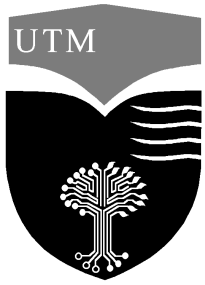

UNIVERSITY of TECHNOLOGY, MAURITIUS

School of Innovative Technologies & Engineering

Department of Industrial Systems Engineering

BEng (Hons) Telecommunications (Top-Up)

PROGRAMME DOCUMENT

VERSION 1.1
BTELTP v1.1
January 2015

University of Technology, Mauritius
La Tour Koenig, Pointe aux Sables, Mauritius
Tel: (230) 207 5250 *Fax:* (230) 234 1747 *Email:* site@utm.intnet.mu
website: www.utm.ac.mu

BEng (Hons) Telecommunications (Top-Up)

A. Programme Information

This top-up programme is designed to integrate telecommunication areas so that graduates can take up demanding, responsible and exciting positions in the rapidly expanding telecommunication industries. This programme will equip graduates to be the engineers of tomorrow while developing their professional qualities and skills as telecommunication engineers. They will also acquire the technical tools and abilities required for effective professional practice. The growth of telecommunications over the last ten years has been phenomenal and this expansion is set to continue for several decades. Networks, radio links and optical fibre systems are all being developed and now form the basis for global communications. The internet is the largest technological machine in the world with an enabling capability which affects us all, ranging from email, worldwide access to information and distributed computing, through to electronic marketing and commerce.

In third level, the modules are built to give the students an understanding of how to apply basic principles to more complex problems and helping them to develop sophisticated analysis methods and design. Hence, the work becomes more specialised with core modules such as Mobile Communication Engineering, Microwave Engineering, IP Telephony, RF Systems and Design and Telecommunications Standards. The last level deals with elective modules such as VLSI design and Technology, Satellite Communication systems and Optical fibre Communication systems. These modules deal with the details of how and why telecommunication systems work. Moreover, in the last level, students will be attached to industries for one full semester so that they can apply their theoretical knowledge to solve real world problems in Telecommunication and Electronic Engineering. The student will have to complete a final year project to be qualified for the BEng programme.

The 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, measurements and instrumentations, networks and switching techniques 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

The programme aims to provide the students with:

- a curriculum which provides a broader range of subjects to facilitate the development of skills, abilities, pursuit of interest and promotion of career development
- the ability to contribute to the new and modern development and management of electrical facilities and systems
- a wide range of transferable and marketable skills and knowledge leading to a variety of employment opportunities within the design and wider associated telecommunication engineering industries
- teaching and learning techniques which place emphasis on active and participative education
- the ability to apply modern technologies to solve various areas of engineering

C. Programme Objectives

After successful completion of the programme, students should be able to

- apply knowledge of mathematics, science modules and engineering
- design engineering system or process to meet specified performance, cost, time & safety
- identify, formulate and solve various telecommunication engineering problems
- apply knowledge to produce engineering solutions
- meet the expectations of the professional environment in relation to their intended careers

PART I - Regulations

D. General Entry Requirements

As per UTM'S Admission Regulations, and '*Admission to Programmes of Study at 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 *Diploma in Telecommunications* from the MITD;

a Diplôme Universitaire Supérieur de Technologie (DUST) in *Génie Électrique et Informatique Industrielle (GEII)* from the IST;

an Advanced Technician Diploma or Full Technological Diploma *in Electrical Engineering or or 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 Tests and Assignments
- Industrial Placement
- Workshops / Seminars / Lab Sessions
- Structured Discussions & Self Directed Study
- Case Study materials & 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 or 4 or 8 credits

Final Year Project = 9 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*):

(i) Written examinations inclusive reading time shall be of duration of 2-3 hours for 3-credit modules and not less than 3 hours for 4-credit modules and above.

(ii) Continuous assessment may vary up to a maximum of 100% of the total module marks. Continuous assessment can be based on a combination of assignments, field study, workshops and class tests.

(iii) The overall pass mark for a module is 40%.Grading

Grade	*Marks x(%)*
A	$x \geq 70$
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 3 contributes a 40% weighting towards the degree classification.
The percentage mark at Level 4 contributes a 60% weighting towards the degree classification.

The maximum marks attainable for each level are:

Level 3: 1200

Level 4: 1300

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 & Coordinator: Dr Vinaye Armoogum

Contact Details:

- Room: G2.12
- Telephone Number: 207 5250
- Email: varmoogum@umail.utm.ac.mu

PART II - Programme Structure

O. BEng (Hons) Telecommunications (Top-Up) – Full Time (Version 1.0)

YEAR 1 (Level 3)							
Semester 1				***Semester 2***			
Code	**Modules**	**L+T/P**	**Credits**	**Code**	**Modules**	**L+T/P**	**Credits**
ASE1102C	*Material Science and Engineering* ***(Bridge module)***	*2+1*	*3*	TELC3107C	IP Telephony	2+2	4
MATH2147C	*Engineering Mathematics* ***(Bridge module)***	*2+2*	*4*	TELC3108C	Mobile Communication Engineering	2+2	4
ELEC1201C	*Engineering Principles and Measurements* ***(Bridge module)***	*3+1*	*3*	MATH3149C	Scientific Computing	2+2	4
CAN1102C	*Networks* ***(Bridge module)***	2+1	3	TELC3109C	Telecommunications standards, regulation and legislation	2+1	3
CAN2113C	*Switching Techniques* ***(Bridge module)***	2+2	4	TELC3110C	Electromagnetic Compatibility	2+1	3
ITE1104C	*Legal Issues & Professional Ethics for Engineers* ***(Bridge module)***	2+1	3	SEM3107C	Project Management for Engineers	2+1	3

YEAR 2 (Level 4)							
Semester 3				***Semester 4***			
Code	**Modules**	**L+T/P**	**Credits**	**Code**	**Modules**	**L+T/P**	**Credits**
TELC3111C	RF Systems and Design	2+2	4	ASE3101C	Research Methodology	2+1	3
TELC3106C	Microwave Engineering	2+2	4	TELC3106C	Microwave Engineering	2+2	4
HCA3110C	Embedded Systems and Design	2+2	4	HCA3110C	Embedded Systems and Design	2+2	4
SECU4114C	Security in Telecommunications	2+2	4				
	Elective 1		*3/4*	PROJ4112C	Telecom Project		

YEAR 3 (Level 4)			
Semester 5			
Code	**Modules**	**L+T/P**	**Credits**
PROJ4201C	Industrial Attachment	-	3
PROJ4112C	Telecom Project		*9*
	Elective 2		*3/4*

P. BEng (Hons) Telecommunications (Top-Up) – Part Time (Version 1.0)

YEAR 1 (Level 3)							
	Semester 1				***Semester 2***		
Code	**Modules**	**L+T/P**	**Credits**	**Code**	**Modules**	**L+T/P**	**Credits**
ASE1102C	*Material Science and Engineering* ***(Bridge module)***	*2+1*	*3*	CAN2113C	*Switching Techniques* ***(Bridge module)***	2+2	4
MATH2147C	*Engineering Mathematics* ***(Bridge module)***	*2+2*	*4*	ITE1104C	*Legal Issues & Professional Ethics for Engineers* ***(Bridge module)***	2+1	3
ELEC1201C	*Engineering Principles and Measurements* ***(Bridge module)***	*3+1*	*3*	TELC3107C	IP Telephony	2+2	4
CAN1102C	*Networks* ***(Bridge module)***	2+1	3	TELC3108C	Mobile Communication Engineering	2+2	4

YEAR 2 (Level 3 & 4)							
	Semester 3				***Semester 4***		
Code	**Modules**	**L+T/P**	**Credits**	**Code**	**Modules**	**L+T/P**	**Credits**
MATH3149C	Scientific Computing	2+2	4	TELC3111C	RF Systems and Design	2+2	4
TELC3109C	Telecommunications standards, regulation and legislation	2+1	3	TELC3106C	Microwave Engineering	2+2	4
TELC3110C	Electromagnetic Compatibility	2+1	3	HCA3110C	Embedded Systems and Design	2+2	4
SEM3107C	Project Management for Engineers	2+1	3				

YEAR 3 (Levels 4)							
	Semester 5				***Semester 6***		
Code	**Modules**	**L+T/P**	**Credits**	**Code**	**Modules**	**L+T/P**	**Credits**
ASE3101C	Research Methodology	2+1	3	PROJ4201C	Industrial Attachment	-	3
TELC3106C	Microwave Engineering	2+2	4		*Elective 1*		*3/4*
HCA3110C	Embedded Systems and Design	2+2	4				
SECU4114C	Security in Telecommunications	2+2	4	PROJ4112C	Telecom Project		-

YEAR 4 (Level 4)			
Semester 7			
Code	**Modules**	**L+T/P**	**Credits**
	Elective 2		*3/4*
PROJ4112C	Telecom Project		9

The university reserves the right not to offer any given elective if the critical number of students is not attained and/or for reasons of resource constraints.

List of Electives			
Code	**Modules**	**L+T/P**	**Credits**
ELEC4104C	VLSI Design and Technology	2+2	4
TELC4111C	Satellite communication systems	2+2	4
TELC4112C	Optical fibre communication systems	2+2	4
SEM4107C	Quality assurance and management principles	2+1	3
TELC4113C	Broadband Communications	2+2	4
CAN2103C	Communication & Networking- Design and Management	2+1	3
TELC4114C	Radio/Television Broadcasting Technology	2+1	3
TELC4115C	Business of Digital TV	2+1	3

Q. MODULE OUTLINE

ASE1102C - MATERIALS SCIENCE AND ENGINEERING (2+1) – BRIDGE MODULE

Materials science or engineering is an interdisciplinary field involving the properties of matter & its applications to various areas of science & engineering. Materials & their structures (metals, insulators & semiconductors), selected elements from periodic table, carrier transport: electrons & concepts of holes; density of elements. Composition of materials. Phase diagram sources. Thermodynamic & kinetic data (Bond strength; Melting point; solubility; heat of formation, fusion & sublimation; vapour pressure & diffusion). Thermal properties (conductivity & expansion). Mechanical properties (tensile, compressive, yield, flexural, shear & fatigue strength; materials hardness). Electrical properties (conductivity; resistivity; dissipation; dielectric strength; tangent loss). Optical properties (transmission range & dispersion; transparency & refractive index). Chemical properties (water absorption of polymers; galvanic series of metals; corrosion rate; flammability); Magnetic Materials, moment, magnetisation, field intensity, susceptibility. Diamagnetic, paramagnetic & ferromagnetic materials.

ELEC1201C - 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.

MATH2147C: ENGINEERING MATHEMATICS (2+2)

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

ITE1104C: LEGAL ISSUES & PROFESSIONAL ETHICS FOR ENGINEERS (2+1)

Philosophical Foundations of Scientific Ethics, Legal & Ethical principles guiding the development of telecommunications and Engineering, Public accountability and transparency, Capacity building on ethical Issues, Media outreach on ethical issues, International cooperation, Patenting Rights and Issues, Business ethics and corporate social responsibility, Ethical Standards for Engineers and Telecoms industry, Ethical Problems and Dilemmas in the Interaction between Science and Media, The Ethics of Collecting and Processing Data and Publishing Results of Scientific Research, Integrity and Misconduct in Research & Development, Legal Aspects of Academic Dishonesty, Professional Ethics

CAN1102C: NETWORKS (2+1)

Physical/logical LAN topologies. Communication devices and technologies used in LAN. LAN extension: repeaters and bridges. Switched LAN. WAN. Communication devices and technologies used in LAN. TCP/IP and LAN/WAN interconnection. The Internet as the single global network of networks. LAN interconnection through WAN: Routing, VLAN, VPN, RAS and tunneling. Mobile networking. LAN/WAN standards

CAN2113C: SWITCHING TECHNIQUES (2+2)

Introduction to Switching and Networks, Ethernet: Distributed Packet Switching for Local Computer Networks, Queueing in Networks, Single Stage Switching Systems, Multistage Switching Systems with Dynamic Routing, Multicast Switch Architectures with Dynamic routing (ATM Switch), Multistage Switching Systems with Static Routing, Unbuffered Switching Networks.

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.

TELC3106C: MICROWAVE ENGINEERING (2+2 RUN ON 2 SEMESTERS)

An introduction to the design and analysis of active and passive radio frequency and microwave circuits. Topics include radio frequency and microwave circuit analysis, measurement methods, transmission line structures, matching networks, oscillators, and mixers. Computer-aided analysis and design. This module runs in two semesters.

Outline
Components of RF and microwave design, Behavior of passive components, Scattering parameters and signal flow diagrams, Using Smith Chart for design, Microstripline circuits, Passive networks and RF filters, Active RF components, Matching networks to active components, Transistor amplifiers, Oscillators, Mixers.

HCA3110C: EMBEDDED SYSTEMS AND DESIGN (2+2 RUN ON 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 and C++, Microprogramming
Program Modeling Concepts for Software-Development Process
Software Engineering Practices in the Embedded Software Development Process
Inter-Process Communication and Synchronization of processes, tasks and threads
Real Time Operating Systems.

TELC3107C: IP TELEPHONY (2+2)

Voice over Internet Protocol. 3-way calling. Secure calls. Integration with other services available over the Internet. VoIP traffic through firewalls and address translators. Quality of service. Integration into global telephone number system. Single point of calling. Mobile phones & Hand held Devices. Security. Pre-Paid Phone Cards. Caller ID. VoIM.

TELC3108C: MOBILE COMMUNICATION ENGINEERING (2+2)

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

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).

TELC3109C: TELECOMMUNICATIONS STANDARDS, REGULATION AND LEGISLATION (2+1)

Forms of telecommunication, Development of Mobile Communication systems, Analogue mobile telephony, GSM, Policy and Regulation in European Union (ITU and WTO), Structure and techniques in Radio Communications, Cellular Telephony, Mobile radio networks, Packet switched mobile data communication (MOBITEX standard), Satellite comm. (INMARSAT A,B, VSAT), Telephony for aviation, Datacasting networks, FM radio, TV channels, Digital radio (DAB) and Digital TV (DVB-T), DVB-H, ETSI, RCC conference.

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).

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

PROJ4201C: INDUSTRIAL ATTACHMENT (15 WEEKS)

Students will be attached to a telecom 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 in Telecommunication and Electronic Engineering 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 in telecommunication engineering. The list of areas will be provided to the students by the school. This module is compulsory and is assessed by both a UTM and company supervisors in a panel of discussion. Students therefore have to perform satisfactorily in this module before qualifying for the award of the degree. A UTM Telecom Industrial Attachment Handbook will be provided to the students.

SECU4114C: SECURITY IN TELECOMMUNICATIONS (2+1)

Basics of cryptography: symmetric and public-key encryption, certificates, cryptographic hash functions, Security Services and Mechanisms (E.g. ITU-T X.800), Web security: SSL/TLS, Denial of service, Internet worms, viruses, attacks on routing infrastructure, Firewalls and Intrusion Detection Systems, Wireless security: WEP, WPA, Privacy-enhancing technologies: RFID, Digital Rights Management: CSS.

PROJ4112C: TELECOM 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.

TELC4111C: SATELLITE COMMUNICATION SYSTEMS (2+2)

Satellite communications (most recent applications and developments), Background and basic concepts of satellite communications, The orbital aspects - geostationary orbit, Frequency assignments and propagation, The design of a digital satellite link (link budgets, modulation, error control coding, baseband signaling theory, and multiple access methods), The satellite subsystem, launching methods, and on-board processing, Antennas and earth station technology are presented, including the design of very small aperture terminals (VSATs), Non-geosynchronous orbits and their applications, Specific applications of satellites (global positioning system (GPS), satellites for mobile communication, and satellite for internet).

TELC4113C: BROADBAND TELECOMMUNICATIONS (2+2)

Introduction to broadband communication services and quality requirements, broadband reference model, broadband traffic characterization, ATM, Switching and multiplexing techniques, ATM protocol architecture, ATM adaptation layer, ATM signaling, ATM networks, ATM switching architectures, ATM congestion control techniques, FDDI, DQDB, synchronous digital hierarchy, optical networking , WDM networking and routing, photonic switching , optical access, edge and core networks, all optical networks, broadband access technologies, Modems, XDSL, HFC, wireless, cable modems, emerging broadband communication and networking technologies, Virtual private networks and Data VPN, Advanced intelligence network , Local Number Portability, Computer Telephony Integration, Signaling system architecture, CTI technologies and applications, ISDN, Frame Relay, ATM, Internetworking, Cable TV systems, IEEE 802.16x (WiMAX).

TELC4112C: OPTICAL FIBRE COMMUNICATION SYSTEMS (2+2)

Historical perspective and basic concepts, Channel capacity, optical fibers (Fiber modes, loss, non-linear optical effects, Manufacturing), optical transmitters (light-emitting diodes, semiconductors lasers, design), optical receivers (design, noise, sensitivity, degradation), systems design and performance, coherent lightwave systems and modulations, Multichannel lightwave systems, optical amplifiers (gain spectrum, bandwidth)

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.

CAN2103C: COMMUNICATION & NETWORKING-DESIGN AND MANAGEMENT (2+1)

- Introduction: Elements of enterprise networks: justifications, goals and benefits. Interoperability issues.
- Network Planning: Requirements Analysis, Business Model, Technology Model, Request for Proposals (RFP), Cost Analysis and Budgeting.
- Network Design: Traditional vs. Building Block Design, Geographic Scope, designing and configuring clients, servers, circuits and devices, Network Design tools.
- Network Management: Configuration, Fault, Performance and Cost Management, End-user Support, Network Management Tools: Hardware and Software, Performance metrics: speedup, Amdahl's Law. Properties of Simple Network Management Protocol (SNMP).
- Network Security: Firewalling, DMZ, subnetting, Application and Protocol Gateways, Authentication. Denial of Service attacks. Network viruses, Malware, Adware and Spyware.

ELEC4104C: VLSI DESIGN AND TECHNOLOGY (2+2)

This module lays a strong foundation for understanding VLSI circuits and their performance. Design of different CMOS integrated devices is covered in great detail along with testing.

Circuit Characterization and Performance Estimation: Resistance and capacitance estimation, switching characteristics, CMOS gate transistor sizing, power dissipation, sizing routing conductors, charge sharing designing margining yield and reliability
Arithmetic Circuit in CMOS VLSI: Bit adder circuits, Ripple carry adders, Carry look ahead adders, high speed adders, multipliers
Design of Memories and Programmable Logic: The static RAM, SRAM, Dynamic RAM, ROM ARRAYS, Logic ARRAYS
System Level Physical Design: Large scale physical design, interconnected delay modeling, crosstalk, interconnected scaling, floor planning & routing, I/P & O/P circuit, power dissipation and consumption, low power design considerations
VLSI clocking and system design: Clocked Flipflop, CMOS clock styles, Pipelined systems, Clock generation and distribution, system design considerations
CMOS Testing: The need for testing, manufacturing test principles, design strategies for test, chip level test techniques, system level test techniques, Layout design for improved Testability.
Hardware Description Language: Basic concepts, structural gate level modeling, switch level modeling, design hierarchies, behavioral and RTL modeling. VHSIC Hardware Description Language (VHDL programming). Verilog HDL.

TELC4114C: RADIO/TELEVISION BROADCASTING TECHNOLOGY (2+1)

Channels and frequencies, bandwidth, Antenna, Transmitter and Receivers, Links, Analogue radio, FM radio, Analogue TV (PAL, SECAM), Digital Radio (DAB), Setting for Advanced TV, Digital Convergence, HDTV (US, Japan, Europe), Digital TV (US, Japan, Europe), SFN and MFN, Satellite TV, global standards, Radio and TV in smart devices, Business of TV.

TELC4115C: BUSINESS OF DIGITAL TV (2+1)

Analogue TV business, Adoption of Digital, Services of Digital TV, Interactive TV, T-Commerce, T-School, Webcasting on TV, BlackBerry (HPDSA).

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.