BSc (Hons) Electronics with Computer Science - E330 (Under Review)

1. Objectives

This programme aims at producing graduates in the field of Electronics with a strong bias in Computer Science, in order to adapt to the rapid development in these two areas. Students will be provided with a strong background in Electronics, Computer Technology, mobile and wireless technologies, database design as well as implementation and their integration in diverse applications.
With a strong background in the fields of electronics and computer science, graduates can expect to find attractive career opportunities in electronics industry and software development companies.

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

MODULES	CREDITS
Engineering	102
GEM	6
TOTAL	**108**

- For the degree award all core modules prescribed by the department must be completed.

(ii) Minimum Requirements for Diploma Award

A student may opt for a Diploma in Electronics with Computer Science provided s/he 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
ELEC 1060Y(1) Analytical Methods	6
ELEC 1061Y(1) Discrete Mathematics and Sampling techniques	5
Engineering	43
Diploma Project (ELEC 2000(3))	6
TOTAL	**60**

5. Programme Duration: Normal 3 years
Maximum 5 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 20-30% 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 2 class tests/assignments per module.**

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 the 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; or

(iii) If s/he is a year 1 student who has scored a CPA of <25% at the end of an academic year (for yearly programmes). However the Board of Examiners might allow a repeat if there are evidence of compelling circumstances or valid medical grounds.

9. List of Modules – BSc (Hons) Electronics with Computer Science

CORE MODULES		**Hrs/Wk L+P**	**Credits**
ENGINEERING			
CSE 1018Y(1)	Computer Programming	1.5+2	5
ELEC 1053Y(1)	Digital Electronics 1	2+1	5
ELEC 1060Y(1)	Analytical Methods	3+0	6
ELEC 1061Y(1)	Discrete Mathematics and Sampling Techniques	2.5+0	5
ELEC 1062Y(1)	Electrical Engineering and Analog Electronics	2+2	6
CSE 1001Y(1)	Fundamentals of Computer Science	2.5+1	6
ELEC 1200	Practical Training/ Software Development	8 weeks	0
CSE 2010Y(3)	Network Computing	1.5+2	5
ELEC 2055Y(3)	Analog Communications	2+1	5
CSE 2001Y(5)	Software Engineering	2.5+1	6
CSE 2011Y(3)	Database and Information Systems	2+1	5
ELEC 2060Y(3)	Microprocessors	2+1	5
ELEC 2061Y(3)	Data and Computer Communications	2+0	4
ELEC 2062Y(3)	Analog Electronics	2+2	6
ELEC 3000(5)	Degree Project	-	10
ELEC 3055Y(5)	Power Electronic Systems	2.5+1	6
ELEC 3060Y(5)	Digital Communication Systems	2+1	5
GEM			6
ELECTIVES			
MATH1111(1)	Mathematics 1	D.E	3
ENGINEERING			
ELEC 3053Y(5)	Telecommunications Network	3+0	6
ELEC 3057Y(5)	Discrete Time Signal Processing	3+0	6
ELEC 3061Y(5)	Broadcasting technologies	3+0	6
CSE 3005Y(5)	Artificial Intelligence	2+2	6
CSE 3006Y(5)	Operations Research and Simulation	2+2	6
CSE 3010Y(5)	Neural Networks, Fuzzy Systems and Genetic Algorithms	2+2	6
ELEC 3058Y(5)	Digital System design	2.5+1	6
ELEC 3063Y(5)	Coding for data transmission	3+0	6

NOTE 1:
Core module for Diploma: ELEC 2000(3): Diploma Project (6 credits), ELEC 1060Y (1): Analytical Methods, ELEC 1061Y(1) Discrete Mathematics and Sampling

NOTE 2:
For a student to clear the module ELEC 1200 s/he must obtain Grade S (Satisfactory) in the module.

NOTE 3:
Students are required to take 6 credits under GEM in the list available at the Faculty's Office. Students are requested to contact their Programme Coordinator before registering for any module under GEM.

10. Programme Plan – BSc (Hons) Electronics with Computer Science

LEVEL 1

Semester 1 & 2

CODE	MODULE	Hrs/Wk L+P	Credits
CORE			
ELEC 1053Y(1)	Digital Electronics 1	2+1	5
ELEC 1060Y(1)	Analytical Methods	3+0	6
ELEC 1061Y(1)	Discrete Mathematics and Sampling Techniques	2.5+0	5
ELEC 1062Y(1)	Electrical Engineering and Analog Electronics	2+2	6
CSE 1018Y(1)	Computer Programming	1.5+2	5
CSE 1001Y(1)	Fundamentals of computer science	2.5+1	6
ELEC 1200	Practical Training/Software Development	8 weeks	0
ELECTIVE			
MATH 1111(1)	Mathematics 1	D.E	3

LEVEL 2

Semester 1 & 2

CODE	MODULE	Hrs/Wk L+P	Credits
CORE			
CSE 2010Y(3)	Network Computing	1.5+2	5
ELEC 2055Y(3)	Analog Communications	2+1	5
CSE 2001Y(5)	Software Engineering	2.5+1	6
CSE 2011Y(3)	Database and Information Systems	2+1	5
ELEC 2060Y(3)	Microprocessors	2+1	5
ELEC 2061Y(3)	Data and Computer Communications	2+0	4
ELEC 2062Y(3)	Analog Electronics	2+2	6
GEM			6

LEVEL 3

Semester 1 & 2

CODE	MODULE	Hrs/Wk L+P	Credits
CORE			
ELEC 3000(5)	Degree Project	-	10
ELEC 3055Y(5)	Power Electronic Systems	2.5+1	6
ELEC 3060Y(5)	Digital Communication Systems	2+1	5
ELECTIVES			
ENGINEERING			
ELEC 3053Y(5)	Telecommunications Network	3+0	6
ELEC 3057Y(5)	Discrete Time Signal Processing	3+0	6
ELEC 3061Y(5)	Broadcasting technologies	3+0	6
CSE 3005Y(5)	Artificial Intelligence	2+2	6
CSE 3006Y(5)	Operations Research and Simulation	2+2	6
CSE 3010Y(5)	Neural Networks, Fuzzy Systems and Genetic Algorithms	2+2	6
ELEC 3058Y(5)	Digital System Design	2.5+1	6
ELEC 3063Y(5)	Coding for data transmission	3+0	6

NOTE: Students should take at least two (2) electives in Year 3.

11. Outline syllabus

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

Note: Pre-requisite (PR); Pre-requirement (PQ).

CORE MODULES

CSE 1001Y(1) FUNDAMENTALS OF COMPUTER SCIENCE (L/P-2.5+1, Credits-6)
Introduction to Computers; Hardware and Software; Input, Output and Storage; Organization of Data; Systems Analysis and Design; Data Communications; Computers and Society; Future of Computing. Propositional Logic; Syntax, Semantics, Truth tables, Simplification Rules, Normal Forms & Proofs; First Order Logic: Syntax, Semantics and Proofs.

CSE 1018Y(1) COMPUTER PROGRAMMING (L/P-1.5+2, Credits-5)
Types of problems solved by computers; Flowcharts and Pseudocodes; different levels of programming languages, Introduction to C language; Data types; operators and expressions; Data Input and Output; Conditional statements; Branching and iterative structures; Functions (including nested functions & value and reference parameters); recursion; arrays ; files processing;structures; Object Oriented Paradigm v/s structured programming; C++ as an Object Oriented Language; Inheritance; Polymorphism; Overloading constructors & operators; Late binding and virtual keyword; Data Structures & the Standard Template Library

ELEC 1053Y(1) - DIGITAL ELECTRONICS 1 (L/P-2+1, CREDITS-5)
Data representation, Number Systems and Codes, Boolean algebra, Combinational logic circuit analysis and design, minimization techniques for logical functions, Representation of signed numbers, Digital arithmetic operations and circuits, Decoders, Demultiplexers, magnitude comparators, Encoders and Multiplexers, Introduction to sequential logic, Basic memory cells, flip-flops, counters and registers.

ELEC 1060Y(1) – ANALYTICAL METHODS (L/P- 3+0, Credits - 6)
Differential Equations: 1st and 2nd order linear differential equations with application to mechanical and electrical systems. Laplace Transforms with application to electrical circuits, transfer functions, inverse Laplace transforms, initial and final value theorems. Fourier Series, Fourier Transforms. Vectors and matrix algebra. Probability and statistics with application to signals and communication systems.

ELEC 1061Y(1) – DISCRETE MATHEMATICS AND SAMPLING TECHNIQUES (L/P- 2.5+0, Credits -5)
Logic and Proofs, Sets, sequences, relations and Functions, Algorithms: notation, complexity, recurrence and applications, Counting methods- Generalised permutation and combination, Introduction to signal analysis: series and transforms, Sampling: theorems and applications.

ELEC 1062Y(1) – ELECTRICAL ENGINEERING AND ANALOG ELECTRONICS (L/P-2+2, Credits-6)
Circuit concepts, Kirchhoff's laws, Network theorems, DC circuit analysis, Magnetic circuits, AC circuit analysis, Power and power factor, Resonance, Semiconductors, PN Junction, Diode Circuits and Applications, Bipolar Junction Transistors, Field-Effect Transistors, Operational Amplifier and Applications.

ELEC 1200 - PRACTICAL TRAINING/SOFTWARE DEVELOPMENT
Electrical and Electronic Workshop Practice. Simulation software for Electrical/ Electronic Engineering . Mini Design Project, Software development.

CSE 2001Y(5) SOFTWARE ENGINEERING (L/P-2.5+1, Credits-6)
Data abstraction, encapsulation, classes, objects, inheritance, polymorphism, aggregation, OO analysis and design using UML, patterns and frameworks, components and component object models, software engineering concepts and practices, software processes, software process improvement, CMM, requirements engineering, software modelling and design techniques, software quality assurance, software project management, software evolution, software maintenance, software procurement.

CSE 2010Y(3) NETWORK COMPUTING (L/P-1.5+2, Credits-5)
Network application models, Wireless Networks, Internet Structure, TCP/IP Stack, Transport protocols, IPv4, IPv6, Mobile IP, Internetwork Routing (ARP,BGP, DHCP, RIP, OSPF), Multithreading, TCP/UDP socket programming, Object Serialization, Multicasting with Java, Distributed computing and RPC, Java RMI, Java CORBA, Protocol handlers, Web Services.

CSE 2011Y(3) – DATABASE AND INFORMATION SYSTEMS (L/P-2+1, Credits-5)
The Database Approach, Architecture, Database Applications, SQL, Entity Relationship Diagram, Reduction of ERD to Tables, Database Design, Normalization, Relational Model, Relational Algebra, Relational Calculus, Information Systems (IS) in the Organization, Types of IS, Electronic Commerce & Electronic Business, Decision Making, Data mining, Data Warehouses, Multidimensional Databases, DSS, Redesigning IS, BPR, Enterprise Applications, CRM, SCM, Systems Development Methodologies, Ethics in IS.

ELEC 2055Y(3) – ANALOG COMMUNICATIONS (L/P-2+1, CREDITS-5) (PQ: ELEC 1060Y(1), ELEC 1061Y(1))
Fourier Transform, Signals and spectra, Amplitude Modulation (AM, DSB, SSB),angle modulation (PM, FM), Noise in amplitude and angle modulation.

ELEC 2060Y(3) – MICROPROCESSORS (L/P-2+1, CREDITS-5)
Architecture of microprocessors. Introduction to Assembly level and Machine Code programming. Internal Registers. Software Concepts Addressing Modes, Data transfers. Instruction sets. Data Processing. Further Programming. Test and Branch. Stack (software and hardware), subroutines, CALL instructions. Encoder/decoder, tristate. Memory Systems and types of memories, memory interfacing. Parallel data transfer and programmable interface chips. Serial data transfer and programmable Interface chips, Input and Output using interrupts.

ELEC 2061Y(3) – DATA AND COMPUTER COMMUNICATIONS (L/P-2+0, CREDITS-4)
Introduction, protocol architecture, data transmission, Guided and wireless transmission, signal encoding techniques, error detection, data link control, multiplexing and spread spectrum. Switching, ATM, routing. LANs. Internetwork protocols and operations, transport protocols and network security.

ELEC 2062Y(3) – ANALOG ELECTRONICS (L/P-2+2, Credits-6)
Multistage Amplifiers, High Frequency Amplifier Circuits. Transistor models: h-Parameters, Power Amplifiers, Feedback and Oscillators, Differential Amplifier, Timer circuits, A/D and D/A converters.
Mini-Project: Analogue Electronics

ELEC 3000(5) – DEGREE PROJECT (CREDITS-10)
Degree project in Electronics/ Computer Science and related areas, consisting of literature review, analysis, design, hardware and/ or software implementation, project report and project presentation.

ELEC 3055Y(5) - POWER ELECTRONIC SYSTEMS (L/P-2.5+1, CREDITS-6)
Power semiconductor switching devices, Switching transients in power semiconductors, Losses and Thermal flow models, 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.
Gate drive circuit design: Transformer and opto-isolated drive circuits;
Protection of power electronic devices, Single phase dc to ac inverters. Control of dc brushed motor drives using switch mode power converters, Dc to ac inverter configurations, Switch mode ac to dc converter topologies; Motor drive applications and selection criteria, Synthesis of low frequency ac voltages, Single phase thyristor-based ac voltage controllers, Power Quality issues and Uninterruptible Power Supply Systems.

ELEC 3060Y(5) –DIGITAL COMMUNICATION SYSTEMS (L/P-2+1, CREDITS-5) (PQ: ELEC 1060Y(1), ELEC 1061Y(1))
Introduction to digital communications systems, Introduction to Information theory, compression techniques, Channel coding, Bandpass modulation and demodulation, Digital modulation and demodulation techniques, Multiple access techniques.

ELECTIVE MODULES

MATHS 1111(1) - MATHEMATICS 1 (D.E, Credits-3)
Calculus of one and several variables. Polar coordinates. Complex numbers. Hyperbolic functions. Limits. Ordinary differential equations.

ELEC 3053Y(5) - TELECOMMUNICATIONS NETWORK (L/P-3+0, Credits-6)
PSTN: Local loop, media, switching, signalling. SS-7 architecture. Layered architectures and protocols: GSM, GPRS. UMTS, Wireless LAN, Bluetooth, Wi-Fi, Wi-Max. Packet switched networks, Network protocols and devices, Data links and transmissions, LANs, Mobile IP, routing, transport and application protocols, security and advanced concepts in telecommunications network.

ELEC 3057Y(5) - DISCRETE-TIME SIGNAL PROCESSING (L/P-3+0, Credits-6)
Continuous and Discrete-time signals, C/D and D/C conversions, aliasing, discrete-time systems, difference equations, impulse response and convolution, frequency response, Z-transform, DTFT, DFS, DFT, filter specification and design, IIR and FIR filters, multirate signal processing,

ELEC 3058Y(5) - DIGITAL SYSTEM DESIGN (L/P-2.5+1, Credits-6)
Sequential Circuit Design: Counters and Shift Registers, Synchronous and Asynchronous sequential circuits, State diagram, State table and State minimization, Flip-flop implementation,
Designing with Programmable Logic Devices (PLD's).
Fault Diagnosis and Testing: Test Pattern Generation, Logic analysers and signature analysers, Design For Testability, Built in Self –Test.
Reliability: System Reliability, Reliability of complex systems, Design of reliable systems.

ELEC 3061Y(5) – BROADCASTING TECHNOLOGIES (L/P-3+0, Credits-6)
Introduction to broadcasting, Frequency allocation for Broadcasting, Antennas, Propagation, Transmitters, Station, Measurements, Digital Audio Broadcasting (DAB) techniques, Digital Terrestrial TV Broadcasting (DTTB) techniques, Digital Cable TV transmission.

ELEC 3063Y(5) – CODING FOR DATA TRANSMISSION (L/P – 3+0, Credits-6)
Introduction, text and multimedia data compression techniques, error correcting codes – linear block codes, convolutional codes, applications of codes to Mobile communications (GSM, GPRS, CDMA), Trellis-Coded Modulation, Concatenated coding systems.

CSE 3005Y(5) - ARTIFICIAL INTELLIGENCE (L/P - 6)
Knowledge representation; Intelligent agents; Search; Heuristics; Game playing; Natural language processing; Planning; Neural networks; AI languages, Toolkits and application; Inference; Knowledge Acquisition; Explanation; Uncertainty; Fuzzy systems; Machine Learning; CBR; Truth maintenance; Trends.

CSE 3006Y(5) - OPERATIONS RESEARCH AND SIMULATION (L/P - 6)
Linear Programming; Simplex Algorithm; Transportation Problems; Network Techniques; Game Theory; Markov's Chains; Queuing Theory; Simulation.

CSE 3010Y(5) - NEURAL NETWORKS FUZZY SYSTEMS AND GENETIC ALGORITHMS (L/P - 6)
An Overview of Combinatorial Optimisation, Theoretical Foundations of Genetic Algorithms, Genetic Algorithms in Engineering and Optimisation, Genetic Algorithms in Natural Evolution, Simulated Annealing and Tabu Search. Fuzzy set theory, fuzzy systems, Fuzzy Logic, Fuzzy Inference. Artificial Neural networks, Neural Networks Architectures and Algorithms, Historical perspective (What, Why, When), simple model neurons, learning and generalisation, perceptrons, multi-layered perceptrons, radial basis function networks, classification and regression problems, temporal learning, recurrent and self-organizing networks, Neural network simulations using appropriate software (Practical/Laboratory based study), Evolving Neural Networks Implementing Genetic Algorithms.