MASTER OF ENGINEERING (ELECTRONICS AND TELECOMMUNICATION)

PROGRAMME SPECIFICATIONS

This is an advanced degree program that exposes and updates students to the cutting-edge technology and techniques in electronics and telecommunication engineering, advanced electronics in IC/microchip design, and communication and computer networks. This course covers all the major aspects of electronics and telecommunications and their applications to the design of electronics or telecommunication systems. Students will also acquire expertise in the use of computer packages available in these areas. Furthermore, opportunities exist for outstanding students on this program to continue with research leading to a Ph.D. degree.

Program Educational Objectives (PEO)

PEO1 Mastery of knowledge and competency in advanced areas of Electronics and Telecommunication Engineering field.

PEO2 Professionalism and high standards of ethical conducts within organization and society.

PEO3 Responsive to changing situations by continuously acquiring new knowledge and skills.

Program Learning Outcomes (PLO)

PLO1 Attain advanced knowledge on theories, methods and applications related to Electronics and Telecommunication Engineering field.

PLO2 Demonstrate mastery in conducting research independently in solving problems related to Electronics and Telecommunication Engineering field through relevant analytical methods, simulations and/or experiments.

PLO3 Synthesize engineering knowledge through design and development.

PLO4 Plan and perform research undertakings responsibly, professionally and ethically.

PLO5 Communicate and express knowledge and ideas effectively.

PLO6 Continue life-long learning and apply technology for the betterment of humanity.

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the course are not allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
MASTER OF ENGINEERING (ELECTRONICS AND TELECOMMUNICATION)					
FACULTY COMPULSORY-12 CREDITS (4 COURSES)					
1	MKEL 1123	Advanced Microprocessor Systems	3	3	
2	MKEL 1173	Advanced Digital System Design	3	3	
3	MKET 1313	Communications and Computer Networks	3	3	
4	MKET 1413	Advanced Digital Communication	3	3	
FACULTY ELECTIVES-12 CREDITS (4 COURSES)					
5	MKEL 1113	Nano-electronic Devices	3	3	
6	MKEL 1133	Integrated Circuit Testing	3	3	
7	MKEL 1143	Advanced Digital Signal Processing	3	3	
8	MKEL 1163	VLSI Circuits & Design	3	3	
9	MKEL 1183	Advanced Computer Architecture	3	3	
10	MKEL 1223	Random Process	3	3	
11	MKEL 1233	Image Processing	3	3	
12	MKEL 1243	Software Engineering	3	3	
13	MKEL 1253	Speech Processing	3	3	
14	MKEL 1263	Special Topic in Electronic Eng.	3	3	
15	MKET 1323	Broadband Multimedia Networks	3	3	
16	MKET 1333	Optical Communications	3	3	
17	MKET 1373	Sonar and Acoustic Engineering	3	3	
18	MKET 1383	Satellite Communication	3	3	
19	MKET 1393	Network Modelling & Performance	3	3	
20	MKET 1423	Wireless Communication Systems	3	3	
21	MKET 1433	RF/Microwave & Antenna Design	3	3	
22	MKET 1453	Special Topic in Telecommunication Eng.	3	3	
23	MKET 1463	Advanced Communication Electronics	3	3	
24	MKET 1483	Optical Networks and Devices	3	3	
FREE ELECTIVES FROM MKEL/MKEM/MKEP/MKET-3 CREDITS (1 COURSE)					
25	MKEx 1xxx		3	3	

MASTER'S PROJECT-10 CREDITS (2 COURSES)					
26	MKEL 1814	Research Project Proposal	4	4	
27	MKEL 1826	Research Project Report	6	6	
TOTAL CREDIT OF ELECTRICAL ENGINEERING COURSES (a)			**37**	**37**	
SCHOOL/UNIVERSITY COMPULSORY- 6 CREDITS (2 COURSES)					
28	MKEU 0013	Introduction to Research Methodology in Electrical Engineering	3	3	
29	Uxxx xxx3	Non-technical subject	3	3	
TOTAL CREDIT OF SCHOOL/UNIVERSITY COMPULSORY COURSES (b)			6	6	
TOTAL CREDIT TO GRADUATE (a + b)			**43**	**43**	

COURSE SYNOPSIS

CORE COURSES

MKEL 1123 - Advanced Microprocessor System

This course is about microprocessors in embedded systems. This course extends the students' knowledge of microprocessors by investigating embedded systems design and state-of-the-art 32-bit embedded processors. The student will be familiarized with problems associated with producing hardware and software in high-level language and assembly language for embedded systems. The topics covered include high-level and assembly language programming for embedded microprocessors, memory and peripherals for embedded systems, system development, and achieving high-performance in embedded systems.

MKEL 1173 - Advanced Digital System Design

This course is designed for students to learn and be able to design and verify complex digital synchronous systems – towards becoming an RTL digital hardware designer in the industry. This is a course that goes beyond the introductory course on digital basic principles and techniques. This course introduces digital circuit modelling with hardware description languages (HDLs), which is the key technique to the modern design of integrated circuits (ICs). The technique involves a CAD approach in which a high-level, text-based, abstract description of the circuit is created, then synthesized to a hardware implementation on a selected technology, and finally verified for its functionality and timing.

MKET 1313 - Communication & Computer Networks

This course will enhance the students' knowledge on communication and computer network. It explains the advance concept of network layers, protocols, interfacing and inter-working between computer networks and network devices in telecommunication systems. The students will be taught with the various possible techniques to understand the modern networks for

wired and wireless services.

MKET 1413 - Advanced Digital Communications

This course provides fundamental concepts in the analysis and design of digital communication system. Main topics to be covered are introduction to information theory, signal space analysis, digital modulation/demodulation over AWGN channel, baseband transmission over bandlimited, channel coding, error control coding. Finally, the system trade-off in designing a digital communication system in AWGN channel is explored.

ELECTIVE COURSES

MKEL 1113 - Nano-electronic Devices

Semiconductors form the basis of most modern electronics systems. This course is designed to provide a basis for understanding the characteristics, operation, and limitations of semiconductor devices. In order to gain this understanding, it is essential to have a thorough knowledge of the physics of the semiconductor material. The goal is to bring together quantum mechanics, the quantum theory of solids, semiconductor material physics, and semiconductor device physics. All of these components are vital to the understanding of both the operation of present day devices and any future development in the field. This course is a continuation to Microelectronics at the undergraduate level and introduces advanced device concepts.

MKEL 1133 - Integrated Circuit Testing

This course introduces students to the techniques of testing a circuit and designing a testable circuit. Several fault models including single stuck-at fault model will be analyzed in details. Fault simulation methods are covered as well in this course. Test pattern generation and design-for-testability are also introduced to students. In order to facilitate the learning process, computer-aided design (CAD) software is used throughout the course. Some practical or almost actual environment problems and solutions are provided.

MKEL 1143 - Advanced Digital Signal Processing

This course introduces students to advanced concepts in digital signal processing. Basic concepts in signal processing will be first reviewed that covers continuous and discrete-time signals and systems with the relevant transformations and operations. Random signal principles are presented with the definition of stationarity and ergodicity, correlation and covariance functions and their estimates. The power spectrum of signals is defined together with the relationship with to the correlation function. Linear systems with random inputs are defined in terms of autocorrelation and cross correlation function and power spectrum. Optimum filtering techniques such as matched filter and wiener filter are presented with examples of applications. Basic constraints in non-parametric power spectrum estimation are described with the appropriate solutions. Linear estimation techniques deal with parameter identification and estimation of signals. Linear prediction is used for

signal modelling and prediction. Towards the end of the course, signal analysis and representation techniques for time-varying signals are presented such as the short-time Fourier transform, Gabor transform, and wavelet transform.

MKEL 1163 - VLSI Circuits & Design

In this course, students learn about VLSI design, with emphasis on designing circuits to meet certain performance criteria. Important issues when designing a VLSI circuit are discussed. MOS transistors are reviewed, including their characteristics, structure, switch-level behaviour, and current equation. SPICE model of MOS transistors is also described. The inverter circuit is studied in detail. This course emphasizes circuit design for speed and power performances. Factors that affect speed are explained. Logical effort concept is introduced to explain how to design a fast circuit. Similarly, the effect of input signal transitions on power dissipation is explained.

MKEL 1183 - Advanced Computer Architecture

This course covers hardware structure of a modern programmable computer, including the basic laws underlying performance evaluation. Students will learn design of control and data path hardware for RISC processor, how to make machine instructions execute simultaneously through pipelining and parallel execution, and how to design fast memory and storage systems.

MKEL 1223 - Random Process

This course introduces students to the concepts in random processing. This course introduces students to the introductory level of random variables and random process. In the beginning, students will be introduced to the concept of probability and its axioms, Bayes theorem, combinations, and permutations. Then the concept of random variable which includes probability density and cumulative functions will be given. This topic will be extended to operations on random variable such as expectation and moments. The topic of multiple random variables which consists of joint distribution and joint density along with conditional distribution and density will be discussed next. This topic will also include operations on multiple random variables. Finally, the topic on random process from the perspective of both the temporal and spectral domains will be given. This topic will cover wide sense stationary, ergodicity and independence, correlation functions, power density spectrum and cross-power density spectrum.

MKEL 1233 - Image Processing

This course introduces students to introductory and intermediate levels of image processing techniques. The area of coverage would be the digitization process as a mean to acquire the digital image. Next would be the enhancement and restoration processes which are to improve the quality of the image for next stage processing. Both the spatial domain and frequency domain approaches will be covered. The next stage would be the segmentation process. This is an important step towards advanced level processing. Another important topic that will also be discussed is the

morphological processing. Wavelet transform and multi-resolution analysis have been pivotal in many image processing applications and thus the introduction to this area will be given. Finally, the topic of compression and coding will be covered. MATLAB will be used extensively for better understanding.

MKEL 1243 - Software Engineering

This course introduces various issues of system and software engineering. This course attempts to cover a vast field covering all aspects of system and software development work from analysis, design, implementation, operation, maintenance, support, cost, management, and risk analysis. Focuses will be given on software development process, programming, testing, and maintenance, which are the fundamental aspect of software engineering. Special emphasis will be given to the process of object oriented design as well as the use of UML in the design activities.

MKEL 1253 - Speech Processing

This course introduces students to introductory and intermediate levels of speech processing techniques. The area of coverage would be speech production mechanism, classification of speech, sounds, nature of speech signal, models of speech production, speech signal processing: the purpose of speech processing, digital models of speech signal, digital processing of speech signals, Significance, short time analysis. Next would be the time domain parameters of speech, methods for extracting the parameters, zero crossings, auto correlation function, pitch estimation. The next stage would be the short time Fourier analysis, filter bank analysis, spectrographic analysis, format extraction, pitch extraction, analysis – synthesis systems. Another important topic that will also be discussed is the formulation of linear prediction problem in time domain, solution of normal equations, interpretation of linear prediction in auto correlation and spectral domains. MATLAB will be used extensively for better understanding.

MKEL 1263 - Special Topic in Electronic Engineering

The aim of the Special Topic course is to provide a mechanism for one-off topic to be offered by any graduate faculty or visiting professor. The topic of any Special Topic course has to be vetted and endorsed by the Faculty's Academic Committee.

MKET 1323 - Broadband Multimedia Networks

This course introduces the basics of multimedia communication systems and services. Students will be familiarized with the underlying theory, concepts and principles of multimedia communication system and the practicality in the current and future IP based network. The topics include the introduction to the concept of multimedia communication model and elements of multimedia communication systems. An overview of the recent trend in multimedia communication system development will be given. The students will be given a comprehensive understanding on multimedia processing in communication,

distributed multimedia systems, multimedia communication standards and multimedia communications across networks. The emphasis will be on multimedia communication on next generation IP based network. Finally the students will be exposed with the various multimedia applications including VOIP, VOD, IPTV etc.

MKET 1333 - Optical Communications
The aim of this course is to introduce the theories, concepts and design of optical communication systems. The course begins with introduction to the basic principles of optical fiber communication systems. This is achieved by providing knowledge about passive and active components of optical communication system and how these components are integrated into optical communication systems. It will emphasize the physical properties and operation of components that comprise optical systems. The next section covers basic knowledge for designing the optical communication systems and verification of fibre optic link for wide area and local area networks. The basic elements of optical network operation will also be described. The course is concluded with highlighting recent advances in optical communications. The material will cover a broad number of topics to allow the student to understand the underlying principles of the field and to be prepared for more detailed study in the form of advanced courses and/or research.

MKET 1373 - Sonar & Acoustic Engineering
This course introduces students to the fundamentals and characteristics of sound waves in air and water, and to sources of ambient noise. The students will be introduced to concepts and criteria of room acoustics, and to perform design for a safe and optimum acoustics, both indoor and outdoor. Then the concept of sonar, such as field of application, transducer technology, sonar equations and processing will be emphasized. The discussion will be extended to detail the characteristics and operations of passive and active sonar.

MKET 1383 - Satellite Communication
This course introduces students to introductory and advanced level of satellite communication. In the beginning students will be introduced to the concept of satellite communication systems. Then the orbit mechanic concepts include look angle and orbit determination. This topic will be extended to the satellite subsystems, link design and propagation effects. The topic of satellite system will include VSATS, satellite broadcasting for TV and radio and Global Position System.

MKET 1393 - Network Modelling & Performance
Network simulation modelling is important in estimating the performance of a particular network. This course introduces the students to the techniques in network modelling using Markov chain and discrete event simulation. Students will be exposed to the probability and random processes in network modelling. Students are will learn the technique to construct transition matric of Markov Chain and calculate the Markov chains at steady state. The students will also

learn queuing analysis and telecommunication system.

MKET 1423 - Wireless Communications System
This course introduces students to introductory and advanced level of wireless communication. In the beginning students will be introduced to the concept of wireless communication systems. Then the cellular concepts which include frequency reuse and cell splitting. This topic will be extended to the interference issues, system capacity, trunking and grade of service. The topic of mobile propagation will include large scale and small scale mobile propagation follows by different multiple access techniques used in wireless communication systems. Finally different wireless systems and standards will also be covered.

MKET 1433 - RF/Microwave & Antenna Design
This course introduces students to the concept and advanced level of RF /Microwave passive and antenna design. In the beginning students will be introduced to the concept of transmission line and S Parameter in RF/ Microwave Engineering. The concept of Smith chart will also be discussed. Then the design of each passive component such as matching network, coupler, divider and resonator will be introduced. The properties and the analysis of the antenna will be introduced in the next section. The design of dipole, monopole and planar type of antenna will be discussed.

MKET 1453 - Special Topic in Telecommunication Engineering
The aim of the Special Topic course is to provide a mechanism for one-off topic to be offered by any graduate faculty or visiting professor. The topic of any Special Topic course has to be vetted and endorsed by the Faculty's Academic Committee.

MKET 1463 - Advanced Communications Electronics
This course introduces students to concept and advanced level of RF communication electronics design especially on active devices concept. In the beginning students will be introduced to the concept of transmitter and receiver in communications system. The design parameter for transmitter and receiver will be discussed. Then the design of each component will be introduced such as amplifiers, oscillators and mixers. The example of the circuit design such as amplifier will be using RF simulator. The analysis of the design will be discussed in the assignment given to the group of students.

MKET 1483 - Optical Network and Devices
This course offers students the essential aspects of optical networking which is the key for today's high speed data transportation technology. It commences with the underlying fibre optic link design and the basic optical components needed of point-to-point links and interchange nodes. The basic principles of operation of optical transmitters, detectors, amplifiers, multiplexers, filters, couplers, isolators, wavelength converters and optical cross connects will be described. The remainder of this course will emphasis on the

transport/networking protocols that are run on optical layer such as SONET/SDH, IP, ATM, Storage Area Networks and Gigabit Ethernet. Other topics that will be covered include network design, control and management, and network deployment in various network domains from access to metro and core networks.