

BSc (Hons) Electronics and Computer Science - E330

1. Objectives

This programme is geared towards producing professionals in the field of Computer Science with a strong bias in Electronics, in order to adapt to the rapid development in these two areas. The Programme is intended to facilitate the integration of our graduates into the job market. Students will be provided with a strong background in Computer Technology, Electronics, and their integration in diverse applications.

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 BSc (Hons) Degree in Electronics and Computer Science, the student must obtain at least 102 credits including 90 credits from all the core modules prescribed by the department and at least 12 credits from the elective modules.

| MODULES | CREDITS |
|------------------------------|----------------|
| Basic Sciences & Mathematics | 9 |
| Engineering | 93 |
| TOTAL | 102 |

- 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 and 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 |
|--------------------------------|----------------|
| Basic Sciences & Mathematics | 6 |
| Engineering | 48 |
| 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

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

| <u>CORE MODULES</u> | | Hrs/Wk | Credits |
|---|---|---------------|----------------|
| | | L+P | |
| Basic Sciences & Mathematics | | | |
| MATHS 1111(1) | Mathematics 1 | D.E. | 3 |
| MATHS 1211(1) | Mathematics 2 | D.E. | 3 |
| MATH 1231(1) | Probability and Statistics 1 | 3+0 | 3 |
| Engineering | | | |
| CSE 1001Y(1) | Fundamentals of Computer Science | 2.5+1 | 6 |
| CSE 1004Y(1) | Structured Systems Development | 2+2 | 6 |
| CSE 2002Y(3) | Database Systems | 2.5+1 | 6 |
| CSE 2004Y(3) | Programming Languages and Algorithms | 2+2 | 6 |
| ELEC 1052Y(1) | Electrical Engineering and Analog Electronics | 2+1 | 5 |
| ELEC 1053Y(1) | Digital Electronics 1 | 2+1 | 5 |
| ELEC 1054Y(1) | Analog Communications | 2+0 | 4 |
| ELEC 1055Y(1) | Computer Programming | 2+1 | 5 |
| ELEC 1200 | Practical Training | 8 weeks | 0 |
| ELEC 2051Y(3) | Network Computing | 2+1 | 5 |
| ELEC 2052Y(3) | Basics of Digital Communications | 2+2 | 6 |
| ELEC 2053Y(3) | Digital Electronics 2 | 2+1 | 5 |
| ELEC 3000(5) | Degree Project | - | 10 |
| ELEC 3051Y(5) | Data Communications and Networking Technologies | 3+0 | 6 |
| ELEC 3055Y(5) | Power Electronic Systems | 2.5+1 | 6 |
| <u>ELECTIVES</u> | | | |
| Engineering | | | |
| CSE 2001Y(5) | Software Engineering | 2.5+1 | 6 |
| CSE 2005Y(3) | Interface Design and Computer Graphics | 2+2 | 6 |
| CSE 2006Y(3) | Systems Software | 2+2 | 6 |
| ELEC 3056Y(5) | Microprocessor and Instrumentation | 2.5+1 | 6 |
| ELEC 3057Y(5) | Discrete Time Signal Processing | 3+0 | 6 |

ELEC 3058Y(5) Digital System Design 2.5+1 6

NOTE 1: Core module for Diploma: ELEC 2000(3): Diploma Project (6 credits)

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

9. Programme Plan – BSc (Hons) Electronics and Computer Science

YEAR 1

| Semesters 1 & 2 Code | Module Name | Hrs/Wk L+P | Credits |
|-------------------------------------|---|-----------------------|----------------|
| CORE | | | |
| MATHS 1111(1) | Mathematics 1 | D.E. | 3 |
| MATHS 1211(1) | Mathematics 2 | D.E. | 3 |
| MATH 1231(1) | Probability and Statistics 1 | D.E. | 3 |
| ELEC 1052Y(1) | Electrical Engineering and Analog Electronics | 2+1 | 5 |
| ELEC 1053Y(1) | Digital Electronics 1 | 2+1 | 5 |
| ELEC 1054Y(1) | Analog Communications | 2+0 | 4 |
| ELEC 1055Y(1) | Computer Programming | 2+1 | 5 |
| CSE 1001Y(1) | Fundamentals of Computer Science | 2.5+1 | 6 |
| ELEC 1200(1) | Practical Training | 8 weeks | 0 |

YEAR 2

| Semesters 1 & 2 Code | Module Name | Hrs/Wk L+P | Credits |
|-------------------------------------|--------------------------------------|-----------------------|----------------|
| CORE | | | |
| ELEC 2051Y(3) | Network Computing | 2+1 | 5 |
| ELEC 2052Y(3) | Basics of Digital Communications | 2+2 | 6 |
| ELEC 2053Y(3) | Digital Electronics 2 | 2+1 | 5 |
| CSE 1004Y(1) | Structured Systems Development | 2+2 | 6 |
| CSE 2002Y(3) | Database Systems | 2.5+1 | 6 |
| CSE 2004Y(3) | Programming Languages and Algorithms | 2+2 | 6 |

YEAR 3

| Semesters 1 & 2 Code | Module Name | Hrs/Wk L+P | Credits |
|-------------------------------------|---|-----------------------|----------------|
| CORE | | | |
| ELEC 3000(5) | Degree Project | - | 10 |
| ELEC 3051Y(5) | Data Communications and Networking Technologies | 3+0 | 6 |
| ELEC 3055Y(5) | Power Electronic Systems | 2.5+1 | 6 |
| ELECTIVES | | | |
| ELEC 3056Y(5) | Microprocessor and Instrumentation | 2.5+1 | 6 |
| ELEC 3057Y(5) | Discrete Time Signal Processing | 3+0 | 6 |

| | | | |
|---------------|--|-------|---|
| ELEC 3058Y(5) | Digital System Design | 2.5+1 | 6 |
| CSE 2001Y(5) | Software Engineering | 2.5+1 | 6 |
| CSE 2005Y(3) | Interface Design and Computer Graphics | 2+2 | 6 |
| CSE 2006Y(3) | Systems Software | 2+2 | 6 |

NOTE: Students should take at least two (2) electives in Year 3, of which at least one CSE module and one ELEC module.

10. Outline Syllabus

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

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

CSE 1001Y(1) - FUNDAMENTALS OF COMPUTER SCIENCE

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 1004Y(1) - STRUCTURED SYSTEMS DEVELOPMENT

Introduction to SSAD; Software life cycles, Introduction to information systems, Components in a system, Preliminary investigation, Requirements Gathering, Requirements Modelling, Data flow analysis, DFD, Data Dictionary, Systems Design, ERD, State Transition Diagram, systems implementation, software design, flowcharts, review methods, managing the development process, estimation and management of development time, Testing, Maintenance Fundamentals of computer applications development, Application Architectures, Databases, Implementation of databases, User interface development, Query By Example, Queries using SQL, Database Access, Forms and Controls, Reports.

CSE 2001Y(5) - SOFTWARE ENGINEERING (PQ: ELEC 1055Y(1))

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 2002Y(3) - DATABASE SYSTEMS

DBMS functions/Components, Database Abstractions, Relational Model ERD, Relational algebra, Normalization, Query Language – SQL, DB design issues, Optimisation, Security Issues, Transactions, Distributed Computing, Synchronization, Overview Of Distributed Databases, Distribution Transparency, Distributed Database Design - Commit Protocols and Concurrency Control, Query Processing.

CSE 2004Y(3) - PROGRAMMING LANGUAGES AND ALGORITHMS (PQ: ELEC 1055Y(1))

Overview of programming languages; language design and implementation issues; language evaluation and selection issues; programming paradigms; programming environments; programming constructs, compilation process; Algorithms Analysis Techniques; Algorithms Design Techniques; Sorting; Searching; String Processing; Graph Algorithms; Dynamic Programming; Backtracking; Mathematical algorithms.

CSE 2005Y(3) - INTERFACE DESIGN AND COMPUTER GRAPHICS

Characteristics of a good UI; User Centred UI; Design tools and methods; Interactive System Design; Prototyping Techniques; Evaluation Techniques; Output Primitives & attributes; Geometric transformations (e.g. Homogeneous coordinates, 2D and 3D matrix

representations); Viewing models (2D viewing and 3D viewing); Curves & surfaces; Line clipping; Polygon clipping; Illumination; Visible surface detection; Fractal generation; Animation. Use of advanced graphics libraries (e.g. OpenGL and/or DirectX) for the implementation of the different concepts discussed.

CSE 2006Y(3) - SYSTEMS SOFTWARE

Overview of Computer Systems, Processes, threads, Memory Management, Processor Scheduling, Input/Output, Files, Computer Security, Systems programming. Stored Program Computer, Advancements in Architectures, Pipelined Systems, Implementation of Pipelining, RISC, RISC v/s CISC, Comparative Architectures.

ELEC 1052Y(1) - ELECTRICAL ENGINEERING AND ANALOG ELECTRONICS

Circuit concepts, Kirchhoff's laws, Network theorems, DC circuit analysis, Magnetic circuits, AC circuit analysis, Power and power factor, Resonance, Three-phase systems, Semiconductors, PN Junction, Diode Circuits and Applications, Bipolar Junction Transistors, Field-Effect Transistors, Operational Amplifier and Applications.

ELEC 1053Y(1) - DIGITAL ELECTRONICS 1

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 1054Y(1) - ANALOG COMMUNICATIONS

Fourier Transform, Signals and spectra, Amplitude Modulation (AM, DSB, SSB), angle modulation (PM, FM), Noise in amplitude and angle modulation.

ELEC 1055Y(1) - COMPUTER PROGRAMMING

Introductory concepts, C fundamentals, Operators and Expressions, Data Input and Output, Flowcharts and Pseudocodes, Control Statements, Functions, Arrays, Pointers, Data files, Introduction to Object Oriented Programming, Abstract data Types including stacks, linked lists, queues, trees and graphs.

ELEC 1200 - PRACTICAL TRAINING

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

ELEC 2051Y(3) - NETWORK COMPUTING (PQ: ELEC 1055Y(1))

Introduction to networking, types of networks, server platforms, Internetworking, distributed systems, client server models, network application development. Introduction to networking and Internet protocols via programming. TCP/IP protocol architecture; user datagram protocol (UDP); multicasting; transmission control protocol (TCP); standard Internet services, and protocol usage by common Internet applications. Sockets programming; client/server; peer-to-peer; Internet addressing; TCP sockets; UDP sockets; raw sockets. Multithreading and exception handling. Finger, DNS, HTTP, and ping clients and servers. Routers and architectures, routing protocols. Router and switch configurations, Internet operating systems. Internet work setup, network topology, wireless internetworking.

ELEC 2052Y(3) - BASICS OF DIGITAL COMMUNICATIONS (PQ: ELEC 1054Y(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.

ELEC 2053Y(3) - DIGITAL ELECTRONICS 2 (PQ: ELEC 1053Y(1))

IC logic families and applications in digital design, Digital system components, ADC and DAC, Sequential Logic circuit (synchronous and asynchronous) analysis and design, Finite State Machines, Programmable Logic Devices and applications.

ELEC 3000(5) - DEGREE PROJECT

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 3051Y(5) - DATA COMMUNICATIONS AND NETWORKING TECHNOLOGIES

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 3055Y(5) - POWER ELECTRONIC SYSTEMS

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 3056Y(5) - MICROPROCESSOR AND INSTRUMENTATION

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. Memory Systems and types of memories, memory interfacing. Parallel data transfer and programmable interface chips. Serial data transfer and programmable Interface chips.

Sensors and Transducers. Different types and characteristics of sensors. Errors in instruments. Measurement of non electrical parameters. Measurement of analog signals and analog instruments. Signal conditioning circuits, D/A and A/D conversion. Digital instruments. Microprocessor based data acquisition systems.

ELEC 3057Y(5) - DISCRETE-TIME SIGNAL PROCESSING

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

Sequential Circuit Design: Counters and Shift Registers, Synchronous and Asynchronous sequential circuits, State diagram, State table and State minimisation, 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.

MATHS 1111(1) - MATHEMATICS 1 (PR: A-LEVEL MATHEMATICS)

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)

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.

MATH 1231(1) - PROBABILITY AND STATISTICS I (PR: A-LEVEL MATHS)

Elementary probability. Conditional probability. Discrete and continuous distributions. The Central Limit Theorem. Introduction to Linear Regression. Estimation and Hypothesis testing.