UNIVERSITY of TECHNOLOGY, MAURITIUS

School of Innovative Technologies & Engineering

Department of Industrial Systems Engineering

MSc (Eng) Telecommunications Engineering

PROGRAMME DOCUMENT

VERSION 1.0
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MSc (Eng) Telecommunications Engineering

A. Programme Information

Telecommunication is one of the most rapidly developing industry sectors globally. The MSc (Eng) Telecommunications Engineering programme, which is a continuation of the BEng (Hons) programmes in telecommunications and related fields, is directly relevant to the current needs of industry. The MSc (Eng) programme has been developed in consultation with leading telecommunications companies in Mauritius. This programme is designed to integrate a wider variety of study in telecommunications and related areas. With this sector experiencing major technological advancements in the recent years, the students shall develop and extend their knowledge, skills and professional practice through various types of assignments and research projects.

The MSc (Eng) Telecommunication Engineering provides a sound theoretical and practical knowledge in main areas of telecommunications, mainly 3G and 4G networks, advanced antenna design, satellite communications engineering, RF and microwave design, wireless IP telephony, broadcast structure, telecommunications management, project leaderships and research methodology. The students will be able to study state-of-the-art technologies taught by researchers, industrial / chartered engineers and consultants.

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 developments and maintenance of infrastructural facilities and systems
- The confidence to design, build and manage more advanced building and structural systems
- A wider range of transferable and marketable skills and knowledge leading to a variety of employment opportunities within the design and wider associated engineering industries
- Teaching and learning techniques which lay emphasis on active and participative education
- The ability to apply modern technologies to solve problems in various areas of Telecommunications and related engineering areas

Employment Prospects

This programme prepares graduates for careers with major network operators, and is suitable for those who are aiming to work in the telecommunications manufacturing business, or in research and development organisations. Some jobs include Telecommunications Analyst, Fiber Engineer, Telecommunications Engineer, Network and Telecom Engineer, Network Engineer Planner, Senior Broadcast Engineer, Manager, Assistant Director or Director of an engineering school in higher education. In addition, there are openings in education, in both teaching and research. The solid base that the programme provides can lead to research work either through an MPhil programme or to study for a PhD.

C. Programme Objectives

After successful completion of the MSc (Eng) programme, the graduates should

- achieve the understanding of engineering principles at higher levels and the ability to apply them to analyse key engineering processes;
- develop the ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modeling techniques;
- develop more abilities to apply quantitative methods and computer software in order to solve engineering problems;
- be able to create and develop economically viable products, processes or systems to meet a defined need;
- acquire intensive knowledge of management techniques which may be used to achieve engineering objectives;
- acquire intensive knowledge of relevant legal requirements governing engineering activities, including personnel, health, safety and risk;
- achieve the understanding of the need for a high level of professional and ethical conduct in engineering;
- 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.

PART I - Regulations

D. General Entry Requirements

As per UTM's Admission Regulations, and 'Admission to Programmes of Study at Master Degree Level'

E. Programme Entry Requirements

The MSc (Eng) is adapted for students holding undergraduate degrees, awarded at least a Second Class Second Division Honours degree in telecommunication, electronic and related engineering programmes that are accredited by or meet the academic requirements set by the engineering councils where the programmes are run (for example, CRPE for Mauritius (CRPE SPEC), ECI for India, SIET for Singapore, etc) or by international engineering councils / agencies such as the Engineering Council UK Council (UK-SPEC), the USA accredited engineering agency (ABET) etc.

F. Programme Mode and Duration

One Semester consists of 15 weeks (excluding exam period)

Part Time: 2 years (4 Semesters)
The Part Time session will be run in two modes: Day Time Session and Evening Session. Candidates should only enrol on one mode.
Day Time Session: Monday to Saturday: Monday to Saturday from 08:30 to 16:30.
Evening Session: Monday to Friday from 16:30 to 20:30
Saturday from 8:30 am to 20:30

G. Teaching and Learning Strategies

- Lectures, Tutorial and Practical
- Tests and Assignments
- Workshops, Seminars and Lab sessions
- Case Study material & scenario
- The student would be expected to perform a substantial amount of self learning both for the theoretical and practical parts of the modules.

H. Student Support and Guidance

- Academic tutoring: 3 hours per week per module
- Intensive tutoring conducted during Week 8 of the semester (optional).

I. Attendance Requirements

As per UTM's Regulations and Policy

J. Credit System

1 module = 3 or 4 or 8 credits
Final Year Project = 12 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 of 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. For this programme, continuous assessment for two modules (*Research methodology in engineering* and *Project leadership for engineers*) shall be 100% of the total 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 contributes a 100% weighting towards the MSc (Eng) degree classification.

The maximum marks attainable for each level are 1400.

M. Award Classification

Overall weighted mark y (%)	Classification
$y \geq 70$	MSc (Eng) with Distinction
$60 \leq y < 70$	MSc (Eng) with Merit
$40 \leq y < 60$	MSc (Eng)
$y < 40$	No Award

Students who are qualified for the above mentioned awards shall earn a total of 48 credits inclusive of project / dissertation.

Students who fail to qualify for the award of the degree may be awarded as follows:

1. Post - Graduate Certificate: 18 credits
2. Post - Graduate Diploma: 30 credits

N. Programme Organisation and Management

Programme Director: Dr Vinaye Armoogum

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Programme Coordinator: Mr Rishi Heerasing

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PART II -Programme Structure

O. MSc (Eng) Telecommunications Engineering – Full Time (Version 1.0)

Not Applicable

P. MSc (Eng) Telecommunications Engineering – Part Time (Version 1.0)

YEAR 1 (Level 1)							
	Semester 1				***Semester 2***		
Code	**Modules**	**L+T/P+DS**	**Credits**	**Code**	**Modules**	**L+T/P+DS**	**Credits**
TELC5001C	Advanced Mobile Communication Engineering	2+2+0	-	TELC5001C	Advanced Mobile Communication Engineering	2+2+0	8
TELC5002C	RF and Microwave Filter Design	2+2+0	4	TELC5005C	Advanced Antenna Design and Propagation	2+2+0	4
TELC5003C	Wireless IP telephony networks and Security	2+2+0	4	TELC5006C	Research Methodology in Engineering	2+1+0	3
TELC5004C	Project Leadership for engineers	2+1+0	3				

YEAR 2 (Levels 2)							
Semester 3				***Semester 4***			
Code	**Modules**	**L+T/P+DS**	**Credits**	**Code**	**Modules**	**L+T/P+DS**	**Credits**
TELC5007C	Satellite Communications Engineering	2+2+0	4	TELC5009C	Telecommunications Management	2+1+0	3
TELC5008C	Communications Security	1+2+0	3				
PROJ5001C	MSc (Eng) Research based Project / MSc (Eng) Industrial Project		-	PROJ5001C	MSc (Eng) Research based Project / MSc (Eng) Industrial Project		12

Q. MODULE OUTLINE

TELC5001C: ADVANCED MOBILE COMMUNICATION ENGINEERING (2 SEMESTERS)

Semester 1: Evolution of modern cellular wireless communications; Cellular concept: radio coverage, frequency reuse, multiple access techniques and capacity; Radio channel: attenuation, fading, Doppler, adjacent and co-channel interference, coherence bandwidth, delay spread and inter-symbol interference, radio channel modelling; Cellular radio design principles: cell planning, sectorisation, call handover, base stations, mobile switching centres; principles of GSM: source/channel coding, modulation, equalization, timing structure of GSM, OSI layers/ GSM specifications and network aspects; GSM evolution for data communications: GPRS and EDGE; Principles of DS/ CDMA systems: Qualcomm's IS-95, channelisation, long and short PN codes, Walsh sequences, power control, correlator design, Rake receiver; W-CDMA: third generation systems UMTS/UTRA;

Semester 2: Introduction to fourth generation system (4G): Principles and mathematics of OFDM. Background on LTE; high data retes in mobile communications;OFDM transmission; widerband sigle carrier transmission; multi antenna techniques; scheduling, link adaptation; Hybrid ARQ; Overview of LTE radio access; radio interface architecture; physical traqnsmission resources; downlink and uplink physical layer processing; retransmission protocols; power control, scheduling and interference handling; Access procedures; multimedfia broadcast/multi cast services; relaying; Spectrum and RF characteristics for LTE; Performance evaluation for LTE and LTE advanced

TELC5002C: RF AND MICROWAVE FILTER DESIGN (1 SEMESTER)

Theory of high frequency circuits: distributed circuits, characteristic impedance, VSWR, scattering parameters, Smith Chart, impedance matching, two-port networks; Physical realization: Microstrip, stripline and waveguide; Passive devices: direct couplers, multiplexers, ferrite isolators and circulators; Measurement of scattering parameters and network analysis; Computer aided design of RF and microwave circuits including case studies.

Microwave communication systems: link budget, RF subsystems, system modelling; Modulation formats and impact on circuit design: distortion and spectral regrowth, direct and heterodyne conversion; Sub-system characterization: system noise figure analysis; Impact of RF/ microwave component design on wireless communication system performance; Microwave and RF filter design.

TELC5003C: WIRELESS IP TELEPHONY NETWORKS AND SECURITY (1 SEMESTER)

Re-Introducing IP Telephony and security; IP framing and architecture; Design Secure, High Performance VoIP networks; Router and Switch hardening; Network Element access control; IP Filtering and Access Control Lists; Session Initiation Protocols; AAA configuration (Authentication, Authorization and Accounting); WLAN component hardening and security implementation; WLAN architecture, Hardware, Software and Security Practices; Host Based Intrusion Detection System; Mobile IP configuration; Media Gateway Control Protocol (MGCP); Deploying VoIP Gateways; Deploying Quality of Service; Performance Testing.

TELC5004C: PROJECT LEADERSHIP FOR ENGINEERS (1 SEMESTER)

Basics of project planning & scheduling, Project Management methodology, Project Estimation and Costing, Managing Communications in projects, Human Resource Management in projects, Procurement management, Portfolio management, Programme management, Project Management Office setup

TELC5005C: ADVANCED ANTENNA DESIGN AND PROPAGATION (1 SEMESTER)

Antenna theory and characterisation: antenna parameters, antenna patterns, beam area, radiation intensity, wire and aperture antennas, antenna temperature, near and far fields; Antenna arrays: array of isotropic and non isotropic point sources, principles of pattern multiplication, design of broadside, end fire, binomial, Hansen Woodyard, triangular and Dolph Chebyshev arrays; Radio propagation principles and models: multipath, fading, noise and interference, antennas for mobile communications, integrated and miniaturised antenna technologies, link budget design, diversity measures – spatial, polarisation, space-time; Case studies to include satellite telephony and TV, broadband services and cellular mobile.

TELC5006C: RESEARCH METHODOLOGY IN ENGINEERING (1 SEMESTER)

A view of research, The research journey (four steps to success), Support (research proposals, finding funds), Tools of research (hard ware and software), Research types (randomised trials, laboratory or industrial experiments, survey), measurements (sampling, interviewing), The Research Problem, Qualitative and quantitative methods, Analysis.

TELC5007C: SATELLITE COMMUNICATION ENGINEERING (1 SEMESTER)

Satellite orbit analysis: Kepler laws, apogee and perigee heights, inclined orbits, calendars, sidereal time, orbital plane, synchronous orbits, geostationary orbit, antenna, look angles, polar mix antenna, limits of visibility, earth eclipse of satellite, sun transit outage; Propagation and link budget: Atmospheric loss, ionospheric effects, EIRP, transmission losses, link power budget, system noise, uplink SNR, down link SNR; Satellite control: altitude control, station keeping, thermal control, transponders, antenna subsystem; Satellite mobile and specialized services: orbital spacing, power ratio, frequency and polarization, transponder capacity, bit rates for digital TV, satellite mobile services, USAT, RadarSat, GPS; Modulation schemes for satellite communication systems.

TELC5008C: COMMUNICATIONS SECURITY (1 SEMESTER)

Cryptography, Information Security, Information warfare, Crypto & Encryption systems, Operations security, Secure communication, Signal Intelligence, Traffic Analysis, Specialities: Crypto security, Emission Security, Traffic Flow security, Transmission security, Telecommunication Equipment Security system.

TELC5009C: TELECOMMUNICATIONS MANAGEMENT (1 SEMESTER)

Principles of Market Structure, Supply and Pricing; strategic planning and implementation (environmental scanning, organisational culture, Total Quality Management, Reengineering Process, Six Sigma, Evaluation and Control); Broadcast Management (Broadcast Industry Structure, Broadcast Program Strategies, Audience Research, Broadcast Marketing and Sales); Principles of Public Utilities and Information Carriage (Public Utilities, Common Carrier Services, Telephone Communication and Competition, Telecommunications and Deregulation); Telephony (Industry Structure, Competitive Challenges in the Telephone Market, Business Considerations) Internet: The Internet as Business Strategy platform; Transnational media and Telecommunications

PROJ5001C: MSC (ENG) RESEARCH BASED PROJECT OR INDUSTRIAL PROJECT (2 SEMESTERS)

Students can choose one of the following two streams:

Research based Project:

It is a research oriented project. Acquaintance with survey, data collection and analysis and research methods in general and their usage in conducting a systematic investigation and style of report preparation shall form basis of evaluation. In brief, the students shall come up with an innovative idea (piece of work) by emphasizing on the originality and significance of the work. Each project shall be evaluated by three experts in the field. A detailed Project Handbook will be provided to students before starting the projects.

Industrial Project:

Project allows the student to work independently to put the knowledge of electronics engineering theory and telecommunication systems into practice. Here, the students shall work in collaboration with the industry to come up with a prototype after simulation process. The students shall be assigned two supervisors (UTM supervisor and a company supervisor). In brief, the student shall collect all necessary information and analyze it, build/fabricate a prototype and/or hardware. The student shall test the prototype/hardware developed vigorously by known testing methods. The student shall prepare and submit a report on the project. A detailed Project Handbook will be provided to students before starting the projects.