UNIVERSITY of TECHNOLOGY, MAURITIUS

School of Innovative Technologies and Engineering

Department of Industrial Systems Engineering

BEng (Hons) Electronic Engineering (Top-Up)

PROGRAMME DOCUMENT

VERSION 1.1
BEETP v1.1
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University of Technology, Mauritius
La Tour Koenig, Pointe aux Sables, Mauritius
Tel: (230) 207 5250 *Fax:* (230) 234 1747 *Email:* site@umail.utm.ac.mu
Website: www.utm.ac.mu

BEng (Hons) ELECTRONIC ENGINEERING (Top-Up)

A. Programme Information

By far, the 21st 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.

This Top-Up programme will allow students with an existing related engineering background to deepen their knowledge and learn new skills. Moreover, in their last level, students will have an industrial attachment for one full semester so that they can apply their theoretical knowledge to solve real-world problems in engineering. Students will have to complete a final year individual project to be qualified for the BEng programme.

Bridge Modules

The bridge modules are introduced in the programme and the aims is to provide an introduction to fundamental and important topics such as foundation and engineering maths, principles of engineering, material science, analogue and digital electronics and legal issues and professional ethics amongst others in order to ensure that the students have sufficient knowledge and aptitude to cope with the more advanced modules that follow as well as to ensure that they have same knowledge and skills as full time students who are following four-year BEng programme in order to be able to apply their engineering skills, combining theory and experience, and to use other relevant knowledge and skills which include knowledge of characteristics of particular materials, equipment, processes, or products, workshop and laboratory skills, knowledge of quality issues, knowledge of codes of practice and industry standards, ability to work with technical uncertainty etc.

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.

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'

E. Programme Entry Requirements

Holding an HSC in Mathematics or GCE in Mathematics at Advanced Level **and** one of the following subjects: Physics, Chemistry, Design and Technology, or any other applied science subject acceptable to the APL/APEL committee at HSC, GCE Advanced, or Baccalaureate Levels.

AND

Holding either a Higher National Diploma (HND) in Instrumentation & Control Engineering or a Higher National Diploma (HND) in Electrical & Electronics Engineering or a Diploma in Applied Electrical & Electronic Engineering from the MITD; an Advanced Technician Diploma or Full Technological Diploma in Electrical and Electronic Engineering from the City and Guilds of London Institute; or any other relevant and appropriate qualification pitched at Level 6 of the MQA National Qualifications Framework, acceptable to the APL/APEL committee.

F. Programme Mode and Duration

Full Time: 2.5 Years (5 Semesters)

Part Time: 3.5 Years (7 Semesters)

G. Teaching and Learning Strategies

- Lectures, Tutorials and Practicals
- Class Test and Assignments
- Industrial Placement, Workshops, Seminars and Lab sessions
- Structured Discussions and Self-Directed Study
- Case Study materials and scenarios centred on real-world problems

H. Student Support and Guidance

- Student Counselling
- Supervision

I. Attendance Requirements

- As per UTM's Regulations and Policy

J. Credit System

- 1 module = 3, 4 or 8 credits

K. Student Progress and Assessment

For the award of the degree, all modules must be passed overall with passes in the examinations, coursework and other forms of assessment.

All modules will carry 100 marks and will be assessed as follows (unless otherwise specified):

Written examination, inclusive of reading time, of duration of 2 - 3 hours for modules carrying 3 credits and not less than 3 hours for modules carrying 4 credits or above; Continuous assessment may vary up to a maximum of 100% of the total module marks. Continuous assessment can be based on seminars, practical labs, workshops, field study and/or assignments or class tests; The overall pass mark for a module is 40%.

L. Evaluation of Performance

The percentage mark at Level 3 contributes a 40% weighting towards the degree classification.

The percentage mark at Level 4 contributes a 60% weighting towards the degree classification.

Maximum marks attainable for each level are:

Level 3	1200 marks
Level 4	1300 marks

Grading Structure

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

M. Award Classification

Overall weighted mark y (%)	**Classification**
$y \geq 70$	1st Class Honours
$60 \leq y < 70$	2nd Class 1st Division Honours
$50 \leq y < 60$	2nd Class 2nd Division Honours
$45 \leq y < 50$	3rd Class Honours
$40 \leq y < 45$	Pass Degree
$y < 40$	No Award

N. Programme Organisation and Management

Programme Director and Coordinator: 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 (Top-Up) – Full Time (Version 1.1)

YEAR 1 (Level 3)							
Semester 1				Semester 2			
Code	**Module Title**	**L+T/P**	**Credits**	**Code**	**Module Title**	**L+T/P**	**Credits**
ASE1102C	Material Science and Engineering	2+1	3	HCA3110C	Embedded Systems & Design	2+2	4
MATH2147	Engineering Mathematics	2+2	4	TLEC3110C	Electromagnetic Compatibility	2+1	3
ELEC1201	Engineering Principles and Measurements	3+1	3	ELEC3103C	Human Machine Interface	2+1	3
ELEC1102	Analogue Electronics	2+2	4	TELC2104C	Antenna & Radio Wave Propagation	2+2	4
ELEC2103	Digital Electronics	2+2	4	MATH2328C	Scientific Computing	2+2	4
ITE1104	Legal Issues & Professional Ethics for Engineers	2+1	3	ELEC3102C	Feedback Control	2+1	3

YEAR 2 (Level 3 & 4)							
Semester 3				Semester 4			
Code	**Module Title**	**L+T/P**	**Credits**	**Code**	**Module Title**	**L+T/P**	**Credits**
HCA3110C	Embedded Systems & Design	2+2	4	SEM3107C	Project Management for Engineers	2+1	3
SEM4107	Quality Assurance & Management Principles	2+1	3	TELC3111	RF Systems and Design	2+2	4
SCG3112C	Artificial Intelligence	2+2	4	ASE3101	Research Methodology	2+1	3
	Elective 1	-	3 or 4	PROJ4113C	Engineering Project	-	-

Year 3 (Level 4)			
Semester 5			
Code	**Module Title**	**L+T/P**	**Credits**
PROJ4201	Industrial Attachment	-	3
PROJ4113C	Engineering Project	-	9
	Elective 2	-	3 or 4

P. BEng (Hons) Electronic Engineering (Top-Up) – Part Time (Version 1.1)

YEAR 1 (Level 3)							
Semester 1				Semester 2			
Code	**Module Title**	**L+T/P**	**Credits**	**Code**	**Module Title**	**L+T/P**	**Credits**
ASE1102C	Material Science and Engineering	2+1	3	ELEC2103	Digital Electronics	2+2+0	4
MATH2147	Engineering Mathematics	2+2	4	ITE1104	Legal Issues & Professional Ethics for Engineers	2+1	3
ELEC1201	Engineering Principles and Measurements	3+1	3	TLEC3110C	Electromagnetic Compatibility	2+1	3
ELEC1102	Analogue Electronics	2+2+0	4	TELC2104C	Antenna & Radio Wave Propagation	2+2	4

YEAR 2 (Level 3)							
Semester 3				Semester 4			
Code	**Module Title**	**L+T/P**	**Credits**	**Code**	**Module Title**	**L+T/P**	**Credits**
HCA3110C	Embedded Systems & Design	2+2	4	HCA3110C	Embedded Systems & Design	2+2	4
ELEC3103C	Human Machine Interface	2+1	3	SEM3107C	Project Management for Engineers	2+1	3
SEM4107	Quality Assurance & Management Principles	2+1	3	MATH2328C	Scientific Computing	2+2	4
ELEC3102C	Feedback Control	2+1	3				

YEAR 3 (Level 4)							
Semester 5				Semester 6			
Code	**Module Title**	**L+T/P**	**Credits**	**Code**	**Module Title**	**L+T/P**	**Credits**
TELC3111	RF Systems and Design	2+2	4	PROJ4201	Industrial Attachment	-	3
SCG3112C	Artificial Intelligence	2+2	4		*Elective 1*		3 or 4
ASE3101	Research Methodology	2+1	3				
				PROJ4113C	Engineering Project		-

Year 4 (Level 4)				
Semester 7				
	Module Title	**L+T/P**	**Credits**	
PROJ4113C	Engineering Project	-	9	
	Elective 2	-	3 or 4	

List of Electives			
Code	**Module Title**	**L+T/P**	**Credits**
ELEC4104C	VLSI Design & Technology	2+1	3
ELEC4105C	Optoelectronics	2+1	3
SCG4101C	Digital Image Processing	2+1	3
TELC3108C	Mobile Communication Engineering	2+1	3
CAN4101C	Advanced Network Processing	2+1	3

Q. MODULE OUTLINE

ASE1102C: MATERIALS SCIENCE AND ENGINEERING (2+1) – BRIDGE MODULE
Materials & their structures (metals, semiconductors & insulators), 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.

ELEC1201 - ENGINEERING PRINCIPLES AND MEASUREMENTS (3+1) – BRIDGE MODULE
Analysis of electrical circuits; Measurement of Resistance, Inductance, and Capacitance; Earth resistance measurement using Megger and by fall of potential methods; Resistive Networks; Ideal circuit elements; linear resistors; Ohms & Kirchoffs laws; Source transformations; Power matching; Thevenin and Norton theorems; Circuit Analysis; Energy storage Elements; 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: Anderson bridges; Sources and detectors; Extension of Instrument Ranges: Shunts and multipliers; Measurement of Power and Related Parameters; Measurement of real & reactive power in three-phase circuits; Induction type energy meter; Principle of working of electronic energy meter; Electronic Instruments; Transducers; Strain gauges; LVDT; Temperature measurements; Photo-conductive and photo-voltaic cells.

ELEC1102C: ANALOGUE ELECTRONICS (2+2) – BRIDGE MODULE
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.

ELEC2103C: DIGITAL ELECTRONICS (2+2) – BRIDGE MODULE
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.

ITE1104C: LEGAL ISSUES & PROFESSIONAL ETHICS FOR ENGINEERS (2+1) – BRIDGE MODULE
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, Professional ethics.

MATH2326C: ENGINEERING MATHEMATICS (2+2) – BRIDGE MODULE
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).

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.

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.

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 ans 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, heterojunctions; Light-emitting diodes; Injection lasers; Photodetectors: photoconductors, photodiodes, avalanche photodiodes; Solar cells; Optoelectronic switching and modulation; Optoelectronics integrated circuit and optical networks

SEM4107: 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.

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.

TELC3111: 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.

ASE3101: 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.

MATH2328C: 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).

PROJ4201C: INDUSTRIAL ATTACHMENT (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 Industrial Attachment 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

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.

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

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

PROJ4113C: ENGINEERING PROJECT (1 LEVEL)
Project allows the student to work independently to put the knowledge of electronics engineering theory and telecommunication systems into practice.
The student will collect all necessary information and analyze it, build/fabricate a prototype or develop necessary software and/or hardware or work on a mathematical/empirical model. The student will test the hardware/software or the mathematical model/empirical developed vigorously by known testing methods. The student will prepare and submit a report on the project. Broadly the report shall have these parts: Introduction, literature review, data collection and analysis, experiments conducted, design, prototype development/software implemented/empirical model and conclusions. Acquaintance with survey and research methods and their usage in conducting a systematic investigation and style of report preparation shall form basis of evaluation. A detailed Telecom Project Handbook will be provided to students before starting the projects.