



# School of Innovative Technologies And Engineering

Department of Industrial Systems Engineering

## BEng (Hons) Electronic Engineering

### PROGRAMME DOCUMENT

*BEE v2.6*  
May 2017

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# BEng (Hons) Electronic Engineering

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## A. Programme Information

By far, the 21<sup>st</sup> Century has witnessed the fusion of electronics and computers in so much as it is almost impossible nowadays to find a modern device which is devoid of a micro-processor or micro-controller of some kind inside, giving rise to a new breed of smart and ubiquitous devices that will shape our life in the future. In the first year of the programme, the fundamentals of electronics, mathematics, as well as the underlying principles and theory of computing are introduced. The second and third years build on the first with core modules in electronics, computing and communication systems.

Moreover, in their last level, students will have one Professional Work Placement for one full semester so that they can apply their theoretical knowledge to solve real world problems in electronic engineering. Students will have to complete a final year individual project to be qualified for the BEng programme.

This BEng (Hons) Electronic Engineering programme meets the academic requirements set by the **Council of Registered Professional Engineers (CRPE)** of Mauritius.

## B. Programme Aims

This programme aims to produce engineering graduates equipped to play valuable roles in the Electronics and ICT industry both locally as well as overseas. Successful graduands are expected to become registered professional engineers.

### Job Prospects:

Electronic engineering graduates are naturally expected to find employment in electronics-related sector such as Power generation, Automotive, Construction, FMCG, Pharmaceutical, Marine, Rail, and Utilities industries. However, non-engineering careers, such as, in Consulting, Law, Financial Services, Sales and Pre-sales, IT and Education where analytical skills and high levels of numeracy are expected, are also possible .

## C. Programme Objectives

To provide an understanding of technical and intellectual skills so that students can:

- Analyse and solve engineering problems
- Design a system, component or process to meet a need
- Evaluate designs, processes and products, and to make improvements
- Take a holistic approach in solving problems and designing systems, applying professional judgements to balance risks, costs, benefits, safety, reliability, aesthetics and environmental impact

## **PART I - Regulations**

### **D. General Entry Requirements**

As per UTM'S Admissions Regulations, and 'Admission to Programmes of Study at First Degree Level' or APL/APEL requirements.

### **E. Programme Entry Requirements**

'A' Level in Mathematics and one subject from Physics, Chemistry, Physics with Chemistry, Electronics, Physical Science, Engineering Science, Computer Studies, Design and Technology or any other applied science subject at Advanced Level acceptable to APL/APEL committee at HSC Level, GCE A-Level, or Scientific Baccalaureate Level, or alternatively holding an Brevet de Technicien in Electrotechnique/ Electronique from the Mauritius Institute of Training and Development or any other higher technical qualification approved by APL/APEL committee.

### **F. Programme Mode and Duration**

Full Time: Minimum 4 Years (8 Semesters) Maximum 7 years (14 Semesters)

Part Time: Minimum 6 Years (12 Semesters) Maximum 9 years (18 Semesters)

### **G. Teaching and Learning Strategies**

- Lectures, Tutorials and Practicals Sessions;
- Class Test and Assignments;
- Industrial Placement, Workshops and Seminars;
- Structured Discussions and Self-Directed Study;
- Case Study on real-world problems.

### **H. Student Support and Guidance**

Each cohort of the programme is allocated a Programme coordinator who acts as a liaison between the students and school management and provides support for academic management of the programme.

### **I. Attendance Requirements**

As per UTM's Regulations and Policy.

### **J. Credit System**

1 credit = 15 Hours

For the award of a Certificate, a minimum of **40** credits are required.

For the award of a Diploma, a minimum of **85** credits are required.

For the award of an Ordinary Degree, a minimum of **139** credits are required.

For the award of a Honours Degree a **148** credits are required.

Awards on the basis of accumulated credits may exceptionally be considered on a case to case basis.

## K. Student Progress and Assessment

The programme is delivered mainly through lectures, tutorials, and practical sessions. Students are expected to be as autonomous as possible and activities may include delivering presentations, reading research papers, quizzes, case-studying, organize and participate in workshops, amongst others.

Each module carries 100 marks and unless otherwise specified will be assessed as follows:

- Continuous assessment (coursework) carries a minimum of 30% and a maximum of 50% of the total marks. Continuous assessment can be based on a combination of assignments, field study, workshops, surveys, practicals and class tests.
- Module 'Communication Workshop' shall be assessed by 100% coursework. The coursework must be consist of at least two assessments.
- Module 'Financial & Management Accounting' shall be assessed by 50% Coursework and 50% Exams.

## Module Grading Structure

Grade	Marks x (%)
A	$70 \leq x \leq 100$
B	$60 \leq x < 70$
C	$50 \leq x < 60$
D	$40 \leq x < 50$
F	$x < 40$
A-D	Pass
F	Fail

## L. Evaluation of Performance

The percentage mark at Level 1 contributes a 20% weighting towards the degree classification.

The percentage mark at Level 2 contributes a 20% weighting towards the degree classification.

The percentage mark at Level 3 contributes a 30% weighting towards the degree classification.

The percentage mark at Level 4 contributes a 30% weighting towards the degree classification.

## M. Award Classification

Overall weighted mark x (%)	Classification
$x \geq 70$	1 <sup>st</sup> Class Honours
$60 \leq x < 70$	2 <sup>nd</sup> Class 1 <sup>st</sup> Division Honours
$50 \leq x < 60$	2 <sup>nd</sup> Class 2 <sup>nd</sup> Division Honours
$45 \leq x < 50$	3 <sup>rd</sup> Class Honours
$40 \leq x < 45$	Pass Degree
$x < 40$	No award

## N. Programme Organisation and Management

Programme Director: Mr. Rishi H. Heerasing

Contact Details: Room: G 2.14  
Telephone Number: 207 5270 (Ext. 124)  
Email: rheerasing@umail.utm.ac.mu

## Part II - Programme Structure

### O. BEng (Hons) Electronic Engineering – Full Time (Version 2.6)

YEAR 1 (Level 1)							
Semester 1				Semester 2			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
ASE1101c	<i>Principles of Engineering</i>	2+1	3	ELEC1102c	<i>Analogue Electronics</i>	2+2	4
MATH1145c	<i>Foundation Mathematics</i>	2+2	4	CAN1103c	<i>Data Communications</i>	2+1	3
MATH1112c	<i>Statistics for Engineers</i>	2+1	3	ASE1102c	<i>Materials Science &amp; Engineering</i>	2+1	3
PROG1114c	<i>Programming for Engineers</i>	2+2	4	PROG1114c	<i>Programming for Engineers</i>	2+2	4
ASE1103c	<i>Measurement &amp; Instrumentation</i>	2+1	3	ITE1104c	<i>Legal Issues &amp; Professional Ethics for Engineers</i>	2+1	3
COMM1106c	<i>Communication Workshop</i>	2+1	3	ACCF1109c	<i>Financial &amp; Management Accounting</i>	2+1	3

YEAR 2 (Level 2)							
Semester 3				Semester 4			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
MATH2147c	<i>Engineering Mathematics</i>	2+2	4	TELC2104c	<i>Antenna &amp; Radio Wave Propagation</i>	2+2	4
ELEC2102c	<i>Digital Electronics</i>	2+2	4	HCA2101c	<i>Microprogramming</i>	2+2	4
ASE2101c	<i>Health, Safety &amp; Risk in Engineering</i>	2+1	3	MKTG1109c	<i>Innovation &amp; Marketing</i>	2+1	3
ELEC2103c	<i>Electronic Circuits &amp; Design</i>	2+2	4	ELEC2103c	<i>Electronic Circuits &amp; Design</i>	2+2	4
ELEC2104c	<i>Signal &amp; Systems Analysis</i>	2+2	4	ELEC2104c	<i>Signal &amp; Systems Analysis</i>	2+2	4
HCA2102c	<i>Microprocessor Design &amp; Organisation</i>	2+1	3	MATH2148c	<i>Advanced Engineering Mathematics</i>	2+2	4

Year 3 (Level 3)							
Semester 5				Semester 6			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
HCA3110c	<i>Embedded Systems &amp; Design</i>	2+2	4	HCA3110c	<i>Embedded Systems &amp; Design</i>	2+2	4
SEM3107c	<i>Project Management for Engineers</i>	2+1	3	MATH3149c	<i>Scientific Computing</i>	2+2	4
TLEC3110c	<i>Electromagnetic Compatibility</i>	2+1	3	SCG3112c	<i>Artificial Intelligence</i>	2+2	4
ELEC3103c	<i>Human Machine Interface</i>	2+1	3	ELEC3102c	<i>Feedback Control</i>	2+1	3
SECU2109c	<i>Cryptography &amp; Network Security</i>	2+2	4	SEM4107c	<i>Quality Assurance &amp; Management Principles</i>	2+1	3
ASE3101c	<i>Research Methodology</i>	2+1	3	TELC3111c	<i>RF Systems and Design</i>	2+2	4

YEAR 4 (Level 4)							
Semester 7				Semester 8			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
PROJ4201c	<i>Professional Work Placement</i>	-	3		<i>Elective 2</i>	-	3
	<i>Elective 1</i>	-	3		<i>Elective 3</i>	-	3
PROJ4113c	<i>Individual Project</i>	-	-	PROJ4113c	<i>Individual Project</i>	-	9

**P. BEng (Hons) Electronic Engineering – Part Time (Version 2.6)**

YEAR 1							
Semester 1				Semester 2			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
ASE1101c	<i>Principles of Engineering</i>	2+1	3	MATH1112c	<i>Statistics for Engineers</i>	2+1	3
MATH1145c	<i>Foundation Mathematics</i>	2+2	4	PROG1113c	<i>Programming for Engineers</i>	2+2	4
ITE1104c	<i>Legal Issues &amp; Professional Ethics for Engineers</i>	2+1	3	ELEC1102c	<i>Analogue Electronics</i>	2+2	4
COMM1106c	<i>Communication Workshop</i>	2+1	3	ASE1103c	<i>Measurement &amp; Instrumentation</i>	2+1	3
→ <b>Start of Level 1</b>							

YEAR 2							
Semester 3				Semester 4			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
CAN1103c	<i>Data Communications</i>	2+1	3	MATH2147c	<i>Engineering Mathematics</i>	2+2	4
PROG1113c	<i>Programming for Engineers</i>	2+2	4	ELEC2104c	<i>Signal &amp; Systems Analysis</i>	2+2	4
ASE1102c	<i>Material s Science &amp; Engineering</i>	2+1	3	ELEC2102c	<i>Digital Electronics</i>	2+2	4
ACCF1109c	<i>Financial &amp; Management Accounting</i>	2+1	3	ASE2101c	<i>Health, Safety &amp; Risk in Engineering</i>	2+1	3
<b>End of Level 1 →</b>				<b>→ Start of Level 2</b>			

YEAR 3							
Semester 5				Semester 6			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
HCA2102c	<i>Microprocessor Design &amp; Organisation</i>	2+1	3	HCA2101c	<i>Microprogramming</i>	2+2	4
ELEC2104c	<i>Signal &amp; Systems Analysis</i>	2+2	4	TELC2104c	<i>Antenna &amp; Radio Wave Propagation</i>	2+2	4
MATH2148c	<i>Advanced Engineering Mathematics</i>	2+2	4	MKTG1109c	<i>Innovation &amp; Marketing</i>	2+1	3
ELEC2103c	<i>Electronic Circuits &amp; Design</i>	2+2	4	ELEC2103c	<i>Electronic Circuits &amp; Design</i>	2+2	4
				<b>End of Level 2 →</b>			

YEAR 4							
Semester 7				Semester 8			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
HCA3110c	<i>Embedded Systems &amp; Design</i>	2+2	4	HCA3110c	<i>Embedded Systems &amp; Design</i>	2+2	4
MATH3149c	<i>Scientific Computing</i>	2+2	4	ASE3101c	<i>Research Methodology</i>	2+1	3
ELEC3103c	<i>Human Machine Interface</i>	2+1	3	TELC3110c	<i>Electromagnetic Compatibility</i>	2+1	3
SECU2109c	<i>Cryptography &amp; Network Security</i>	2+1	3	ELEC3102c	<i>Feedback Control</i>	2+1	3
<b>→ Start of Level 3</b>							

YEAR 5							
Semester 9				Semester 10			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
TELC3111c	<i>RF Systems and Design</i>	2+2	4	PROJ4201c	<i>Professional Work Placement</i>	-	3
SEM3107c	<i>Project Management for Engineers</i>	2+1	3		<i>Elective 1</i>	-	3
SCG3112c	<i>Artificial Intelligence</i>	2+2	4				
SEM4107c	<i>Quality Assurance &amp; Management Principles</i>	2+1	3	PROJ4113c	<i>Individual Project</i>	-	-
<b>End of Level 3 →</b>				<b>→ Start of Level 4</b>			

YEAR 6							
Semester 11				Semester 12			
Code	Module Title	Hrs/ Wk L+T/P	Credits	Code	Module Title	Hrs/ Wk L+T/P	Credits
	<i>Elective 2</i>	-	3		<i>Elective 3</i>	-	3
PROJ4113c	<i>Individual Project</i>	-	-	PROJ4113c	<i>Individual Project</i>	-	9
				<b>End of Level 4 →</b>			

List of Electives			
Code	Module Title	Hrs/ Wk L+T/P	Credits
ELEC4104c	<i>VLSI Design &amp; Technology</i>	2+1	3
ELEC4105c	<i>Optoelectronics</i>	2+1	3
SCG4101c	<i>Digital Image Processing</i>	2+1	3
TELC3108c	<i>Mobile Communication Engineering</i>	2+2	3
CAN4101c	<i>Advanced Network Processing</i>	2+1	3



## **Q. MODULE OUTLINE**

### **ACCF1109c: FINANCIAL & MANAGEMENT ACCOUNTING (2+1)**

Included topics are balance sheets, Funds flow statements. Profit & loss statements. Cash flow analysis. Capital investment appraisal. Capital budgeting. Ratio analysis. Fixed & variable costs. Cost-volume analysis & budgetary control.

### **ASE1101c: PRINCIPLES OF ENGINEERING (2+1)**

Mechanical and electrical systems and applications; electric circuits and applications; Analysis of electrical circuits; Resistive Networks: Ideal circuit elements; linear resistors; Ohms Law, Kirchoffs law; Source transformations; Power matching; Thevenin and Norton theorems; Nodal and loop method of analysis; Energy storage Elements: Transition from electromagnetic and electrostatic ideas to the linear capacitor and inductor, input and output impedances, phase, Db; Maximum available power, Circuit analysis with time-dependent excitation. Steady behaviour of individual R, L and C elements to sinusoidal excitation. Transient Analysis: Step signals in RC and RL circuits; Energy calculations.

### **ASE1102c: MATERIALS SCIENCE AND ENGINEERING (2+1)**

Materials & their structures, selected elements from Periodic Table, carrier transport: electrons & concepts of holes; density of selected elements. Composition of materials. Phase diagram sources. Thermodynamic & kinetic data (Bond strength; Melting point; solubility; phase change thermodynamic). Thermal properties (conductivity & expansion). Mechanical properties (tensile, compressive, yield, flexural & shear strength; hardness; fatigue strength). Electrical properties (conductivity & resistivity; Dissipation factor; dielectric strength; tangent loss). Optical properties (transmission range & dispersion; transparency & refractive index). Chemical properties (galvanic series of metals; corrosion rate; flammability); Magnetic Materials: moment, magnetisation, field intensity, susceptibility. Diamagnetic, para-magnetic & ferro-magnetic materials.

### **ASE1103c: MEASUREMENT AND INSTRUMENTATION (2+1)**

Measurement principles, units and standards. Continuous, discrete and periodic signals in both the time domain and the frequency domain. Data analysis, errors, accuracy and statistics. Instrument calibration. Meters (voltmeter, ammeter, ohmmeter) and bridges (AC/DC). Oscilloscopes, signal sources, spectrum analysers & frequency counters. Transducers, temperature measurement, strain, pressure, motion and light.

### **ASE2101c: HEALTH, SAFETY & RISK IN ENGINEERING (2+1)**

Safety and Health Movement, Then and Now: Ethics and Safety, Roles and Professional Certifications for Safety and Health Personnel; Safety Management in a TQM Setting: Promoting Safety, Safety and Health Training, The OSH Act (2005)- Standard, Regulation & Practice. Comparisons with other countries.

### **ASE3101c: RESEARCH METHODOLOGY (2+1)**

Research view, documenting, literature review, research ethics, research support, research proposals, tools of research, creativity, synthesis and evaluation, research types, measurement, analysis, models and simulations, optimization, writing the piece of work, presentation.

### **CAN1103c: DATA COMMUNICATIONS (2+1)**

Communications Model; Data Communications; Overview of Networking; Protocols characteristics and functions; Protocol Architectures; Data Transmission concepts & terminologies; Transmission Impairments; Nyquist formula and Shannon's Capacity; Transmission Media: Guided & Wireless; Encoding and Modulation Techniques; Asynchronous and Synchronous Data Transmission; Flow Error Control Techniques; Multiplexing Techniques.

### **CAN4101c: ADVANCED NETWORK PROCESSING (2+1)**

Congestion Control: TCP performance and multicast, Quality of Service: definition, architectures, policies, Traffic and performance engineering, Families of network processor architectures, Fundamental principles in network processors, NP system hierarchy, Scaling issues, Case studies, NP programming, instructions, Packet classification languages, controlling packet flow.

### **COMM1106c: COMMUNICATION WORKSHOP (2+1)**

Development of key communication skills required by a Telecom / Electronic engineer, Techniques for presentation, interviewing, report-writing, meetings, negotiations, drafting of contracts and tender/marketing document, Quantitative appraisal of documentation: FOG index.

**ELEC1102c: ANALOGUE ELECTRONICS (2+2)**

Analogue v. Digital, amplification, signal processing, oscillators, measurement instrumentation. Qualitative description and applications of: diodes, transistors, photo-detectors, operational amplifier, more esoteric devices. The ideal op-amp, gain control, sample circuits, photo-detection, integrator and differentiator, high/low pass filters, rectifier, logarithmic amplifier, DAC/ ADC. The real op-amp, gain bandwidth, input offset voltage, input bias current, CMRR, input and output impedances, bipolar JFET and CMOS op-amps.

**ELEC2102c: DIGITAL ELECTRONICS (2+2)**

Numbers & Character Systems: General system of numbers, Decimal & binary system, MSB & LSB. Number system conversion. Binary arithmetic. Signed numbers, magnitude, complement. 1s & 2s complement. Binary, weighted, complementary, error-detecting, mechanical codes. Floating-point numbers. ASCII. Combinational & Binary Logic. Logic functions: AND, OR, NOT. Truth table. Boolean Algebra, Boolean postulates & theorems. Principle of duality. Logic gates. Canonical forms - sum of products, product of sums. Minimisation of Boolean functions - Karnaugh map. NAND & NOR implementations of logic functions. Multiple-input gates. Minimisation. half & full-adders, half & full-subtractors, Muxers. Decoder & Encoder. Sequential Logic: Memory, feedback, synchronous & asynchronous. Basic SR, gated SR, D-type, Master-slave, J-K Latches. Shift Registers. Counters.

**ELEC2103c: ELECTRONIC CIRCUITS & DESIGN (2+2) x 2 SEMESTERS**

Filters: Frequency domain analysis, gain and phase and use of the s variable. Types of filter response, low-pass, band-pass etc. and relation to the transfer function. Design of low-order active filters from pole-zero locations. Butterworth, Chebyshev & Elliptic responses with design from tables & computer programs. Small-signal analysis with matrix-based nodal analysis for circuits using operational amplifiers. Computer-based analysis in the frequency and time domain. Circuits & systems: Instrumentation & logarithmic amplifiers, oscillators & mixers. Analysis & design considering temperature compensation & stability. Understand principles of VLSI theory with respect to Complementary Metal Oxide Silicon circuits. NMOS & CMOS basic circuits. CMOS, Pseudo-NMOS, Dynamic CMOS logics. PLA structures. Design Entry using symbolic sticks notation. Circuit Level Simulation. Mask Level Layout & Floor-planning. Logic Level Simulation.

**ELEC2104c: SIGNALS & SYSTEM ANALYSIS (2+2) x 2 SEMESTERS**

Basic continuous time signals including step, pulse, impulse and sinusoidal signals. Mean square, energy and power. Linear models, integrator, first and second order differential equations. Laplace transform, step responses of first and second order systems, impulse response. Transfer functions. Block diagrams, convolution. Introduction to simulation software package e.g. SIMULINK. Modelling of simple mechanical, electrical systems and operational amplifier circuits. Frequency response, Bode plots, and introduction to filters. Fourier series and Fourier transforms. Amplitude and Frequency modulation. Experiments for first and second order systems. Data analysis using e.g. MATLAB. Digital signals sampling requirements, anti-aliasing. Digital systems difference equations, responses of digital systems. The z-transform, z-plane pole-zero representations, frequency response. Discrete Fourier transform (DFT), overview of Fast Fourier transform (FFT). Spectra of signals, leakage and windowing. Examples of DSP using e.g. MATLAB. Overview of DSP hardware.

**ELEC3102c: FEEDBACK CONTROL (2+1)**

Control objectives and feedback systems. Transfer function description of dynamical systems; open loop, closed loop, and error transfer functions. Laplace transforms and system response. Final Value theorem and steady state errors. Pole-Zero diagrams and Root Locus methods. Bode and Nyquist Diagrams. Stability, Hurwitz-Routh and simplified Nyquist criteria; Gain and phase margins. Introduction to PID, lead, lag, and lead/lag controllers. Introduction to modern control methods.

**ELEC4104c: VLSI DESIGN AND TECHNOLOGY (2+1)**

Circuit Characterization & Performance Estimation: Resistance & capacitance estimation, switching characteristics, CMOS gate transistor sizing, power dissipation, sizing routing conductors, charge sharing designing margining yield & reliability. Design of Memory & Programmable Logic: SRAM, DRAM, ROM and Logic ARRAYS. System Level Physical Design: Large scale physical design, crosstalk, interconnected delay modelling, interconnected scaling, floor planning & routing, I/P & O/P circuit, power dissipation & consumption, low power design considerations. VLSI clocking & system design: Clocked Flip-flop, CMOS clock styles, Pipelined systems, Clock generation & distribution, system design considerations. CMOS Testing: The need for testing, manufacturing test principles, design test strategies, chip level & system level test techniques, Layout design for improved testability. Hardware Description Language: Basic concepts, structural gate-level and switch-level modelling, design hierarchies, behavioural and RTL modelling.

**ELEC4105c: OPTOELECTRONICS (2+1)**

Crystals and elements of crystal structure; Energy bands in semiconductors; Electron dynamics, energy levels, quantum confinement, Statistical Mechanics of electrons and holes, elements of carrier transport; Optical processes in semiconductors; Optical waves: propagation in solids, waveguides; Junctions:  $p$ - $n$  junctions, Schottky barriers and Ohmic contacts, heterojunctions; Light-emitting diodes; Injection lasers; Photodetectors: photoconductors, photodiodes, avalanche photodiodes; Solar cells; Optoelectronic switching and modulation; Optoelectronics integrated circuit and optical networks

**HCA2101c: MICROPROGRAMMING (2+2)**

Basic Concepts: Princeton v/s Hardware Architectures, RISC vs. CISC, Pipelining, Superscalar architectures. Assembler Overview: Program Structure: .STACK, .DATA, .CODE segments. Introduction to Macros: Macro for I/O; DOS function calls; Numeric I/O and Magic Numbers. Arithmetic: Addition, Subtraction, Multiplication, Division; Signed and unsigned integer operations. Comparing & Branching: Decision-making; Conditional jumps and looping; Instruction timing. Subprograms & Stack: Public Keyword, Call & Ret, Stack Operations. Macros: Macro declarations & expansion; Parameters; Pseudo-macros. Arrays & File Processing: ;Addressing, Arrays, Byte Swapping, Opening, creating, reading, writing and closing files. Advanced bit operations & Floating Point Unit: Shifts and Rotates, FPU Data and Stack, FPU Arithmetic and I/O. Memory Structure: Segments and Offset; Addressing modes; Types and rules of address expressions. Interrupts: 80X86 Interrupt processing; Interrupts handlers.

**HCA2102c: MICROPROCESSOR DESIGN & ORGANISATION (2+1)**

Computer architecture and organisation, Structure, functions and operations of modern computers, data processing, Instruction Set Architecture. Computer Evolution and Performance: Commercial computers, Moore's Law, Latency & Throughput, Ahmdahl's Law, Benchmark. Buses: Program Concept, Control Unit, Machine Cycle, State Diagrams, Interrupts, Bus types, Arbitration and Timing. Peripheral Component Interconnect Bus. Memory: Cache: characteristics, performance, design and mapping. Internal memory: type, structure, error correction, memory hierarchy. External memory: magnetic media, RAID, optical media. Input/Output: I/O modules and mapping, Polling, Programmed I/O, Interrupts, DMA. Computer Arithmetic: Arithmetic Integer operations: addition, multiplication and negation. FP arithmetic. Boolean Algebra.

**HCA3110c: EMBEDDED SYSTEMS AND DESIGN (2+2) x 2 SEMESTERS**

Embedded systems are a combination of hardware and software and run critical areas like communication, transportation and energy systems. This module provides crucial knowledge required to understand, analyze and design embedded systems and real time programming. Outline: Introduction to Embedded Systems; Processor and Memory organization; Devices and Buses for Device networks; Device Drivers and Interrupts Servicing Mechanism; Programming concepts and embedded programming in C/C++, Microprogramming; Program Modelling Concepts for Software-Development Process; Software Engineering Practices in the Embedded Software Development Process; Inter-Process Communication & Synchronization of processes, tasks and threads; Real Time Operating Systems.

**ITE1104c: LEGAL ISSUES & PROFESSIONAL ETHICS FOR ENGINEERS (2+1)**

Philosophical foundations of scientific ethics, Legal & ethical principles guiding the development of Engineering, Public accountability & transparency, Capacity building on ethical Issues, Media outreach on ethical issues, International cooperation, Patenting rights & issues, Business ethics & corporate social responsibility, Ethical standards for Engineering industry, Ethical problems & dilemmas in the Interaction between science & media, The ethics of collecting & processing data & publishing results of scientific research, Integrity & misconduct in Research & Development, Legal aspects of academic dishonesty.

**MATH1112c: STATISTICS FOR ENGINEERS (2+1)**

Probability: random variables, distribution and density functions, expectations. Normal distribution, Central Limit Theorem. Estimation of parameters: moment & maximum likelihood methods, confidence intervals. Regression: least square fit, correlation. QC: acceptance sampling, reliability, failure, Weibull distribution.

**MATH1145c: FOUNDATION MATHEMATICS (2+2)**

Functions and coordinate geometry (Composite & Inverse functions, Modelling of periodic phenomena with trigonometric functions). Introducing MATLAB. Complex numbers. (Differentiation/Integration, Applications to related rate of change & optimization problems, Integration by parts). Vector Algebra & Geometry (2D/3D vectors, Equations of lines and planes, Application to motion & kinematics). Sequences & series (Convergence, Power series, Taylor polynomials, ODEs). Solving mathematical / engineering problems with high-performance languages (e.g. MATLAB).

**MATH2147c: ENGINEERING MATHEMATICS (2+2)**

Matrix Algebra (Matrix operations, Solution of linear system of algebraic equations, Eigenvalues & eigenvectors). Calculus (Logarithmic differentiation, Improper integrals). Fourier series & Fourier integrals (Periodic functions, Euler formulae for Fourier coefficients, Fourier transformations, Linearity property, transform of derivatives, convolution theorem, Gamma & Beta functions, Error functions). Boundary value problems & systems of ODEs. Multi-variable calculus (Partial derivatives, Directional derivatives, Chain rule, Maxima & minima). Solving mathematical/engineering problems using high-performance language for technical computing (e.g. MATLAB).

**MATH2148c: ADVANCED ENGINEERING MATHEMATICS (2+2)**

Complex analysis (Functions of complex variables, Differentiation integration of complex functions, Line integrals in the complex plane). Integral transforms (Laplace transforms). Statistics (Probability density function, Distribution function of random variables, Joint density function of multivariate random functions. Sampling distributions. Estimation of variances (Hypotheses concerning one variance and two variances). Solving engineering problems using high-performance language for technical computing (e.g. MATLAB).

**MATH3149c: SCIENTIFIC COMPUTING (2+2)**

Numerical Analysis, Errors in numerical computations, Numerical solution of algebraic and transcendental equations, Polynomial interpolation, Finite difference and finite element methods, Numerical differentiation, Numerical integration, Numerical solution of differential equations. Solving mathematical / engineering problems using high-performance language for technical computing (e.g. MATLAB).

**MKTG1109c: INNOVATION & MARKETING (2+1)**

Understand the fundamental principles of marketing in relation to engineering and business; Demonstrate their understanding of innovation and the role of innovation within marketing; Appreciate the importance of marketing research for successful businesses; Identify market segmentation models and relate them to targeting and positioning within business; Understand organisational and consumer buying behaviour; Understand the importance of the marketing mix with particular reference to new product development.

**PROG1113c: PROGRAMMING FOR ENGINEERS (2+2) X 2 SEMESTERS**

Basic I/O, Basic data types. Sequence, selection and iteration, Use of control graph. Introduction to procedural programming, Use of call graph. Implementation of simple algorithms. Elementary code inspection and testing. Fundamental quality attributes of code. Introduction to professional programming conventions and protocols. Implementation using abstract structures, referential data types. Use of file I/O. Implementation of a few complex algorithms/ data structures. Introduction to OOP paradigm: Class, object, association, inheritance, polymorphism. Programming workshops in C++ or Java JDK. Implementation of generic data structures in OOP (stack, linked lists etc). Use of Objects in ADT. Testing of OO code. Quality attributes of OO code.

**PROJ4201c: PROFESSIONAL WORK PLACEMENT (15 weeks)**

Students will be attached to an ICT company or organization for a period of at least 15 weeks. Students will have the opportunity to apply theoretical knowledge to solve real world problems and to work within the organisational structure of the company. Students will have to complete a certain number of mini-projects (decided by the School) out of a list of areas. The list of areas will be provided to the students. This module is compulsory and is assessed by both UTM and external supervisors in a discussion panel. Students therefore have to perform satisfactorily in this module before qualifying for the award of the degree. An Professional WorkPlacement Handbook will be provided to the students.

**SCG3112c: ARTIFICIAL INTELLIGENCE (2+2)**

Brief overview of AI: classes of models, applications and software environment. Defining competing/complementary terminology: AI, Expert Systems & Knowledge-based-systems, Robotics. Intelligent agents. Introduction to various types of agents: problem-solving, knowledge-based, planning, acting under uncertainty, learning, communicating. Introduction to LISP /Prolog.

**SCG4101c: DIGITAL IMAGE PROCESSING (2+1)**

Basics: Image/video acquisition and display, properties of the human visual systems, colour representations, sampling, quantization, and image transforms. Common image formats, basic principles of compression for images and videos, motion estimation and compensation for videos, popular standards such as JPEG, and MPEG. Manipulation, Enhancement, and Restoration: image warping, contrast enhancement, interpolation, dithering, etc. Topics such as feature extraction, image registration, simple recognition and content analysis, visible and invisible watermarking.

**ELEC3103c: HUMAN MACHINE INTERFACE (2+1)**

System interface, User models in design, cognitive psychology, human perception, input/output devices, controllers, PLC, design principles, menu design, windows controls, software use (e.g. Labview), HMI programming (use of Visual Tools), data access via internet, storyboards, Usability principles, analysis and design, prototyping, evaluation techniques

**SECU2109c: CRYPTOGRAPHY AND NETWORK SECURITY (2+2)**

Introduction: Security needs, services and mechanisms. ITU-T X.800. Classical Cryptography: Mono-alphabetic, poly-alphabetic, transposition, and product ciphers; Rotor machines. Modern Cryptography: Block & stream ciphers; Feistel cipher; DES; 3-DES; Rijndael (AES): operation and implementation. Public Key Encryption: Number Theory; Euler Totient Function; Chinese Remainder Theorem; Primality Testing; Miller- Rabin. RSA: Algorithm, Implementation and Security. Authentication: MAC and Hash functions; SHA-1: Implementation and Security; Diffie-Hellman Key Algorithm and Exchange; Digital signatures. Kerberos and X.509 certificates. SSL and IPsec. Computer Malware, Network defences and IDS.

**SEM3107c: PROJECT MANAGEMENT FOR ENGINEERS (2+1)**

Project Management Fundamentals, Feasibility Study for large technical projects, Project Planning, Project organization, Techniques for Project Scheduling, Resource management, Risk management, Budgeting & Cost Management, Communications management, Procurement management, Project Monitoring, Managing technical people, Project Evaluation and Termination.

**SEM4107c: QUALITY ASSURANCE AND MANAGEMENT PRINCIPLES (2+1)**

Purchasing Principles and Management; Stores Management and Control; Procurement Management: Identifying the Procurement Requirement, Scanning the Market, Requesting for Tenders, Evaluating tenders, awarding contracts and holding debriefing sessions, maintaining a positive and ethical trading relationship, contract management including preventive and curative approaches; Central Tender Board Act 1994 and the Concessions Act 1997; Dispute Resolutions; Negotiation, Arbitration and Litigations, ISO.

**TELC3110c: ELECTROMAGNETIC COMPATIBILITY (2+1)**

Emission issues. Susceptibility or immunity issues. Coupling Mechanisms. Conductive Coupling. Inductive coupling, Capacitive coupling. Magnetic coupling. Radiative Coupling. Types of Interference (Continuous, Pulse or Transient, Conduction). EMC Design. Laws and regulators (FCC, ETSI, BSI).

**TELC2104c: ANTENNA AND RADIO WAVE PROPAGATION (2+2)**

Antenna Fundamentals, Hertzian dipoles, Yagi antenna, Antenna Parameters, Safety Precaution, Antenna Arrays, 2-element array, broadside, end-fire, n-element array, multiplication of arrays, binomial arrays, array factor, Radio Wave Propagation, troposphere, Process of refraction, Earth Curvature, Modelling of the ionosphere, Ionosphere propagation, Reflection from the ionosphere, Surface wave propagation

**TELC3111c: RF SYSTEMS AND DESIGN (2+2)**

RF and wireless Technology. RF systems overview (Satellite, Radar, mobile etc), Transmitter and receiver system architecture, Modulation and Detection, Inter-symbol Interference, Non-linearity and time-invariance, use of ABCD parameters, Insertion loss, typical filter, Filter design, System stability, Return loss, Other components design, Distortion, path loss analysis, System Noise Figure, Sensitivity and Dynamic Range, sub-system architecture.

**TELC3108c: MOBILE COMMUNICATION ENGINEERING (2+1)**

Mobile communication Engineering overview, mobile-radio communication design, cellular concepts, Capacity related issues, blocking probability, Markov models and Erlangs, Mobile-radio signal environment, Statistical communication theory, Propagation models, Propagation mechanisms and effects, Large scale channel models, fading models, Received-Signal Envelope characteristics. Received-Signal Phase characteristics, Introduction to 3G and concept of spreading codes