UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Faculty of Electrical Engineering

POSTGRADUATE

MASTER OF ENGINEERING (COMPUTER AND MICROELECTRONIC SYSTEMS)

www.fke.utm.my

MISI & VISI
UNIVERSITI TEKNOLOGI MALAYSIA

Visi

Universiti Terkemuka Menyediakan Perkhidmatan Pendidikan dan Penyelidikan Bertaraf Dunia

A Premier University Providing World-Class Education and Research

Misi

Untuk Membangun Bakat Holistik dan Mensejahtera Kehidupan Menerusi Ilmu dan Inovasi Teknologi

To Develop Holistic Talents and Prosper Lives Through Knowledge and Innovative Technologies

Profile Page

MASTER OF ENGINEERING
(COMPUTER AND MICROELECTRONIC SYSTEMS)

Name of Student : _____

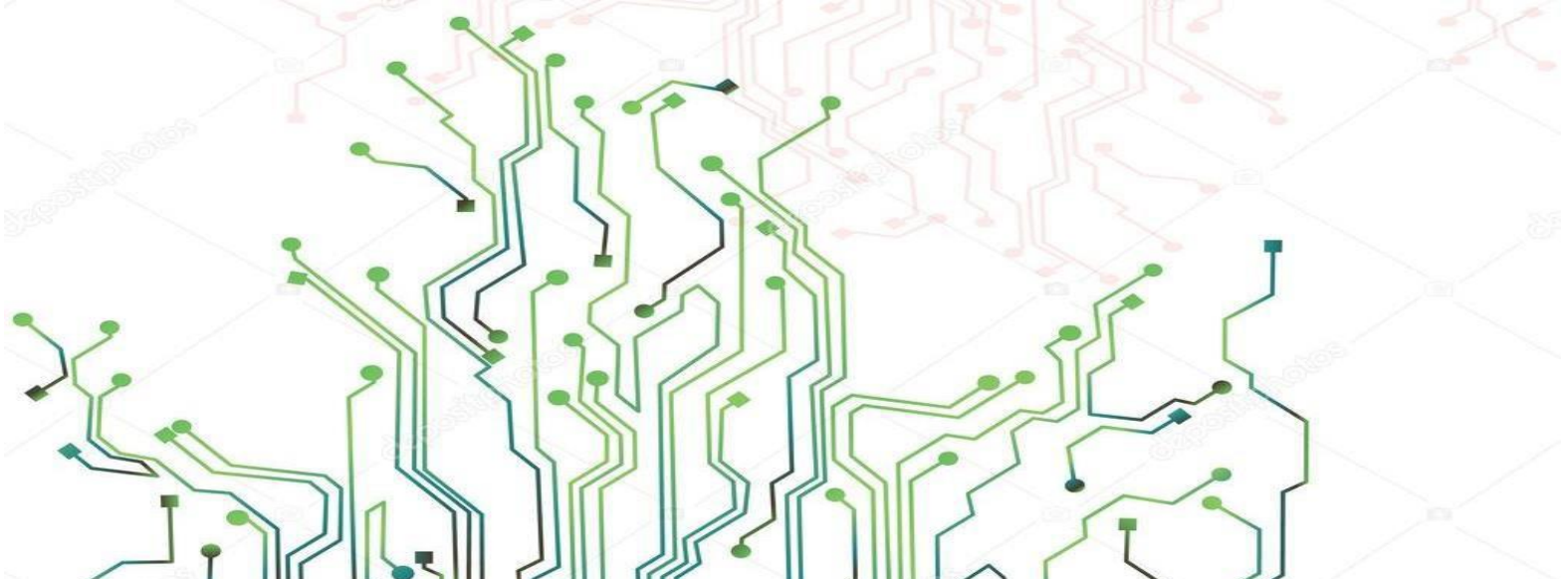
Matric. No. : _____

Phone No. : _____

Email : _____

Name of Academic Advisor : _____

A JOURNEY TO THE FUTURE



PROGRAMME GUIDELINES

The University adopts the semester system, for an academic year it is divided into two (2) normal semesters, namely Semester I and Semester II, and a short semester at the end of Semester II. New intake of graduate students is made during Semester I and Semester 2 of an academic year. The minimum duration of the programme is 1.5 years (3 semesters) and maximum 4 years (8 semesters).

All courses offered by the faculty have credits, except for courses which are approved by the University Senate. One (1) credit is equivalent to 14 hours of lectures or 30 hours of practical sessions (studio/project), in a semester. The total number of credits for the Master of Engineering (Computer and Microelectronic Systems) programme is 43 credits.

All students' performance and achievements are assessed formally. Normally, every course is assessed based on the coursework, which constitutes not less than 50% of the overall marks, and a final exam paper, which constitutes another 50%. Coursework can be in the form of homework, quiz, test and presentation. Final examination is held at the end of each academic semester. Some courses only being assessed based on course works only. Students' performance in a course is indicated by the letter grade, generally the passing grade for any course is a 'B-'. Students who obtained grade lower than 'B-' are considered as failed, and are required to repeat the course the following semesters when it is offered. Subject to the Faculty and University's Academic Regulation, students may withdraw from a course within the stipulated period. Other information on academic regulation can be retrieved from UTM website (UTM Academic Regulations).

A student must pass all courses specified in the programme of study and fulfil all the requirements specified for the programme of study set by the Faculty and University in order to be awarded with the Masters degree.

PROGRAMME LEARNING OUTCOMES (PLO)

All graduate programmes offered in FKE share a common Programme Learning Outcomes (PLO) set by MQA. After having completed the programme, graduates should be able to demonstrate the following competencies:

PLO	PLO STATEMENTS
PLO1	Attain advanced knowledge on theories, methods and applications in computer and microelectronic systems..
PLO2	Able to demonstrate proficiency in relevant analytical methods, simulations, and/or experiments to perform research.
PLO3	Able to critically solve problems and apply engineering knowledge in design and development.
PLO4	Able to plan and perform research undertakings responsibly, professionally and ethically.
PLO5	Able to communicate, and express knowledge and ideas effectively.
PLO6	Integrate digital technologies and software competently in providing solutions to problems.

MASTER OF ENGINEERING (COMPUTER AND MICROELECTRONIC SYSTEMS) (MKEH)

Introduction

A rapid development in electronics, computer and telecommunication industry is one of the major contributors to the Malaysian economy. Rapid development has enabled the electronic, computer and telecommunication industry to flourish. This means that more and more competent electronic graduates are required, to meet the growing demand of skilled manpower. The requirements towards professionals in this field is gradually intensifying and it is predicted that the need will be continued in the next few years. Electronic Engineering is a vast area of studies and is gradually expanding. Graduates undertaking this programme will face a demanding professional career ahead. Various courses are being offered within the programme with the intention of preparing graduates with sufficient knowledge in electronic and computer engineering fields.

Programme Specifications

The Master of Engineering (Computer and Microelectronic Systems) programmed is offered on a full-time, either on campus or off campus (PESISIR) . The on campus programme is offered at UTM Main Campus in Johor Bahru, while the off campus programme is offered at various learning centres throughout Malaysia. The duration of study for the full-time programme is subjected to the student's entry qualifications and lasts between one (1.5) years to a maximum of four (4) years.

The programme is offered on full-time basis and is based on a 2-Semester per academic session and the short semester. Generally, students are expected to undertake courses equivalent to between fifteen (15) to eighteen (18) credit hours per semester. Assessment is based on coursework and/or final examinations given throughout the semester.

Mode of Study

Graduate students can pursue an on-campus or off-campus taught course program. On-campus taught course programs are offered at UTM's main campus in Johor Bahru. Select off-campus programs are available at the UTM Kuala Lumpur campus or other centres.

- **On-campus (PERDANA):** The on-campus study requires a minimum duration of 1.5 years (three semesters), depending on the programs. The student may register a maximum of twenty (20) credits in the normal semester. The class sessions take place during weekdays. International students on study visa can only register for this mode of study.
- **Off-campus (PESISIR):** Off-campus study normally takes 2 years (4 normal semesters and one 8-week short semester) to complete. The student may register a maximum of twelve (12) credits in the normal semester and maximum of six (6) credits in short semester. Classes are scheduled on weekends to suit working professionals. Expatriates on working visa and permanent residents may register in this mode of study.

Teaching Methods: A taught module takes the following forms: formal lectures, tutorials, assignment and/or laboratory work as well as industrial exposure. Each 3-credit module is delivered in 42 hours of lectures. Teaching/learning is student-centered; hence it should be complemented with adequate self-study and self-learning by the students.

Assessment and Grading: Students' progress is assessed (continuously) throughout the semester by a coursework assessment component and a final examination for each module. The coursework component may consist of set written assignments, practical work/lab assignments, and short tests. Passing mark for each taught module is 60% or equivalent to B-. Any failed core course must be repeated with that same course, while failed elective course can be replaced with another elective course approved by the Postgraduate office.

Students must obtain at least 2.67 cumulative grade point average (CGPA) or equivalently a B- average for each semester to continue the study. For a Masters degree to be awarded, candidates must complete a minimum of 43 credits and achieve a final CGPA≥ 3.00. Table IV in the appendix shows the academic standing and students' status.

Students may also register a course under *HS* (attendance only). In order for this module to appear in the transcript, students' attendance must be at least 80% and fulfill other coursework requirements.

Master Project: Students must undertake a 10-credit master's project. This 1 year (2-semester) project will be supervised by a graduate faculty member of FKE. Towards the end of the 1st semester, students will defend their project proposal. At the end of the project in the second semester, students must defend their Masters project and a comprehensive project report must be submitted. The Masters project could be industry-related although must still meet academic requirements, defined by the academic supervisor. An industry co-supervisor may be appointed from persons with appropriate academic standing or experience, subject to approval of the Faculty's Academic Committee.

OFF-CAMPUS (PESISIR) MODE OF STUDY

Our off-campus programs offer flexible solutions for working engineers and professionals to advance their career through our industry-driven curricula. All of our Masters programs are accredited by the Malaysian Qualification Agency (MQA).

Classes taught by Universiti Teknologi Malaysia faculty members at our PESISIR centres. The fees are affordable and competitive. Our PESISIR program can be completed within 2 years (four normal semesters and one short semester). Classes are conducted on Saturday and Sunday at all study centres.

- **Johor Bahru** **:** Universiti Teknologi Malaysia Main Campus
- **Kuala Lumpur** **:** Universiti Teknologi Malaysia City Campus
- **Pulau Pinang** **:** Penang Skills Development Centre

Programme Educational Objectives (PEO)

After having exposed to 3 to 5 years working experience, our graduates should become professionals who demonstrate the following competencies:

PEO	Statement
PEO1	To produce postgraduates with multidisciplinary knowledge needed for designing, integrating and optimizing solutions, central to modern computer and microelectronics systems.
PEO2	To produce postgraduates who are able to generate new knowledge, idea and technique in computer and microelectronics systems.
PEO3	To produce postgraduates who are able to function in R&D research team and innovative industrial ventures.
PEO4	To produce postgraduates who are able to consistently perform their responsibilities ethically and professionally.

PROGRAMME GENERAL INFORMATION				
1.	Awarding Institution		**Universiti Teknologi Malaysia**	
2.	Teaching Institution		**Universiti Teknologi Malaysia**	
3.	Programme Name		**Master of Engineering (Computer and Microelectronic Systems)**	
4.	Final Award		**Master of Engineering (Computer and Microelectronic Systems)**	
5.	Programme Code		**MKEH**	
6.	Professional or Statutory Body of Accreditation		**MQA**	
7.	Language(s) of Instruction		**English and Bahasa Melayu**	
8.	Mode of Study (Conventional, distance learning, etc)		**Conventional**	
9.	Mode of operation (Franchise, self-govern, etc)		**Self-governing**	
10.	Study Scheme (Full Time/Part Time)		**Full Time**	
11.	Study Duration		**Minimum: 1.5 year** **Maximum: 4 years**	
Type of Semester		**No. of Semesters**	**No. of Weeks/ Semester**	
			On Campus	**Off Campus**
Normal		3	18	**18**
Short		**1**	**10**	**10**

COURSE CLASSIFICATION
Master of Engineering (Computer and Microelectronic Systems)- MKEH

Programme Structure

No.	Classification	Credit Hours	Percentage (%)
1	University General Courses	3	7
2	Programme General Core	3	7
3	Programme Core	12	28
4	Programme Electives	15	35
5	Master Project	10	23
	Total	43	100
Total Credit Hours to Graduate		**43**	

Programme Core and General Core (15 Credits)

Bil	Code Course	Name	Credit
1	MKEU 1013	Introduction to Research Methodology in Electrical Engineering	3
2	MKEL 1113	Nanoelectronic Devices	3
3	MKEL 1123	Advanced Microprocessor Systems	3
4	MKEL 1173	Advanced Digital System	3
5	MKEL 1193	Analog CMOS Design	3
Total			**15**

Programme Electives (Choose 5(1 cross field) – 15 Credits)

Bil	Code course	Name	Credit
1	MKEL 1143	Advanced Digital Signal Processing	3
2	MKEL 1183	Advanced Computer Architecture	3
3	MKEL 1243	Software Engineering	3
4	MKEL 1263	Special Topic in Electronic Engineering	3
5	MKEL 1283	Hardware and Software Co-Design	3
6	MKEL 1133	Integrated Circuit Testing	3
7	MKEL 1273	VLSI Design Automation	3
8	MKEL 1163	VLSI Circuits and Design	3
9	MKEL 1223	Random Process	3
10	MKEL 1233	Image Processing	3
11	MKEL 1253	Speed Processing	3

Bil	Code Course	Name	Credit
1	MKEH 1814	Research Project Proposal	4
2	MKEH 1826	Research Project Thesis	6
Total			10

STUDY PLAN
Master of Engineering (Computer and Microelectronic Systems)- MKEH
COHORT 2024/2025(1)

COURSE MENU (INTAKE SEMESTER 1)

Semester 1 (October)

	Course Code	Course Name	Credit
1	MKEU 1003	Research Methodology in Electrical Engineering	3
2	MKEL 1193	Advanced Analog CMOS IC Design	3
3	MKEL 1113	Advanced Nano-electronic Devices	3
4	MKEL 1**3	Elective 1	3
5	MKEL 1**3	Elective 2	3
		Total	15

Semester 2 (March)

	Course Code	Course Name	Credit
1	MKEL 1123	Advanced Microprocessor Systems	3
2	MKEL 1173	Advanced Digital System Design	3
3	MKEH 1814	Research Project Proposal	4
4	MKEL 1**3	Elective 3	3
5	MKEL 1**3	Elective 4	3
		Total	16

Semester 3 (October)

	Course Code	Course Name	Credit
1	UHMS 013	Seminar on Global Development, Economic and Social Issues	3
1	MKEH 1826	Research Project Thesis	6
2	MKE* 1**3	Elective 5	3
		Total	12

COURSE MENU (INTAKE SEMESTER 2)

Semester 1 (March)

	Course Code	Course Name	Credit
1	MKEU 0013	Research Methodology in Electrical Engineering	3
2	MKEL 1123	Advanced Microprocessor Systems	3
3	MKEL 1173	Advanced Digital System Design	3
4	MKEL 1**3	Elective 1	3
5	MKEL 1**3	Elective 2	3
		Total	15

Semester 2 (October)

	Course Code	Course Name	Credit
1	MKEL 1193	Analog CMOS Design	3
2	MKEL 1113	Nanoelectronic Devices	3
3	MKEL 1**3	Elective 3	3
4	MKEL 1**3	Elective 4	3
5	MKEH 1814	Research Project Proposal	4
		Total	16

Semester 3 (March)

	Course Code	Course Name	Credit
1	UHMS 6013	Seminar on Global Development, Economic and Social Issues	3
2	MKEH 1826	Research Project Thesis	6
3	MKE* 1**3	Elective 5	3
		Total	12

COURSE SYNOPSIS

CORE COURSES

MKEU 1013 Introduction to Research Methodology in Electrical Engineering

This course covers the fundamental processes in conducting academic research particularly in the field of electrical engineering (EE). Among the topics that will be covered are introduction to research and its philosophy, problem formulation and research objective, literature review, research methodology and design, data collection procedures and data analysis, research management and ethics. Another important focus is on technical writing that can be utilized for scientific publications, research proposal and thesis. The main objective is to prepare the student with a sound background of methods to plan and conduct research, which will be useful in their master's dissertation, PhD work and beyond. Despite the specific application on the field of EE, the general principles can be used in other discipline

MKEL 1113 Nanoelectronic 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 1123 Advanced Microprocessor Systems

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 students 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

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.

MKEL 1193 Analog CMOS Design

In this course, students will be taught the characteristics of MOSFET transistor as a prerequisite of CMOS analog design. It highlights the nonlinearity as an imperfection that will limit the performance of analog circuits. The course will then proceed to analyse CMOS single ended as well as differential amplifiers. The advantages and disadvantages between different architectures will be discussed which designers could choose to fit their design requirements. The trademark of analog design, which is the design challenge to fulfil design matrix, will be highlighted. Students will be guided on design principles to meet design specifications with acceptable accuracy. Other important sub-modules such as differential amplifier, op amps, and switch capacitor amplifiers will be addressed towards the end of the course.

ELECTIVE COURSES

MKEL 1173 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 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 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 1263 Special Topic in Electronic Engineering

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

MKEL 1283 Hardware and Software Co-Design

The course covers the design and development aspects of heterogeneous (hardware/software) digital systems. This course explores the process involved in defining system specification and how design space exploration can be done. Special focus is given on design quality and cost estimation, partitioning source description into different implementation domains, target code generation, interface synthesis and co-verification.

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 1273 VLSI Design Automation

In this course, students learn about computing methodologies and algorithms for VLSI design automation. The course covers fundamental techniques in VLSI physical design automation flow; from system partitioning and chip floorplanning; placement and routing with global, detailed and specialized techniques, to timing closure. Students will also explore, study, and implement some of the advanced techniques used in EDA tools.

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 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.

MKEH 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.

MKEH 1814 Research Project Proposal

The aim of the Research Project Proposal (Master Project 1) is to give students opportunity to apply the knowledge that they gained during studying in FKE to solve practical engineering societal problem. The students will be exposed in identifying and formulate through literature review and design a project proposal. This will help students to develop important skills in summarizing a research area, understanding research objectives and selling their ideas.

MKEH 1826 Research Project Thesis

The aim of the Research Project Thesis (Master Project 2) is to provide students the opportunity to explore and implement creative and innovative knowledge to solve practical science, mathematical and engineering societal problems. Students are exposed to project management planning and execution. With these skills, it is hoped that the students will gain

knowledge and experience in planning, designing and solving problems systematically. After graduation, they will be ready to work as reliable and productive engineer/researcher.

GRADUATION 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 courses are not eligible to graduate.

NO	CODE	COURSE	CREDIT EARNED	CREDIT COUNTED	TICK (/) IF PASSED
ENGINEERING COURSES					
1	UHAP 6013	Seminar on Global Development, Economic and Social Issues	3	3	
2	MKEL 1193	Analog CMOS Design	3	3	
3	MKEL 1113	Nanoelectronic Devices	3	3	
4	MKEL 1**3	Elective 1	3	3	
5	MKEL 1**3	Elective 2	3	3	
6	MKEL 1**3	Elective 3	3	3	
7	MKEU 1003	Introduction to Research Methodology in Electrical Engineering	3	3	
8	MKEL 1123	Advanced Microprocessor Systems	3	3	
9	MKEL 1173	Advanced Digital System Design	3	3	
10	MKEH 1814	Research Project Proposal	4	4	
11	MKEL 1**3	Elective 4	3	3	
12	MKE* 1**3	Elective 5	3	3	
12	MKEH 1826	Research Project Thesis	6	6	

ACADEMIC PROGRESS

No	Session (Semester)	GPA	CGPA	Remarks
1	2024/2025(1)			
2	2024/2025(2)			
3	2025/2026(1)			
4	2025/2026(2)			
5	2026/2027(1)			
6	2026/2027(2)			

GRADUATE FACULTY MEMBERS
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DIRECTOR OF DEPARTMENT

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Ph. D. (Electrical Engineering) (UTM)
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Speech Recognition, Biomedical Signal Analysis, Medical Electronics

PROFESSOR

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Deputy Dean (Research, Innovation and Development)

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ASSOCIATE PROFESSOR

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Ph. D. (Bioengineering) (Imperial College London, UK),
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Design of Medical Devices, Virtual Reality Systems, Surgical Simulators, Rehabilitation Robots, Haptics, Human Motor Learning and Assessment, Connected Healthcare Systems

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Semiconductor Material Engineering, Device Modelling of Low Dimensional Nanostructure, Device Simulation based on Tight-Binding

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Computer Vision, Biomedical Image and Signal Processing

SENIOR LECTURERS

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Head of Research Group - BMiE
B. Eng. (Electrical - Electronics) (UTM), M. Eng. (Advanced Electrical Engineering), Ph. D. (Biomedical Engineering) (Warwick University, UK)
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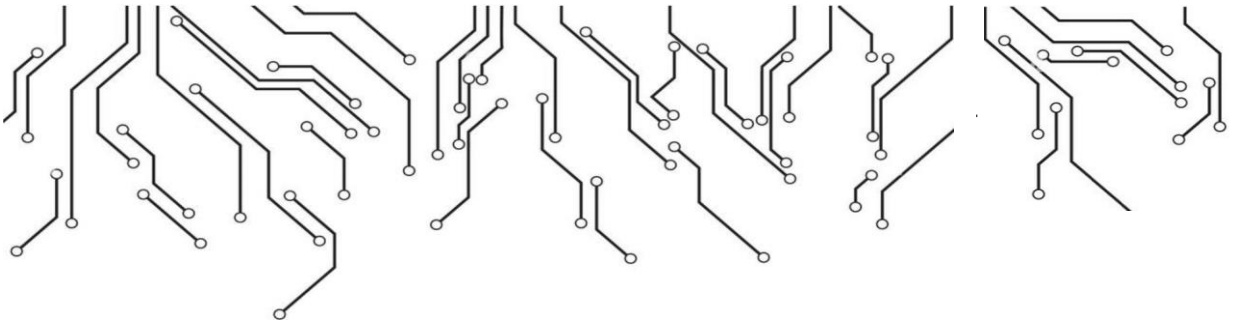

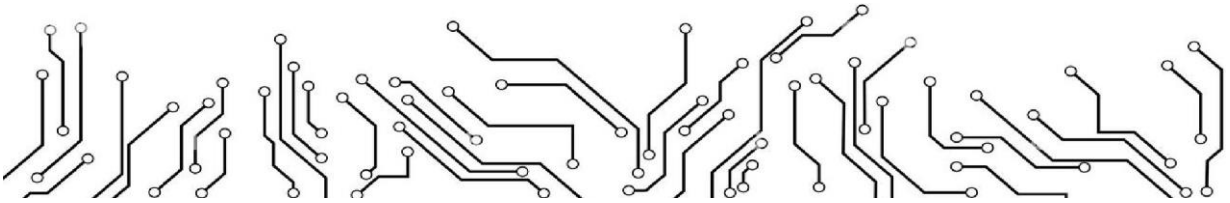

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