

BEng (Hons) Electrical and Electronic Engineering - E430 (Under Review)

1. Objectives

Electrical & Electronic Engineering encompasses a large variety of topics ranging from electrical machines, power systems, electronics, control and microprocessors, to computer systems and communications. The main objective of the course is to provide a strong foundation on the various major disciplines of electrical engineering and electronics. The course is designed to train students for a career in engineering whilst at the same time give them the opportunity to acquire in-depth knowledge so as to enable them to pursue postgraduate studies in the field of electrical and electronic engineering.

2. General Entry Requirements

As per General Entry Requirements for Admission to the University for Undergraduate Degrees.

3. Programme Requirements

2 GCE 'A' Level Passes in Mathematics and one of the following subjects: Physics, Physical Science, Engineering Science, Physics with Chemistry.

4. (i) Minimum Requirements For Degree Award

For the award of the BEng (Hons) Degree in Electrical and Electronic Engineering, the student must obtain at least 130 credits including 122 credits from all the core modules prescribed by the department and at least 8 credits from the elective modules.

MODULES	CREDITS
Humanities & Management	9
Basic Sciences & Mathematics	12
Engineering	97
Degree Project	12
TOTAL	130

- For the degree award all core modules prescribed by the department must be completed.
- Practical Training and Industrial training must be completed satisfactorily for the award of the degree.

(ii) Minimum Requirements For Diploma Award

A student may opt for a Diploma in Electrical and Electronic Engineering provided he/she satisfies the following minimum requirements. The Diploma project would normally be of 8 weeks duration for an input of at least 90 hours.

MODULES	CREDITS
Humanities & Management	3
Basic Sciences & Mathematics	6
Engineering	45
Diploma Project (ELEC 2000(3))	6
TOTAL	60

- 5. Programme Duration:** Normal 4 years
Maximum 7 years

- 6. Credits per Year:** Minimum 18, Maximum 48 subject to Regulation 5.

7. Assessment

Continuous and Written Assessment of Modules

Assessment will be based on a written examination of 2 to 3-hour duration (normally a paper of 2 hour duration for modules carrying less or equal to 3.5 credits and 3 hour paper for modules carrying four-six credits) and on continuous assessment done during the semester or year.

Written examinations for all modules, whether taught in semester 1 or in semester 2 or both, will be carried out at the end of the academic year (unless otherwise stated).

The continuous assessment will count for 10-40% of the overall percentage mark of the module(s), except for a Programme where the structure makes for other specific provision(s). Continuous assessment may be based on laboratory work, seminars and/or assignments and **should include at least 1 class test.**

There will be a compulsory class test for all modules taught in semester 1 at the end of semester 1 of the given academic year unless stated otherwise in the Programme Structure.

A minimum of at least 30% should be attained in each of continuous assessment and written examination, with an overall total of 40% for a candidate to pass a module

Special examinations (e.g. class tests) will be arranged at the end of semester 1 or semester 2 for exchange students who have registered only for one semester. In case of yearly modules, credits will be assigned on a pro-rata basis.

8. Repeat and Termination of Registration

If the CPA of a student is <40% for an academic year, s/he will have to repeat the entire academic year, and retake modules as and when offered. However, s/he will not be required, if s/he wishes, to retake modules for which Grade C or above has been obtained.

Students will be allowed to repeat only once over the entire duration of the Programme of Studies.

Registration of a student will be terminated if

- (i) the CPA < 40% at the end of an academic year and the student has already repeated one year of study; or
- (ii) the maximum duration allowed for completion of the Programme of Studies has been exceeded.

9. List of Modules - BEng (Hons) Electrical and Electronic Engineering

CORE MODULES

		Hrs/Wk	Credits
		L+P	
BASIC SCIENCES & MATHEMATICS			
MATHS 1111(1)	Mathematics 1	D.E	3
MATHS 1211(1)	Mathematics 2	D.E	3
ELEC 2001Y(3)	Analytical Techniques	3+0	6
ENGINEERING			
CSE 1010e(1)	Introduction to Information Technology	O.E	3
ELEC 1002Y(1)	Electronics 1	3+1	7
ELEC 1003Y(1)	Electrical Engineering	2+1	5
ELEC 1004Y(1)	Computer Programming	2+1	5
ELEC 1005Y(1)	Measurement Systems	2+1	5
ELEC 1200	Practical Training/Software Development	8 weeks	0
ELEC 2002Y(3)	Electronics 2	2+1	5
ELEC 2003Y(3)	Electromagnetics & Analog Communications	3+1	7
ELEC 2004Y(3)	Circuits, Signals and Systems	3+0	6
ELEC 2005Y(3)	Power Systems 1	2+0	4
ELEC 2006Y(3)	Electrical Machines	2+1	5
ELEC 3001Y(5)	Microprocessors	2+2	6
ELEC 3002Y(5)	Control Systems 1	2+0	4
ELEC 3003Y(5)	Power Electronics	2+1	5
ELEC 3004Y(5)	Digital Communications	2+1	5
ELEC 3005Y(5)	Electronic System Design	2+1	5
ELEC 3200	Industrial Training	10 weeks	0
ELEC 4000(5)	Degree Project	-	12
ELEC 4001Y(5)	Power Systems 2	2+0	4
ELEC 4002Y(5)	Power Electronic Drives	2+0	4
ELEC 4003Y(5)	Control Systems 2	2+0	4
HUMANITIES & MANAGEMENT			
COMS 1010(1)	Communication Skills	D.E.	3
MGT 3099Y(5)	Business Studies	3+0	6

ELECTIVES

ENGINEERING

ELEC 4021Y(5)	Data Communications and Networking	2+0	4
ELEC 4022Y(5)	Mobile Communications	2+0	4
ELEC 4011Y(5)	Instrumentation Systems	2+0	4
ELEC 4012Y(5)	Digital Signal Processing	2+0	4
ELEC 4013Y(5)	Antenna Theory	2+0	4
ELEC 4014Y(5)	Optoelectronics	2+0	4
ELEC 4015Y(5)	RF and Microwave Engineering	2+0	4
ELEC 4016Y(5)	Image Processing	2+0	4

NOTE 1: Engineering Electives

Students are required to take a minimum of 8 credits from Year 4 elective modules in the engineering elective category.

NOTE 2:

Students are allowed to choose any elective module contained in GEMs list available at the Faculty's Office. However, the offer of the electives would be subject to availability of resources and existence of a critical mass of demand for the modules. Students are requested to contact their Programme Coordinator before entering any module under the GEMs in their module registration form.

NOTE 3:

For a student to clear the modules ELEC 1200 and ELEC 3200, s/he must achieve Grade S (Satisfactory) in each of these modules.

NOTE 4: Core module for Diploma

ELEC 2000(3): Diploma Project (6 credits)

10. Programme Plan - BEng (Hons) Electrical and Electronic Engineering

LEVEL 1			
Semester 1 & 2			
Code	Module	Hrs/Wk L+P	Credits
CORE			
MATHS 1111(1)	Mathematics 1	D.E	3
MATHS 1211(1)	Mathematics 2	D.E	3
ELEC 1002Y(1)	Electronics 1	3+1	7
ELEC 1003Y(1)	Electrical Engineering	2+1	5
ELEC 1004Y(1)	Computer Programming	2+1	5
ELEC 1005Y(1)	Measurement Systems	2+1	5
ELEC 1200	Practical Training/Software Development	8 weeks	0
CSE 1010e(1)	Introduction to Information Technology	O.E	3
COMS 1010(1)	Communication Skills	D.E	3

LEVEL 2			
Semester 1 & 2			
Code	Module	Hrs/Wk L+P	Credits
CORE			
ELEC 2001Y(3)	Analytical Techniques	3+0	6
ELEC 2002Y(3)	Electronics 2	2+1	5
ELEC 2003Y(3)	Electromagnetics & Analog Communications	3+1	7
ELEC 2004Y(3)	Circuits, Signals and Systems	3+0	6
ELEC 2005Y(3)	Power Systems 1	2+0	4
ELEC 2006Y(3)	Electrical Machines	2+1	5

LEVEL 3			
Semester 1 & 2			
Code	Module	Hrs/Wk L+P	Credits
CORE			
MGT 3099Y(5)	Business Studies	3+0	6
ELEC 3001Y(5)	Microprocessors	2+2	6
ELEC 3002Y(5)	Control Systems 1	2+0	4
ELEC 3003Y(5)	Power Electronics	2+1	5
ELEC 3004Y(5)	Digital Communications	2+1	5
ELEC 3005Y(5)	Electronic System Design	2+1	5
ELEC 3200	Industrial Training	10 weeks	0

LEVEL 4			
Semester 1 & 2			
Code	Module	Hrs/Wk L+P	Credits
CORE			
ELEC 4000(5)	Degree Project	-	12
ELEC 4001Y(5)	Power Systems 2	2+0	4
ELEC 4002Y(5)	Power Electronic Drives	2+0	4
ELEC 4003Y(5)	Control Systems 2	2+0	4
ELECTIVES*			
ELEC 4021Y(5)	Data Communications and Networking	2+0	4
ELEC 4022Y(5)	Mobile Communications	2+0	4
ELEC 4011Y(5)	Instrumentation Systems	2+0	4
ELEC 4012Y(5)	Digital Signal Processing	2+0	4
ELEC 4013Y(5)	Antenna Theory	2+0	4
ELEC 4014Y(5)	Optoelectronics	2+0	4
ELEC 4015Y(5)	RF and Microwave Engineering	2+0	4
ELEC 4016Y(5)	Image Processing	2+0	4

NOTE: * Students should choose a minimum of 2 electives

11. Outline Syllabus

This outline syllabus is not prescriptive and is intended to serve as a guide only.

Note: Pre-requirement (PQ).

CORE MODULES

MATHS 1111(1) - MATHEMATICS 1 (PR: A-LEVEL MATHEMATICS) (D.E)

Calculus of one and several variables. Polar coordinates. Complex numbers. Hyperbolic functions. Limits. Ordinary differential equations.

MATHS 1211(1) - MATHEMATICS 2 (PR: A-LEVEL MATHEMATICS) (D.E)

Matrix Algebra: Matrices and determinants. Solution of linear systems of equations. Eigenvalues and eigenvectors. Infinite Series: Comparison test and Ratio test for non-negative series. Vector Algebra: Scalar and vector products, triple products. Vector equations. Vector Analysis: Gradient, divergence and curl. Line and multiple integrals. Green's theorem in the plane, Divergence theorem and Stokes' theorem.

ELEC 1002Y(1) - ELECTRONICS 1 (L/P – 3+1, CREDITS – 7)

PN Junction, Diode Circuits and Applications, Bipolar Junction Transistors, Field-Effect Transistors, Operational Amplifier and Applications, Number Systems, Boolean Algebra, Combinational Logic Circuits, Flip Flops, Digital Arithmetic.

ELEC 1003Y(1) - ELECTRICAL ENGINEERING (L/P – 2+1, CREDITS – 5)

Passive electrical elements, Current and Voltage Sources, Instantaneous, average and rms quantities, form factor, Kirchhoff's laws, Dc circuit analysis, Network Theorems, Magnetism and Electromagnetic Induction, Magnetic circuits, Single Phase Ac circuits and phasor diagrams, Power triangles, Power factor and correction, Ac circuit analysis using complex notation, Series and parallel resonance, 3 phase circuit analysis, Star and delta connected supplies and loads, Balanced and unbalanced 3-phase systems.

ELEC 1004Y(1) - COMPUTER PROGRAMMING (L/P – 2+1, CREDITS – 5)

Introductory concepts, C fundamentals, Operators and Expressions, Data Input and Output, Flowcharts and Pseudocodes, Control Statements, Functions, Arrays, Pointers, Data files, Object Oriented Design and Analysis, abstraction, classes, objects, methods, references, accessors, encapsulation, Pointers, Arrays, Constructors, Destructors, Inheritance, Polymorphism, Client-server model.

ELEC 1005Y(1) - MEASUREMENT SYSTEMS (L/P – 2+1, CREDITS – 5)

Statistic characteristics of measurement systems, Sensing elements: Resistive, capacitive, inductive, electromagnetic, piezoelectric, thermo-electric, optical types. Current and voltage sensors, Signal conditioning elements, Dynamic Characteristics of Measurement systems, Analogue ac and dc measuring instruments: moving coil, moving iron and electrodynamic instruments, Measurement of current, voltage, resistance, power and energy, Digital measuring instruments, Classification of data and errors, Error bands. Uncertainty analysis, Detectors and their signal conditioning circuits, Introduction to PC Based data acquisition systems.

ELEC 1200 - PRACTICAL TRAINING/SOFTWARE DEVELOPMENT

Electrical and Electronic Workshop Practice. Simulation software for Electrical/ Electronic Engineering . Mini Design Project, Software development.

CSE 1010E(1) - INTRODUCTION TO INFORMATION TECHNOLOGY (D.E)

The World of Computers; Main components of the computer; The evolution of computers; Input and output devices; Secondary Storage; Programming, Systems Software; Application software; Systems analysis and design; Communications and connectivity; The internet; Information technology and society.

COMS 1010(1) - COMMUNICATION SKILLS (D.E)

Writing skills, non-verbal communication, modes of speech delivery and presentation aids, speeches, perception and listening skills, business and technical writing.

ELEC 2001Y(3) - ANALYTICAL TECHNIQUES (PQ: MATHS 1211(1)) (L/P - 3+0, CREDITS - 6)

Laplace Transforms: Introduction to transforms and operators, Laplace transforms of basic functions, unit step function, transforms of 1st and 2nd derivatives, application to electrical circuits, transfer functions, inverse Laplace transforms, derivation using partial fractions, Direct (s-domain) analysis of electrical circuits, interpolation of s-domain functions, system poles and their effect on system response, initial and final value theorems, transforms of piecewise continuous functions, Fourier Series and Transforms; Matrix solution of simultaneous linear equations, row reduction methods, Gaussian and Gauss Jordan elimination, consistency of simultaneous linear equations, transpose and inverse of a matrix, use of inverse to solve simultaneous linear equations, determinants, properties of eigenvectors, diagonalisation, couples linear systems; Generating functions: Recurrence relations, Proof using mathematical induction; Probability and statistics: Permutations and combinations, random events and assignment of probability, axioms of probability, Venn diagrams, independence, conditional probability and Baye's rule, Bernoulli trials, discrete and continuous random variables, Probability density (PDF) and cumulative distribution (CDF) functions, mean and variance, uniform, Gaussian and Poisson PDFs, The Central Limit Theorem, Estimation and Hypothesis testing, Linear regression and correlation, Examples: SNR of a PCM signal, bit error rate for binary data with Gaussian noise

ELEC 2002Y(3) - ELECTRONICS 2 (PQ: ELEC 1002Y(1)) (L/P - 2+1, CREDITS - 5)

Analog electronics:

Low frequency amplifier circuits: r_e models ; 'h' and 'y' parameters, high frequency response, small signal hybrid - pi model. Negative feedback : Analysis of various NFB amplifiers, effects of NFB on amplifier system performance. Power Amplifiers: class A, class B and class AB operations; crossover and harmonic distortions; push-pull amplifiers. Oscillators: Hartley, Colpitts,R-C and Wien bridge types, crystal oscillators. Operational amplifiers and their applications. Waveform generators, Schmitt triggers, Precision full-wave rectifier, Timer circuits.

Digital electronics:

Digital System Components. Combinational logic circuits, Design using MSI components. Sequential Logic: Analysis and Design. Finite State Machines. ADC, DAC.

ELEC 2003Y(3) - ELECTROMAGNETICS & ANALOG COMMUNICATIONS (L/P - 3+1, CREDITS - 7)

Electric Charge and Current, Electric Field strength, Magnetic fields, dipoles, magnetic forces, Electromagnetic induction, Induction and magnetic energy, Dielectric materials, Maxwell's equations, electromagnetic waves, co-axial lines, waveguides.

Amplitude and angle modulation, Noise in AM, FM, PM, introduction to digital modulation techniques.

ELEC 2004Y(3) - CIRCUITS, SIGNALS & SYSTEMS (PQ: ELEC 1003Y(1)) (L/P - 3+0, CREDITS - 6)

Systems and signals: continuous time and discrete time, differential and difference equations, impulse response and convolution, frequency response and transfer functions, continuous-time Fourier series and transform, Laplace transform, Z-transform.

Circuits: s-domain circuit analysis, transient circuit analysis, two-port networks, network functions, first-order and second-order transfer functions, L-C network synthesis, Y-matrix circuit formulation, active circuit synthesis, analogue filter design.

ELEC 2005Y(3) - POWER SYSTEMS 1 (PQ: ELEC 1003Y(1)) (L/P - 2+0, CREDITS - 4)

Generating Stations, Power System Economics, Line Parameters, Performance of Transmission Lines, Distribution Systems, Fault Analysis, Power System Protection.

ELEC 2006Y(3) - ELECTRICAL MACHINES (PQ: ELEC 1003Y(1)) (L/P - 2+1, CREDITS - 5)

Magnetic Circuits and Energy Conversion in Machines. Transformer Theory, Connection and Operation. DC Machines: Principles and Characteristics/Operation of DC Motor and Generators. Induction Machines: Principles, Applications and Operation. Special Machines: Servomotors, Stepper Motors, Reluctance Motors, Brushless Dc Motors.

MGT 3099Y(5) - BUSINESS STUDIES (L/P - 3+0, CREDITS - 6)

Part 1 – Management (45 hours)

What is an Organisation?, Organisation Strategy, Structure and Culture, Formal Organisation, Organisation Design, Introduction to Management, Functions of Management, Roles and Responsibilities of Managers,

Evolution of Theories of Management, Communication, Introduction to Functional Areas of Management including Marketing, HRM, Production and Operations (Inventory control and critical path method), Industrial Relations and law, Introduction to organisation Behaviour, motivation, Leadership, Ethics and Social Responsibilities, Introduction to Quality Management.

Part 2 – Accounting and Finance (45 hours)

The Role of Accounting Information; Recording and Summarising Transactions; Accounting Concepts & Preparing Final Accounts; Adjustments to Final Accounts; Capital vs Revenue Expenditure; Bank Reconciliation Statement; Depreciation; Limited Companies; International Accounting Standards & Desirable Attributes of Accounting Information; Cash Flow Statement; Interpretation of Financial Statements; Accounting for Internal Decision Making Techniques; Elements of Cost; Costing Methods & Techniques; Decision Making Techniques; Accounting for Manufacturers; Budgets. Consumption, investment and capital markets ; Basis of financial decision making v/s role of accounting profit; Basic valuation of equities and bonds; Time Value of Money (present values and wealth); meaning behind a discount rate; Traditional methods of investment appraisal (NPV, IRR, Payback, ARR)

ELEC 3001Y(5) - MICROPROCESSORS (L/P - 2+2, CREDITS - 6)

Binary and Hexadecimal representation of numbers. Binary arithmetic. Architecture of 8085 microprocessor. Introduction to Assembly level and Machine Code programming. Internal Registers. Software Concepts Addressing Modes, Data transfers. Instruction sets for 8085. Data Processing. Further Programming. Test and Branch. Stack (software and hardware), subroutines, CALL instructions. Encoder/decoder, tristate, interfacing. Memory Systems RAM and ROM type of memories, EPROM and EEPROM, commercial memory chips. Memory and bit maps, address decoding, memory interfacing. Microprocessor timing and instruction design timing diagram and conventions, T-states, M-cycles, I-cycles, Instruction length and execution time.

Interrupts: RST Instructions and implementation of interrupts. Multiple interrupts and priorities, RIM and SIM Instructions. A/D and D/A conversions. Successive Approximation A/D converters. Programmable Interface chips: Intel 8155 and 8255 and their different modes of operation. Interfacing A/D converters and printers via Intel 8255. DMA. Serial communication, Standards: RS-232C. Asynchronous serial I/O. Data transmission to TTY and data reception from TTY. Serial I/O using programmable chip, Intel 8251A Programmable Communication Interface

ELEC 3002Y(5) - CONTROL SYSTEMS 1 (L/P - 2+0, CREDITS - 4)

Modelling of mechanical, hydraulic, pneumatic, and electrical systems. Brief Revision of Laplace transforms, Block Diagrams, Transfer functions, Signal Flow Graphs and their reduction. State space representation of SISO systems. System Analysis: Transient response of SISO systems, steady-state errors, stability, Routh-Hurwitz criterion, root-locus method.

Frequency Response Analysis: Bode diagram, Nichols Chart Analysis, polar plots, Nyquist plot and stability criterion.

NOTE: Matlab/Simulink to be used.

ELEC 3003Y(5) - POWER ELECTRONICS (PQ: ELEC 2004Y(3)) (L/P - 2+1, CREDITS - 5)

Characteristics of Power Semiconductor devices, Losses and Thermal flow models in switching devices, thermal design, switching aid and snubber circuits, Switch Mode Dc-dc Converters: Buck, Boost, Buck-boost and bridge topologies, Continuous and Discontinuous Modes of Operation, Closed loop control of dc-dc converters. Introduction to controlled rectification. Gate drive circuit design: Transformer and opto-isolated drive circuits; Protection of power electronic devices, Single phase dc to ac inverters. Harmonic reduction techniques. Dc motor drive operating modes; Control of dc brushed motor drives using switch mode power converters.

ELEC 3004Y(5) - DIGITAL COMMUNICATIONS (PQ: ELEC 2003Y(3)) (L/P - 2+1, CREDITS - 5)

Introduction to digital communications systems, Performance criteria and limits of a communication system. Introduction to Information theory, Source and Channel coding, Bandpass modulation and demodulation, Digital modulation and demodulation techniques, Cryptography, Optical fibre communications.

ELEC 3005Y(5) - ELECTRONIC SYSTEMS DESIGN (PQ: ELEC 2002Y(3)) (L/P - 2+1, CREDITS - 5)

Sequential Systems (Review) : Counters and Shift Registers, LFSR.

Finite State Machines: Clock-Mode and Incompletely Specified Sequential Machines, Fundamental-Mode Sequential Machines. Races and Hazards.

Programmable Logic Devices. PAL and PLA. Sequential Logic Design.

Fault Diagnosis and Testing : Test Pattern Generation, Path Sensitisation, Boolean Difference, D-Algorithm, PODEM. Design For Testability , Built in Self –Test. System Reliability.

ELEC 3200 - INDUSTRIAL TRAINING

Students will be attached to a firm or organization for a period of at least 10 weeks. The objective is to provide students with the opportunity to apply theoretical knowledge to solve real world problems in Electrical and Electronic Engineering and to work within the organisational structure of the firm. Students have to perform satisfactorily in this module before qualifying for the award of the degree.

ELEC 4000(5) - DEGREE PROJECT

Degree project in Electrical/ Electronic Engineering and related areas, consisting of literature review, analysis, design, hardware and/ or software implementation, project report and project presentation.

ELEC 4001Y(5) - POWER SYSTEMS 2 (PQ: ELEC 2005Y(3)) (L/P - 2+0, CREDITS - 4)

Load Flow Studies, Optimal System Operation, Automatic Generation Control, Power System Stability, Power System Security, State Estimation.

ELEC 4002Y(5) - POWER ELECTRONIC DRIVES (PQ: ELEC 3003Y(5)) (L/P - 2+0, CREDITS - 4)

3-phase dc to ac inverter configurations, Single phase and three-phase switch mode ac to dc converter topologies; continuous and discontinuous modes of operation. Motor drive applications and selection criteria, Mechanical system requirements and torque speed characteristics, Synthesis of low frequency ac voltages for motor drives, Inverter based Induction motor adjustable speed drives, Speed control using 3-phase ac voltage controllers, Single phase thyristor-based ac voltage controllers, Power Quality issues and Uninterruptible Power Supply Systems.

ELEC 4003Y(5) - CONTROL SYSTEMS 2 (PQ: ELEC 3002Y(5)) (L/P - 2+0, CREDITS - 4)

Controller design: Proportional, PI, PD, PID, Phase-Lead, Phase-Lag and Lead-Lag compensators design in continuous time and frequency domain. Process Control models, Tuning rules for PID controllers, Ziegler-Nichols tuning. Control systems analysis and design by state-space methods. Digital Control: Linear discrete dynamic system analysis, the z-transform, sampling and reconstruction, system time-response characteristics, stability analysis techniques, digital controller design. Matlab/Simulink to be used.

ELECTIVE MODULES**ELEC 4021Y(5) - DATA COMMUNICATIONS AND NETWORKING (PQ: ELEC 3004Y(5)) (L/P - 2+0, CREDITS - 4)**

Data communications fundamentals, asynchronous and synchronous transmissions, data synchronizations, data link control protocols, switching techniques, ISDN, X.25, Frame Relay, ATM, Internetworking. Network services and Architectures, Network routing and Addressing, Congestion Control, Queuing theory and network queues, Quality of Service, network management, delay and loss performance models.

ELEC 4022Y(5) - MOBILE COMMUNICATIONS (PQ: ELEC 3004Y(5)) (L/P - 2+0, CREDITS - 4)

Historical development, Fundamentals of cellular communications, Modulation techniques for cellular communications, Propagation and propagation path loss. Narrow Band System Performance. Wideband System Principles, Access technologies, GSM system, UMTS.

ELEC 4011Y(5) - INSTRUMENTATION SYSTEMS (L/P - 2+0, CREDITS - 4)

Piezoelectric, electrochemical, ultrasonic and optical sensors. Loading effects in instrumentation systems, Identification of dynamic characteristics, Dynamic errors and compensation techniques, Effects of noise and interference and methods of reducing their effects, Reliability analysis of instrumentation systems, Telemetry and applications.

ELEC 4012Y(5) - DIGITAL SIGNAL PROCESSING (PQ: ELEC 2004Y(3)) (L/P - 2+0, CREDITS - 4)

Continuous-time to discrete-time conversion and back, discrete-time systems and definition of DSP, DTFT, filter specifications, sampling rate conversions, DFS, DFT, FFT, filter structures, IIR filter design, FIR filter design, autocorrelation and power spectral density of random signals, applications.

ELEC 4013Y(5) - ANTENNA THEORY (L/P - 2+0, CREDITS - 4)

Antenna theory and characterization, antenna parameters, wire and aperture antennas, microstrip patch antennas, antenna arrays, radio propagation principles and models, multipath, fading, noise and interference, antennas for mobile communications, integrated and miniaturized antennas technologies including MIC/MMIC techniques, link budget design, VSATs, diversity measures (spatial, polarization, space-time), measurement techniques, beamforming

ELEC 4014Y(5) - OPTOELECTRONICS (L/P - 2+0, CREDITS - 4)

Light and Electromagnetic waves, Review of semiconductor devices, Electroluminescence, Optical Sources. Heterostructures, Electro-Optic Modulation, Detection of Optical Signals, Optical cavities, Fiber optical waveguides.

ELEC 4015Y(5) - RF AND MICROWAVE ENGINEERING (L/P - 2+0, CREDITS - 4)

Basic theory of high frequency circuits, transmission line theory, propagation coefficient, reflection coefficient for a terminated line, impedance transformation, impedance matching, VSWR, Smith Chart, two-port networks (z, y and h parameters), Interconnected two-port networks, s-parameters, insertion and return loss.

ELEC 4016Y(5) - IMAGE PROCESSING (L/P - 2+0, CREDITS - 4)

Image formation and acquisition, representation and formats, frequency domain representation, FIR filters for image processing, image processing basics, image enhancement, image restoration, image coding.

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