the last day of the session.

ELEC4122 Strategic Leadership and Ethics

***UOC:*** 6 ***HPW:*** 5 ***Session*** S2 UnderGrad

***PreRequisit*** 120 UOC

Organisational behaviour, leading change, strategic planning processes; decision analysis and risk analysis. The legislative basis of business activities and the corporation Innovation and entrepreneurship: the role of engineering in the knowledge economy; engineering innovation in processes and products. Intellectual property: the acquisition, protection and commercialisation of intellectual property .and its role in engineering businesses Engineering ethics principles and practice: an introduction to ethical systems; the application of ethical frameworks to engineering practice with particular reference to electrical engineering and computing; codes of ethics in the professions; social, political, environmental and economic considerations.

ELEC4123 Electrical Design Proficiency

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1&S2 UnderGrad

***PreRequisit*** All 3rd year's core courses

The course involves four competency components, as follows: Electronic Circuit Design: Devices, amplifiers, tuned circuits, opamp circuits, etc. Control System Design: Feedback and stability, linear control, non-linear control, data acquisition and sampling, etc. Signal Processing Design: Filter design, frequency response, spectrum analysis, BIBO etc. Power System Design: Transformer, motor, power electronic converter, power factor, harmonics, etc. Laboratory assessment requires the construction of a working system to solve a specified problem.

ELEC4445 Entrepreneurial Engineering

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** 132 UOC

Course introduction: the entrepreneurial revolution; The entrepreneurial process; Opportunities Recognising and screening; Entrepreneur and the internet; Entrepreneur, manager and team; Obtaining venture and growth capital; Resource requirements; Business plan; Introduction to entrepreneurial finance; Rapid growth and troubled times; Ethics and the entrepreneur; Harvesting the wealth.

ELEC4601 Digital and Embedded Systems Design

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC3106

Topics include; introduction to custom digital processors including DSP hardware, high-speed digital design techniques, modern chip design methodologies, hardware and software co-design, advanced programming paradigms including state machines and concurrent processes, real-time programming and operating systems.

ELEC4602 Microelectronic Design and Technology

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1 UnderGrad

***PreRequisit*** ELEC3106

Basic IC processing technology: lithography, oxidation, diffusion, implantation, film deposition, etching, metalisation. IC technologies: Si, GaAs, SiGe, SOS, BiCMOS. Rev. MOS device models. On-chip components: capacitors, inductors, resistors, diodes. CMOS design rules, scaling. Floor planing, cell layout (inc. common centriod) and routing. Corner and Monto Carlo simulations. CMOS analogue building blocks: current mirrors, differential stage, active load. Noise sources and analysis. CMOS operational amplifiers. D/A converters and A/D converters. Oscillators, PLLs, Schmitt triggers and charge pumps. Static and dynamic CMOS gates and flip-flops. CMOS digital bulding blocks: level shifters, decoders, multiplexers, tri-states, buffers and adders. Memories: ROM, SRAM and DRAM cell design; Sense amplifiers. Introduction to MEMS. IO circuits, ESD, latch-up, assembly techniques and packaging. Interconnects and noise shielding; mixed analogue-digital design. Yield, reliability and failure analysis techniques; 6-sigma design.

ELEC4603 Solid State Electronics

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC2133

Band-structure and doping of semiconductors. Drift-Diffusion Equations; Density of states; Fermi function; Law of Mass Action. PN Junctions: Derivation of I-V characteristics. PN Junctions: Capacitance; Breakdown; Non-idealities. Bipolar Junction Transistor (BJT): Operation principles. BJT: Derivation of I-V characteristics. BJT: Ebers-Moll model; Non-idealities. MOSFET: Derivation of I-V characteristics. MOSFET: Structure; Threshold Voltage; Enhancement- & Depletion-mode. Microwave devices. Transistors for Digital Logic: TTL, ECL, CMOS. Optoelectronic & Photonic Devices: Direct Vs Indirect Band-gap devices. LEDs; Semiconductor Lasers; Photovoltaic Cells. Principles and key technologies involved in microfabrication of integrated circuits. Microfabrication of: MOSFETs; CMOS; BJTs.

ELEC4604 RF Electronics

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1 UnderGrad

***PreRequisit*** ELEC3106

Review of transceiver architectures. RF basics: transmission lines. Smith charts. S-parameters. RF active/passive devices and parasitics. Linearity and noise. Impedance matching. RF filters: design and implementation of microstripline filters, Kuroda identities. LNA: circuit architectures, impedance, noise, bandwidth, power gain. Mixers: active/passive mixer architectures, isolation, linearity, conversion gain. Oscillators: architecture, voltage controlled oscillators and tunability, phase noise. Phase-locked loops: analysis and dynamics of PLL, charge pump, frequency synthesiser. Power amplifiers: class C,E, F, efficiency.

ELEC4611 Power System Equipment

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1 UnderGrad

***PreRequisit*** ELEC3105

Power transformers, instrument transformers, rotating machines, cables and overhead lines, circuit interrupters (fuses, surge arresters, circuit breakers). Insulating materials used in power equipment, dielectric properties. Electric stress calculation, field grading. Thermal rating of major equipment. Electrodynamic forces in power equipment. Overcurrent, overvoltage, harmonics: causes and effects on equipment operation. High-voltage measurement and testing. Condition monitoring and insulation assessment. Electrical safety: earthing systems for equipment and personnel protection. Utilisation of electrical energy (e.g. lighting and industrial heating).

ELEC4612 Power System Analysis

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC3105

An overview of modern power systems. Review of the basic concepts used in power system analysis: phasors, complex power, three phase systems and per-unit methodology. Modelling circuit of power system components including transformers, generators, transmission lines and loads. Steady-state and dynamic behaviour of power systems. Network matrices and power flow analysis. Power system fault calculations: symmetrical components, symmetrical faults, unsymmetrical faults. Surge propagation. Power system stability: swing equation, multi-machine applications. Power system protection principles. Power system control, economic dispatch.

ELEC4613 Electrical Drive Systems

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC3105

Introduction to Electrical Drive Systems. Elements of Drive systems and their requirements for servo and industrial drive applications. Drive representation, quadrant operation, dynamic and regenerative braking. Performance analysis of induction motor drives with variable voltage, variable current and variable frequency supply. Performance analysis of synchronous, brushless DC and reluctance motors with variable voltage, current and variable frequency supply. Computer modeling and design of drive system. Analysis of dynamics of DC, induction and synchronous machines; drive system design.

ELEC4614 Power Electronics

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1 UnderGrad

***PreRequisit*** ELEC2133

Power semiconductor switching devices and their limitations; Switching characteristics, protection and limitations of various types of power semiconductor switches; Elementary concepts in power electronics; Application of power electronic converters in energy conversion, utility applications and power supplies and utilizations; Diode rectifier circuits, multi-pulse rectifiers, input and output waveform characterization, filter design. Non isolated DC-DC converters, circuits topologies, characteristics with continuous and discontinuous conduction, circuit design and control considerations, Quadrant operation; Isolated DC-DC converters, transformer design issues, core resetting; Single-phase and three-phase DC-AC inverters, modulation strategies, output waveform analysis and filter design; Utility interfaces; High power applications; Converter system implementation.

ELEC4621 Advanced Digital Signal Processing

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC3104

FIR Lattice filters, All-pole IIR Lattice filters and their implementation; Fixed Point or finite word length implementations and effects; Random Processes, Auto-correlation,cross-correlation, and power spectrum estimation techniques; Leastsquare filter design, Adaptive filters, Wiener filters, adaptive noise cancellation; Linear prediction, statistical and deterministic formulation. Applications of linear prediction. Time frequency analysis:short-time Fourier transform, quadrature mirror filter banks, multilevel filter banks and wavelet transform.

ELEC4622 Multimedia Signal Processing

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC3104

Signal acquisition, sampling and interpolation for signals in 1, 2 and 3 dimensions. Digital representation of multimedia signals, including representations for colour. Fourier transforms, power spectra and convolution in multiple dimensions. Introduction to shape, geometry and motion processing techniques. Compression technologies and standards for image, video, speech and audio signals. Communication technologies and standards for real-time multimedia signals, including protection. against and concealment of errors. Software and hardware techniques for representing and processing multimedia signals.

ELEC4623 Biomedical Instrumentation, Measurement and Design

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC3104

Introduction to Biomedical Instrumentation and Physiological Measurement. The nature of biomedical signals. The origin of biopotentials and other biological signals. The volume conductor and field potentials. Biopotential electrodes .Tissue equivalent circuits .Principles and operation of basic transducers and sensors. Microelectronic sensors. Sources and characteristics of biological and instrumentation noise. Basic biopotential amplifiers. Interference coupling. Use of grounds and shields for reducing interference noise. ECG lead systems and waveforms. Design of a practical ECG preamplifier. Safety and performance standards (ASA, IEC and FDA) for medical instrumentation Design implications of international safety and performance standards Biological signal processing (I): Design of analogue filters. Effect of filter characteristics on waveform morphometry. Biological signal processing (II): Design of digital filters. Statistical and algorithmic methods for the automated signal detection and analysis. The measurement of blood pressure. The measurement of blood flow and volumes The measurement of respiratory flows. .Design Case Study: Hot wire Anemometry for respiratory flow measurements. The basics of Ultrasound.

ELEC4631 Continuous-Time Control System Design

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1 UnderGrad

***PreRequisit*** ELEC3114

Overview of systems and control with emphasis on modern and post-modern developments. Mathematical tools: matrix, quadratic forms and singular value decomposition (SVD). Modeling of multi-input multi-output (MIMO) systems by using state equations. Controllability and observability of MIMO systems. Linear quadratic regulator. Servo-regulator control. Lyapunov stability. State and output feedback control design. Robust control in state-space and optimisation based techniques.

ELEC4632 Computer Control Systems

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC3114

Examples of digital control systems, differences and similarities between digital and analog control systems, discrete-time systems, stability analysis, observability and Controllability, state space models, digital PID controllers, pole placement design, digital control systems characteristics, nonlinear discrete-time systems, optimal control design methods, discrete Kalman filter, identification, case studies.

ELEC4633 Real-Time Engineering

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1 UnderGrad

***PreRequisit*** ELEC3114

Real-time operating systems and processes: Concurrent processes. Multitasking and multithreading. Interrupts. Foreground/background systems. Context switching. Types of real-time kernels. Scheduling. Static and Dynamic scheduling. Rate-monotonic and Deadline-driven scheduling. Priority inversion, the priority inheritance and priority ceiling protocols. Markov Models. Inter-process communication and memory management: Data buffering. Shared memory. Global memory. Critical regions. Semaphores. Mutual exclusion. Message passing. Memory allocation. Coding practices. Real-time embedded system design: process specification. Q-models. State machines and systems of state machines. Date representation. Numerical issues. Assembly language and C. Input/output programming. Device drivers. The implications of using limimted resources. Implementation: Microcontrollers. The Mitsubishi M16C/62 and Motorola MC68HC11 microcontrollers. RTLinux.

PHTN3117 Photonic Engineering Design

***UOC:*** 6 ***HPW:*** 5 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC2133

Design Project Management: Introduction to scheduling, costing, marketing, standards, patents, quality, safety, (electronic) manufacturing methods, engineering innovation, Report Writing and Oral Presentations. Design Methodology: Systematic design procedures, design documentation. Designing for quality, manufacture, maintenance, minimum life cycle cost. Aspects of Electronic Design: Component selection, tolerances, passive component characteristics. Also EMC, earthing and PCB layout principles. Engineering Drawing and Graphical Communications: Projections, dimensioning and drawing interpretation. Group Project: Students are required to design and build a photonic engineering project. This process will include producing specifications, detailed design, prototype production and testing. The Design will be presented in a seminar and documented in two formal technical reports that also consider scheduling, marketing and business plans.

PHTN4120 Thesis A

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1&S2 UnderGrad

***PreRequisit*** PHTN3117 & 120 UOC

The thesis project topic area chosen by the student may be in any technical area covered by the interests and expertise of the academic staff of the School who will act as the project supervisors. In addition the course covers: Information literacy, Introduction to project management, project planning. Problem analysis and synthesis . Written and oral communications.

PHTN4121 Thesis B

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1&S2 UnderGrad

***PreRequisit*** PHTN4120

The project may require design and construction of laboratory equipment or hardware, development and use of computer software, experiments and teaching associated with these. A written thesis on the work performed is required at the end of the session and the student must attend and exhibit his/her thesis work at an Open Day in the School on the last day of the session.

PHTN4123 Photonic Design Proficiency

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1&S2 UnderGrad

***PreRequisit*** All 3rd year's core courses

The course involves four competency components, as follows: Signal Processing Design: Filter design, frequency response, spectrum analysis etc. Physical communication design: modulation, interference & noise, BER, etc. Waveguide design: Design an optical circuit, whether the application be in sensing, telecommunications or biotechnology. Optical Sensing Applications

PHTN4661 Optical Circuits and Fibres

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC3115

Types and applications of optical fibres; ray analysis of multimode fibres; characteristics of single-mode fibres including experiments; losses and dispersion in fibres; fibre fabrication; cabling and handling fibres. Waveguiding in integrated optics & fibres; fabrication processes, optical substrates; modelling methods, manufacturing constraints on design; Photonic devices: Operating principles & applications of waveguuide-based devices, selected from the following list: tapers, couplers, polarisers, Bragg gratings, filters, interferometers, fibre lasers & amplifiers; Operation \& application of LEDs, lasers, & detectors.

PHTN4662 Photonic Networks

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** TELE3113 or ELEC3115

All-optical & hybrid networks, topologies; WDM; optical switching & routing, SONET; dispersion management, BER & sources of noise, power budgets; phase modulation effects & nonlinear scattering in optical links; safety, regulations & standards.

TELE3113 Analogue and Digital Communications

***UOC:*** 6 ***HPW:*** 5 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC2132

Telecommunication Fundamentals: Free space propagation characteristics, phasors, fourier transform, spectrum analysis, random signals. Analogue: continuous wave modulation (AM, DSB, SSB, VSB, QAM, FM, and PM), complex envelope, receivers, error and noise analysis. Digital: sampling, quantisation, Digital Baseband (PAM, PWM, PPM, PCM, DM, and line coding), Passband: techniques (Binary and M-ary signaling ASK, PSK, FSK, QPSK, QAM), multiplexing techniques (FDM, TDM, and quadrature multiplexing), intersymbol interference and eye diagrams.Systems: Analogue and Digital PSTN, Satellite Communication fundamentals, Satellite television.

TELE3117 Telecommunications Engineering Design

***UOC:*** 6 ***HPW:*** 5 ***Session*** S2 UnderGrad

***PreRequisit*** ELEC2133

Design Project Management: Introduction to scheduling, costing, marketing, standards, patents, quality, safety, (electronic) manufacturing methods, engineering innovation, Report Writing and Oral Presentations. Design Methodology: Systematic design procedures, design documentation. Designing for quality, manufacture, maintenance, minimum life cycle cost. Aspects of Electronic Design: Component selection, tolerances, passive component characteristics. Also EMC, earthing and PCB layout principles. Engineering Drawing and Graphical Communications: Projections, dimensioning and drawing interpretation. Group Project: Students are required to design and build a telecommunications project. This process will include producing specifications, detailed design, prototype production and testing. The Design will be presented in a seminar and documented in two formal technical reports that also consider scheduling, marketing and business plans.

TELE3118 Network Technologies

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1 UnderGrad

***PreRequisit*** ELEC2142

Network architectures in terms of topology, role (client/server, peer-to-peer), and layered specification. Packet and circuit switching. Physical characteristics of network transmission links. Medium access control protocols for wired links (e.g. Ethernet) and wireless links (e.g. 802.11). Protocols for error and flow control and their link layer application. Interconnection of networks using bridges, switches and routers. Routing techniques, including Dijkstra's algorithm, distance vector and link state routing. Addressing and naming. Network congestion control. End-to-end protocols for matching applications to networks, including TCP and UDP. Network applications, such as web (HTTP), email (SMTP, POP, IMAP), and streaming media (e.g.VOIP).

TELE3119 Trusted Networks

***UOC:*** 6 ***HPW:*** 5 ***Session*** S2 UnderGrad

***PreRequisit*** TELE3118

CRYPTOGRAPHY: (i) Symmetric Encryption and Message Confidentiality, (ii) Public-Key Cryptography and Message Authentication, (iii) Key Distribution, (iv) Mathematical Principles of Cryptography. NETWORK SECURITY APPLICATIONS: (i) Authentication Applications, (ii) Electronic Mail Security, (iii) IP Security, (iv) Web Security. SYSTEM SECURITY: (i) Intruders, (ii) Attacks and Countermeasures, (iii) Malicious Software, (iv) Firewalls.

TELE4120 Thesis A

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1&S2 UnderGrad

***PreRequisit*** TELE3117 & 120 UOC

The thesis project topic area chosen by the student may be in any technical area covered by the interests and expertise of the academic staff of the School who will act as the project supervisors. In addition the course covers: Information literacy, Introduction to project management, project planning. Problem analysis and synthesis . Written and oral communications.

TELE4121 Thesis B

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1&S2 UnderGrad

***PreRequisit*** TELE4120

The project may require design and construction of laboratory equipment or hardware, development and use of computer software, experiments and teaching associated with these. A written thesis on the work performed is required at the end of the session and the student must attend and exhibit his/her thesis work at an Open Day in the School on the last day of the session.

TELE4123 Telecommunications Design Proficiency

***UOC:*** 6 ***HPW:*** 5 ***Session*** S1&S2 UnderGrad

***PreRequisit*** All 3rd year's core courses

The course involves four competency components, as follows: Electronic Circuit Design: Devices, amplifiers, tuned circuits, opamp circuits, etc. Signal Processing Design: Filter design, frequency response, spectrum analysis, BIBO etc. Physical Communication Design: AM/FM modulation, interference, phase locked loops, etc. Data Networking Design: IP addressing, router configuration, socket programming. Laboratory assessment requires the construction of a working system to solve a specified problem.

TELE4642 Network Performance

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** TELE3118

Applications: (i) Services Required by Applications, (ii) Performance Requirements of Voice over IP, (iii) Performance Requirements Streaming Video, (iv) Performance Requirements Real Time Video. Capacity, Throughput and Service: (i) Source Traffic Characteristics, (ii) Statistical Multiplexing, (iii) Traffic Regulation, (iv) Bandwidth Utilization. Quality of Service (QoS) (i)Definitions of QoS, (ii)Best-Effort Service, (iii)Guaranteed QoS, (iv)Statistical QoS, (v)Delivering QoS via Admission Control. Traffic Models: (i)Stochastic Processes (ii)Discrete Time Markov Processes, (iii)Self-Similar Processes, (iv)Short and Long-Range Dependence. Queuing Theory: (i)Queuing System properties, (ii)Queuing Applied to IP Networks, (iii)Queuing Models, (iv)Scheduling Algorithms (v)The M/M/1 Queue (vi)The M/G/1 Queue (vii)The G/M/1 Queue (viii)Complex Queues, (ix)Effective Bandwidth, (x)Voice/Data Integration Savings Network Design for QoS: (i)Putting it all Together, (ii)Designing a Network For End-To End Performance, (iii)Network Design Tools (iv)Network Scalability (v)Measuring Traffic and Performance.

TELE4651 Wireless Communication Technologies

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** TELE3113

Wireless Communications Channels: time-variant multipath fading, Doppler shift, fade rate, shadowing effect, time selective channel, frequency selective channel, the effects of fading on wireless transmission, performance analysis. Digital Transmission over Fading Channels: continues carrier-phase modulation, demodulations, performance analysis, burst-error correcting codes for fading channels, convolutional codes, soft output Viterbi algorithm, coded modulation, turbo principles, iterative processing, space diversity, time diversity and frequency diversity techniques. Wideband Transmissions: spread-spectrum communications, DS-CDMA, frequency hopping, OFDM techniques, their applications.

TELE4652 Mobile and Satellite Communication Systems

***UOC:*** 6 ***HPW:*** 4 ***Session*** S2 UnderGrad

***PreRequisit*** TELE3113

Introduction to Mobile Communications: historical development of mobile telephony. Mobile Communications: Cellular concept, Antennae and Antenna Arrays, Radio propagation and transmission, Multi-path fading, Multiple Access techniques, modulation techniques for mobile radio, equalisation and diversity in mobile communications, channel coding for Mobile Communication Systems, source coding fundamentals. Mobile Communication Standards: GSM, CDMA spread spectrum concept, IS-95 CDMA, evolution to 3G networks (GPRS, EDGE), WCDMA, cdma2000 and UMTS-2000. Satellite Communications: Satellite radio, GPS.

TELE4653 Digital Modulation and Coding

***UOC:*** 6 ***HPW:*** 4 ***Session*** S1 UnderGrad

***PreRequisit*** TELE3113

Communication concepts: Fourier transforms, random signals, Transmitter and receiver filters, matched filter, Nyquist criterion. Digital Modulation schemes:M-ary ASK, QPSK, FSK, CPM, spectral analysis of modulated signals, ML and MAP detectors, signal space methods, bit error rate analysis. Digital Receivers:carrier and clock synchronisation. Information theory: entropy, channel capacity, source coding. Channel Coding: block codes, convolutional codes.