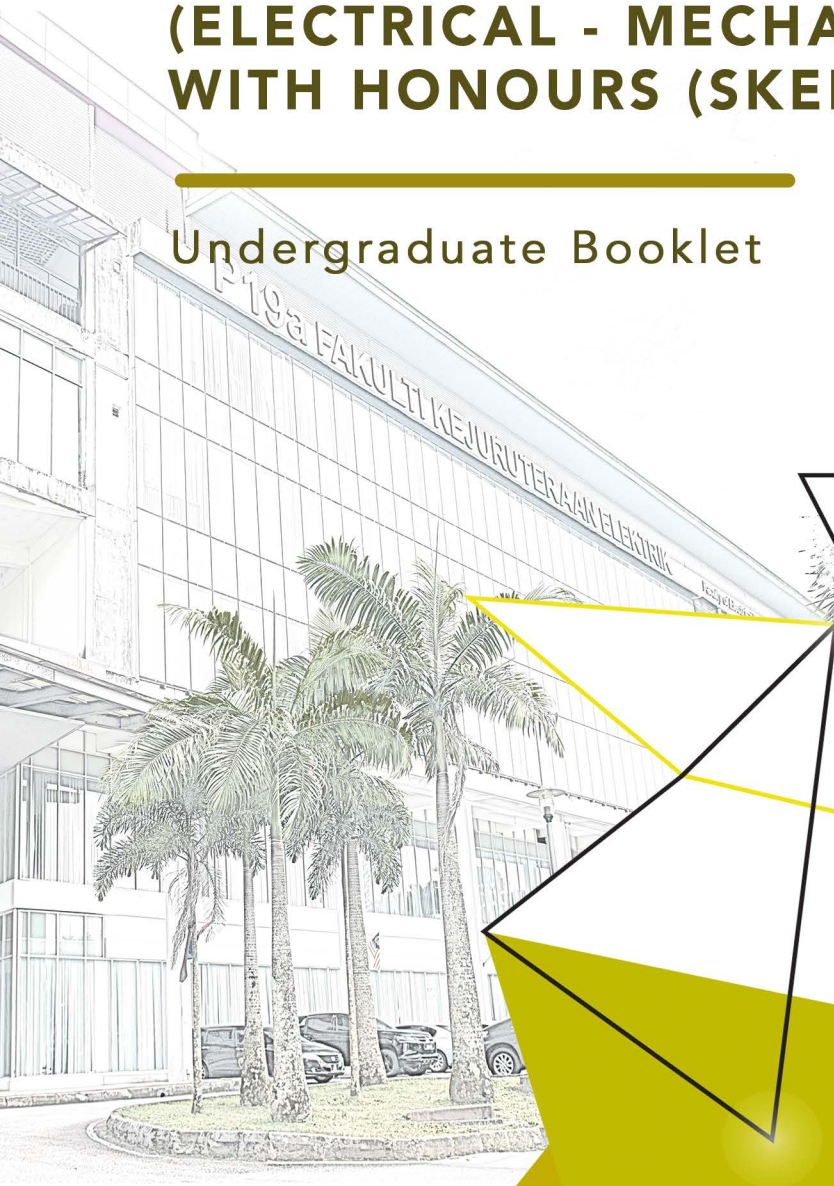
UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Faculty of
Electrical Engineering

Academic Session
2024/2025

BACHELOR OF ENGINEERING (ELECTRICAL - MECHATRONICS) WITH HONOURS (SKEMH)

Undergraduate Booklet



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BACHELOR OF ENGINEERING (ELECTRICAL – MECHATRONICS) WITH HONOURS

(SKEMH)

STUDENT INFO

NAME	
MATRIC NO.	
PHONE NO.	
EMAIL	
ACADEMIC ADVISOR	

PROGRAMME GUIDELINES

The University operates on a semester system. One academic year consists of two main semesters, Semester I and Semester II, followed by a short semester after Semester II. New undergraduate students are typically admitted at the start of Semester I. The minimum duration for the programmes is four years (eight semesters).

All courses offered by the Faculty carry credits, with some exceptions as approved by the University Senate. One (1) credit corresponds to 14 hours of lectures or 30 hours of practical sessions (such as studio work or projects) within a semester. The Bachelor of Engineering (Electrical-Mechatronics) with Honours (SKEMH) programme requires a total of 136 credits for graduation.

Student performance is assessed through formal evaluations. Typically, each course is graded based on coursework, which makes up at least 50% of the final mark, and a final examination, which accounts for the remaining 50%. Coursework may include assignments, quizzes, tests, and presentations. The final examination takes place at the end of each academic semester. A student's performance in a course is indicated by a letter grade, with a passing grade generally being a 'D+'. Students who fail a course (receiving a grade of 'D' or below) must retake it in subsequent semesters when it is offered. Students can also improve their grades for any course where they received a 'B-' or lower. According to Faculty and University Academic Regulations, students may withdraw from a course if necessary. To be awarded a Bachelor's degree, a student must pass all required courses and meet all other programme requirements set by the Faculty and University.

PROGRAMME LEARNING OUTCOMES (PLO)

All undergraduate programmes offered in FKE share a common Programme Learning Outcomes (PLOs). After having completed the Bachelor's degree programme, graduates should be able to demonstrate the following competencies:

CODE	PROGRAMME LEARNING OUTCOMES
PLO1 *Engineering Knowledge*	Apply knowledge of mathematics, science, computing and engineering fundamentals, and electrical engineering specialization to develop solutions to complex engineering problems.
PLO2 *Problem Analysis*	Identify, formulate, conduct research literature and analyze complex engineering problems reaching substantiated conclusions using principles of mathematics, sciences and electrical engineering with holistic considerations for sustainable development.
PLO3 *Design / Development Solutions*	Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole-life cost, net-zero carbon as well as resource, cultural, societal, and environmental considerations as required.
PLO4 *Investigation*	Conduct investigation of complex engineering problems using research methods including research-based knowledge, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PLO5 *Tool Usage*	Create, select and apply, and recognize limitation of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems.
PLO6 *The Engineering & The World*	Analyze and evaluate sustainable development impacts to: society, the economy, sustainability, health and safety, legal frameworks, and the environment, in solving complex engineering problems.
PLO7 *Ethics*	Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion.
PLO8 *Individual and Collaborative Teamwork*	Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face-to-face, remote and distributed settings.
PLO9 *Communication*	Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, taking into account cultural, language, and learning differences.
PLO10 *Project Management & Financ*	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects in multidisciplinary environments.
PLO11 *Lifelong Learning*	Recognise the need for and have the preparation and ability for i) independent and lifelong learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

PROFESSIONAL SKILLS CERTIFICATE (PSC)

UTM has designed its own UTM Professional Skills Certificate (UTM PSC) programme managed by UTM School of Undergraduate Studies (UGS) to enhance the knowledge and skills of UTM students. It provides students with value-added courses so that they will have a competitive edge when they enter the employment market. Students will receive a Certificate of UTM Professional Skills Programme and the courses will appear in the student transcript. Students are required to undertake and must pass five (5) PSC courses as listed below:

NO.	PSC COURSE	CODE
Compulsory Courses (must take all THREE (3) courses)		
1	Design Thinking for Entrepreneur	GLRB 0010
2	Talent and Competency Management	GLRM 0010
3	English Communication Skills for Graduating Students	GLRL 0010
Elective Courses (must take any TWO (2) of these courses)		
1	Data Analytics For Organization	GLRT 0010
2	Professional Ethics and Integrity	GLRM 0020
3	Construction Measurement (Mechanical & Electrical)	GLRT 0020
4	OSHE For Engineering Industry and Laboratory	GLRT 0030
5	Quality Management For Built Environment and Engineering Professionals	GLRT 0050
6	Safety and Health Officer Introductory Course	GLRT 0060
7	Industrial Machinery and Lubrication	GLRT 0070

PRISMS (PROGRAM INTEGRASI SARJANA MUDA - SARJANA)

PRISMS is a newly introduced programme that integrates undergraduate high-level elective SK** 5**3 courses with the core courses of the Master degree programme. Under PRISMS, students have an opportunity to complete and receive two degrees which are Bachelor degree and Master degree within 5 years (4+1).

Requirements

Students who have completed third year second semester courses with a cumulative grade point average (CGPA) of 3.3 and above are eligible to apply for PRISMS. Students can apply using the PRISMS application form and must be recommended by the Academic Advisor, approved by the Program Director, and certified by the Dean of Faculty. Once the application to join PRISMS is approved, students can register for the SK** 5**3 courses during the course pre-registration or compulsory registration period.

PRISMS Credit Transfer

Students must obtain grade B and above of the high-level elective SK** 5**3 courses for vertical credit transfer into the Master degree program that students plan to enrol. Maximum unit allowed for the credit transfer is twelve (12) credits.

BACHELOR OF ENGINEERING (ELECTRICAL - MECHATRONICS) WITH HONOURS (SKEMH)

INTRODUCTION

Mechatronic Engineering is a branch of engineering that combines elements of mechanical engineering, electronic engineering, computer science, and control engineering. The curriculum for SKEMH programme is designed with a strong emphasis on preparing students for successful engineering careers in this fast-paced and ever-changing field. In view of this, the programme will equip the students with the knowledge of embedded systems, robotics, automation, control engineering, and artificial intelligence.

Mechatronic engineering focuses on the design, development, and maintenance of intelligent and automated systems, blending mechanical components with electronic and software solutions to create innovative products and processes. Mechatronic engineers work on a wide range of applications, including robotics, automotive systems, industrial automation, consumer electronics, and more. They integrate sensors, actuators, microcontrollers, and software algorithms to enable machines to perform tasks autonomously, respond to environmental changes, and communicate with humans and other systems. This multidisciplinary field aims to create efficient, reliable, and versatile systems that enhance automation, improve efficiency, and advance technology across various industries. Those whose expertise revolves around these areas are extremely needed by the existing industries and have an immense advantage in employment.

The Bachelor of Engineering (Electrical-Mechatronics) with Honours program has been offered for more than two decades by UTM. The program is a four-year program completed with a final year project. The programme is offered only at the UTM Main Campus in Johor Bahru. The duration of study is subject to the student's entry qualifications and can be completed within four (4) years to a maximum of six (6) years.

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

CODE	PROGRAMME EDUCATIONAL OBJECTIVES	TARGET
PEO1	Become mechatronic engineers who are competent, innovative, and productive in addressing stakeholders' needs.	60% of graduates work as engineer AND 10% of graduates work as senior engineer
PEO2	Grow professionally with proficient soft skills.	5% of graduates pursued postgraduate studies or enrolled in self-improvement skill-based workshops (or equivalent) AND 1% of graduates become Professional Engineers or attain equivalent professional qualification.
PEO3	Demonstrate high standards of ethical conduct, positive attitude, and societal responsibilities.	10% of graduates are involved in services to community.

GENERAL INFORMATION

Awarding Institution	Universiti Teknologi Malaysia
Teaching Institution	Universiti Teknologi Malaysia
Programme Name	Bachelor of Engineering (Electrical - Mechatronics) with Honours
Final Award	Bachelor of Engineering (Electrical - Mechatronics) with Honours
Programme Code	SKEMH
Professional or Statutory Body of Accreditation	Board of Engineers Malaysia (BEM)
Language(s) of Instruction	English and Bahasa Melayu
Mode of Study	Conventional
Mode of operation	Self-governing
Study Scheme	Full Time
Study Duration	Minimum: 4 years (8 semesters) Maximum: 6 years (12 semesters)

AWARD REQUIREMENTS

To graduate, students must:

- Attain a total of 136 credit hours with a minimum CGPA of 2.0
- Complete Professional Skills Certificates (PSC).

COURSE CLASSIFICATION

NO.	CLASSIFICATION	CREDIT	%
1.	University General Courses	16	12 %
2.	Mathematics	15	11 %
3.	Programme Core	96	71 %
4.	Programme Electives	6	4 %
5.	Free Electives	3	2 %
	Total	**136**	**100 %**
A	Engineering Courses a) Lecture/Project/Laboratory b) Workshop/Field/Design Studio c) Industrial Training d) Final Year Project	 91 - 5 6	75 %
Total Credits for Part A		**102**	
B	Related Courses a) Applied Science/Mathematic/Computer b) Management/Law/Humanities/Ethics/Economy c) Language d) Co-Curriculum e) Free Electives	 15 8 6 2 3	25%
Total Credits for Part B		**34**	
Total Credits for Part A and B		**136**	**100%**
Total Credits to Graduate		**136**	

STUDY PLAN FOR SKEMH

YEAR 1

CODE	COURSE	CREDIT	PRE-REQUISITE	TOTAL CREDIT
SEMESTER 1				
ULRS 1032	Integrity and Anti-Bribery	2		**16**
SSCE 1693	Engineering Mathematics I	3		
SKEE 1012	Introduction to Electrical Engineering	2		
SKEE 1013	Electrical Circuit Analysis	3		
SKEE 1033	Scientific Programming	3		
SKEE 1233	Digital Electronic Systems	3		
SEMESTER 2				
ULRS 1182	Appreciation of Ethics and Civilizations (Local Students)	2		**17**
UHLM 1012	Malay Language for Communication 2 (International Students)			
SSCE 1793	Differential Equations	3		
SKEM 1113	Engineering Mechanics	3		
SKEE 1103	C Programming for Engineers	3		
SKEE 1073	Electronic Devices and Circuits	3	SKEE 1013	
SKEM 1503	Computer Aided Engineering Design	3		

YEAR 2

CODE	COURSE	CREDIT	PRE-REQUISITE	TOTAL CREDIT
SEMESTER 1				
SSCE 1993	Engineering Mathematics II	3	SSCE 1693	**17**
SKEE 2073	Signals and Systems	3		
SKEE 2133	Electronic Instrumentation and Measurement	3		
SKEE 2433	Principles of Electrical Power Systems	3	SEEE1013	
SKEE 2752	Electronic Design Laboratory	2		
SKEE 3223	Microprocessor	3	SKEE 1233	
SEMESTER 2				
ULRS 1022	Philosophy and Current Issues (Local Students)	2		**18**
ULRS 1182	Appreciation of Ethics and Civilizations (International Students)			
ULRF 2**2	Elective of Service Learning and Community Engagement	2		
UHLB 2122	Professional Communication Skills 1	2		
SSCE 2193	Engineering Statistics	3		
SKEE 2523	Electromagnetic Field Theory	3	SSCE 1993	
SSCE 2393	Numerical Methods	3		
SKEM 2013	Mechanics of Materials	3		

YEAR 3

CODE	COURSE	CREDIT	PRE-REQUISITE	TOTAL CREDIT
SEMESTER 1				
UHL* 1112	Elective of Foreign Language for Communication	2		**18**
UHLB 3132	Professional Communication Skills 2	2		
SKEM 3143	Mechanical System Design	3		
SKEE 3133	System Modeling & Analysis	3	SKEE 2073	
SKEE 3533	Communication Principles	3	SKEE 2073	
SKEE 3732	Common 3rd Year Laboratory	2	SKEE 2752	
SKEE 3263	Electronic Systems	3	SKEE 1073	
SEMESTER 2				
ULRS 3032	Entrepreneurship & Innovation	2		**17**
SKEE 3143	Control System Design	3	SKEE 3133	
SKEM 3133	Electrical Motors and Drives	3		
SKEE 3733	Integrated Design Project	3	SKEE 3732	
SKEL 3233	Digital Signal Processing	3	SKEE 2073	
S*** ***3	Free Elective	3		
SEMESTER 3				
SKEE 3925	Industrial Training	5		**5**

YEAR 4

CODE	COURSE	CREDIT	PRE-REQUISITE	TOTAL CREDIT
SEMESTER 1				
SKEE 4542	Engineering Management Principles	2		**17**
SKEM 4143	Robotics	3	SSCE 1993	
SKEE 4813	Methodology of Research and Development	3		
SKEM 3123	Hydraulic and Pneumatic Systems	3	SKEM 1113	
SKEM 4333	Mechatronics System Design	3		
SKE* 4**3 / 5**3	Field Elective 1 / PRISMS Elective 1 / Faculty Free Elective[1]	3		
SEMESTER 2				
SKEE 4826	Final Year Project	6	SKEE 4813	**11**
SKEE 4012	Professional Engineering Practice	2		
SKE* 4**3 / 5**3	Field Elective 2 / PRISMS Elective 2 / Faculty Free Elective[1]	3		
			CUMULATIVE CREDITS	**136**

[1] For Free Faculty Elective, students can only take one course only – either in Semester 1 of Year 4 OR Semester 2 of Year 4.

ELECTIVE COURSES

CODE	COURSE	CREDIT	PRE-REQUISITE
SKEM 4133	Machine Vision Systems	3	
SKEM 4153	Robot Technology for Automation	3	SKEM 4143
SKEM 4173	Artificial Intelligence	3	
SKEM 4223	Embedded Systems	3	SKEE 3223
SKEE 4173	Industrial Process Control	3	
SKEM 4313	PLC and SCADA System Design	3	SKEE 3143
SKEM 4113	Modern Control Theory	3	SKEE 3143
SKEE 4153	Digital Control Systems	3	SKEE 3143
SKEE 3433	Power Electronic and Drives	3	SKEE 2433
SKEM 4183	Industrial Instrumentations and Applications	3	SKEE 2133
SKEM 4193	Advanced Transducers and Sensors	3	SKEE 2133
SKEM 4243	BioMEMS and Microanalytical Systems	3	SKEE 2133
SKEM 4233	Nanotechnology and Application	3	
SKEM 4323	Advanced Control Theory	3	SKEE 3143
SKEM 4343	System Identification and Estimation	3	SKEE 3143
SKEM 4163	Autonomous Robot	3	SKEM 4143
SKEM 4123	Industrial Engineering	3	
SKEL 4213	Software Engineering	3	SKEE 1103

SEEM ELECTIVE COURSES FOR PRISM			
Code	**Course**	**Credit**	**Pre-requisite**
SKEM 5753	Advanced Instrumentation and Measurement	3	
SKEM 5713	Artificial Intelligence and Applications	3	
SKEM 5703	Control Systems Engineering	3	

TRACKS (for Electives)

Robotics	Smart Manufacturing	Control Systems	Instrumentation
Robot Technology for Automation	PLC and SCADA System Design	Artificial Intelligence	Artificial Intelligence
Autonomous Robot	Industrial Process Control	Modern Control Theory	BioMEMS and Microanalytical Systems
Machine Vision System	Machine Vision System	Advanced Control Theory	Advance Transducers and Sensors
Embedded Systems	Digital Control System	System Identification and Estimation	Industrial Instrumentation and Applications
Artificial Intelligence	Industrial Engineering	Power Electronics and Drives	Embedded Systems
Industrial Instrumentation and Applications	Industrial Instrumentation and Applications	Control System Engineering (PRISM)	Nanotechnology and Application
Advance Transducers and Sensors	Advance Transducers and Sensors	Industrial Process Control	Advanced Instrumentation and Measurement (PRISM)
Software Engineering	Advanced Instrumentation and Measurement (PRISM)	PLC and SCADA System Design	
	Artificial Intelligence	Digital Control System	

UTM Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MALAYSIA

ROADMAP TO YOUR GRADUATION

Bachelor of Engineering (Electrical-Mechatronics) with Honours (SKEMH)

Cohort 2023/2024 ONWARDS

Year 1

Semester 1 — 16 credit

- SKEE 1013 Electrical Circuit Analysis
- SKEE 1012 Intro to Elect. Eng.
- SKEE 1033 Scientific Programming
- SKEE 1233 Digital Electronic Systems
- SSCE 1693 Engineering Mathematics I
- ULRS 1032 Integrity & Anti-corruption Course

Semester 2 — 17 credit

- SKEE 1073 Electronic Devices and Circuits
- SKEE 1103 C Programming for Engineers
- SSCE 1793 Differential Equations
- SKEM 1503 Computer Aided Eng. Design
- SKEM 1113 Engineering Mechanics
- ULRS 1182 Appreciation of Ethics and Civilizations
- UHLM 1012 Malay Language for Communication 2

Year 2

Semester 1 — 17 credit

- SKEE 2073 Signals & Systems
- SKEE 2433 Principles of Electrical Power Systems
- SKEE 2133 Electronic Instrumentation and Measurement
- SSCE 1993 Engineering Mathematics II
- SKEE 2752 Electronic Design Laboratory
- SKEE 3223 Microprocessor

Semester 2 — 18 credit

- SKEE 2523 Electromagnetic Field Theory
- SKEM 2013 Mechanics of Materials
- SSCE 2193 Engineering Statistics
- SSCE 2393 Numerical Method
- ULRS 1022 Philosophy and Current Issues
- ULRS 1182 Appreciation of Ethics and Civilizations
- UHLB 2122 Professional Communication Skills 1
- ULRF 2**2 Elective of Service Learning & Community Engagement

Year 3

Semester 1 — 18 credit

- SKEE 3533 Communication Principles
- SKEE 3133 System Modeling & Analysis
- SKEE 3263 Electronic Systems
- SKEM 3143 Mechanical System Design
- SKEE 3732 Common 3rd Year Lab
- UHL* 1112 Elective of Foreign Language for Communication
- UHLB 3132 Professional Communication Skills 2

Semester 2 — 17 credit

- SKEL 3233 Digital Signal Processing
- SKEE 3143 Control System Design
- SKEM 3133 Electrical Motors and Drives
- SKEE 3733 Integrated Design Project
- S*** ***3 Free Elective

Semester 3 — 5 credit

- SKEE 3925 Practical Training

Year 4

Semester 1 — 17 credit

- SKEM 4333 Mechatronics System Design
- SKEE 4813 Methodology of Research and Development
- SKEM 3123 Hydraulic and Pneumatic Systems
- SKEM 4143 Robotics
- SKE* 4**3/5**3 Field Elective 1 / PRISMS Elective 1
- SKEE 4542 Engineering Management Principles

Semester 2 — 11 credit

- SKEE 4012 Proffesional Engineering Practice
- SKEE 4826 Final Year Project
- SKE* 4**3/5**3 Field Elective 2 /PRISMS Elective 2

Electrical Engineering Core Courses
Mathematics Courses
University General Courses
Mechatronics courses
For local students
For international students
Hands-on courses
Industrial/Community-based courses

Total Credit Hours : 136
Total No. of Courses: 50

Department of Control and Mechatronics Engineering (CMED)

UTM Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MALAYSIA

ROADMAP TO YOUR GRADUATION

Bachelor of Engineering (Electrical-Mechatronics) with Honours (SKEMH)

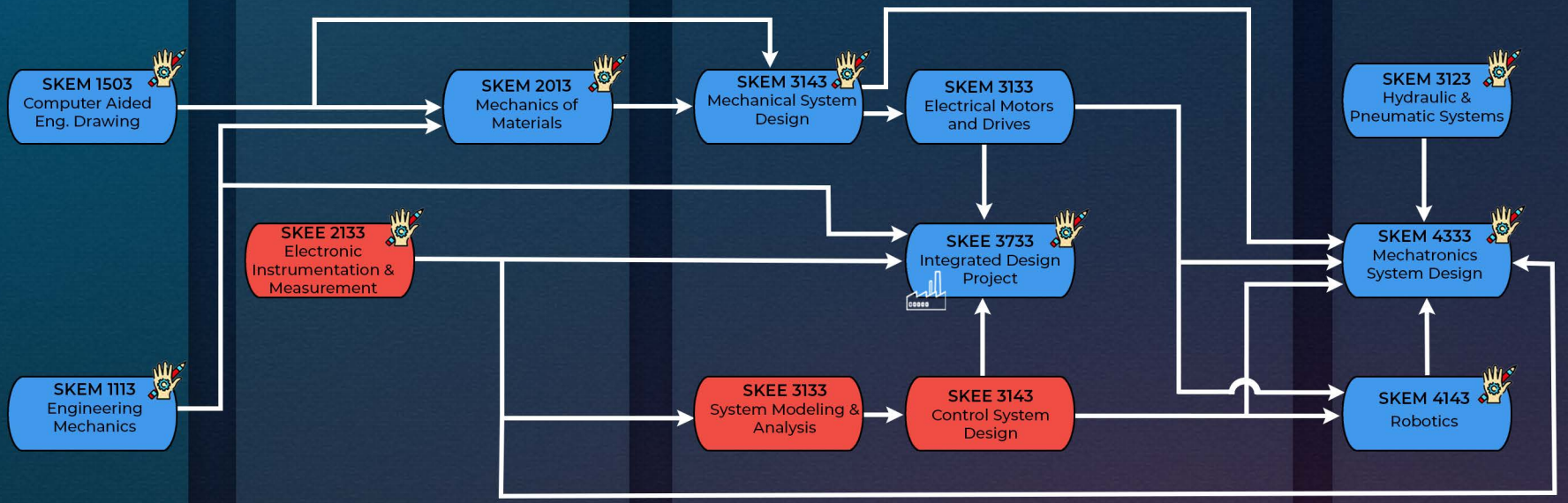
Session 2023/2024 ONWARDS

Year 1		Year 2		Year 3			Year 4	
Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2	Semester 3	Semester 1	Semester 2

Electrical / Electronics /Communication / Computing

Industrial Training

Engineering Management & Professional Practice



Department of Control and Mechatronics Engineering (CMED)

Electrical Engineering Core Courses

Mechatronics courses

Hands-on courses

Industrial/Community-based courses

Total Credit Hours : 136
Total No. of Courses: 50

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SEEM/SKEMH ENABLING TECHNOLOGY FOR IR 4.0

★ CAREER EXCELLENCE
★ ALUMNI NETWORKING
★ GLOBAL CITIZEN

Three SEEM/SKEMH Technical DNA

1. Highly Competent in Embedded System Design
2. Proficient in Robotics and Automation System Integration
3. Excellent in Computing Skill

CORPORATE BEHAVIORS

IQ
- Project Design
- Problem-based Learning
- Integrated Design Project

EQ
- Counselling
- Extra Curriculum
- Experiential Learning
- Career Fair

SQ
- Cooperative/Collaborative Learning
- Community Service

TEAMWORKING SKILLS

YEAR 4

- Lifelong Learning
- Communication skills
- Management
- Professional Engineering Practice

PERSONAL SKILLS

YEAR 2 & 3

- Communication skills
- Responsibility
- Adaptability
- Teamworking
- Leadership
- Entrepreneurship
- Community Service

YEAR 1

- Lifelong Learning
- Design Thinking
- Positive Attitude & Behaviors
- Critical Thinking
- Problem Solving

Bachelor of Engineering (Electrical - Mechatronics) with Honours (SEEM/SKEMH)
Department of Control and Mechatronic Engineering (CMED)
Faculty of Electrical Engineering (FKE)

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 courses are not allowed to graduate.

Bachelor of Engineering (Electrical - Mechatronics) with Honours - SKEMH

NO.	CODE	COURSE	CREDITS EARNED	CREDITS COUNTED	TICK (√) IF PASSED
1.	SKEE 1012	Introduction to Electrical Engineering	2	2	
2.	SKEE 1013	Electrical Circuit Analysis	3	3	
3.	SKEE 1033	Scientific Programming	3	3	
4.	SKEE 1233	Digital Electronic Systems	3	3	
5.	SKEM 1113	Engineering Mechanics	3	3	
6.	SKEE 1103	C Programming for Engineers	3	3	
7.	SKEE 1073	Electronic Devices and Circuits	3	3	
8.	SKEM 1503	Computer Aided Engineering Design	3	3	
9.	SKEE 2073	Signals and Systems	3	3	
10.	SKEE 2133	Electronic Instrumentation and Measurement	3	3	
11.	SKEE 2433	Principles of Electrical Power Systems	3	3	
12.	SKEE 2752	Electronic Design Laboratory	2	2	
13.	SKEE 3223	Microprocessor	3	3	
14.	SKEE 2523	Electromagnetic Field Theory	3	3	
15.	SKEM 2013	Mechanics of Materials	3	3	
16.	SKEM 3143	Mechanical System Design	3	3	
17.	SKEE 3133	System Modeling & Analysis	3	3	
18.	SKEE 3533	Communication Principles	3	3	

19.	SKEE 3732	Common 3rd Year Laboratory	2	2	
20.	SKEE 3263	Electronic Systems	3	3	
21.	SKEE 3143	Control System Design	3	3	
22.	SKEM 3133	Electrical Motors and Drives	3	3	
23.	SKEE 3733	Integrated Design Project	3	3	
24.	SKEL 3233	Digital Signal Processing	3	3	
25.	SKEE 3925	Industrial Training	5	HL	
26.	SKEE 4542	Engineering Management Principles	2	2	
27.	SKEM 4143	Robotics	3	3	
28.	SKEE 4813	Methodology of Research and Development	3	3	
29.	SKEM 3123	Hydraulic and Pneumatic Systems	3	3	
30.	SKEM 4333	Mechatronics System Design	3	3	
31.	SKE* 4**3 / 5**3	Field Elective 1 / PRISMS Elective 1 / Faculty Free Elective	3	3	
32.	SKEE 4826	Final Year Project	6	6	
33.	SKEE 4012	Professional Engineering Practice	2	2	
34.	SKE* 4**3 / 5**3	Field Elective 2 / PRISMS Elective 2 / Faculty Free Elective	3	3	
		TOTAL CREDITS OF ENGINEERING COURSES (A)	**102**	**97**	
MATHEMATICS COURSES (Faculty of Science)					
1.	SSCE 1693	Engineering Mathematics I	3	3	
2.	SSCE 1793	Differential Equations	3	3	
3.	SSCE 1993	Engineering Mathematics II	3	3	
4.	SSCE 2193	Engineering Statistics	3	3	
5.	SSCE 2393	Numerical Methods	3	3	
		TOTAL CREDITS OF MATHEMATICS COURSES (B)	**15**	**15**	

UNIVERSITY GENERAL COURSES					
Cluster 1: Malaysia Core Value					
1.	ULRS 1182	Appreciation of Ethics and Civilizations (Local Students)	2	2	
	UHLM 1012	Malay Language for Communication 2 (International Students)			
2.	ULRS 1022	Philosophy and Current Issues (Local Students)	2	2	
	ULRS 1182	Appreciation of Ethics and Civilizations (International Students)			
Cluster 2: Value and Identity					
1.	ULRS 1032	Integrity and Anti-Bribery	2	2	
Cluster 3: Global Citizen					
1.	ULRF 2**2	Elective of Service Learning and Community Engagement	2	2	
Cluster 4: Communication Skills					
1.	UHLB 2122	Professional Communication Skills 1	2	2	
2.	UHLB 3132	Professional Communication Skills 2	2	2	
3.	UHL* 1112	Elective of Foreign Language for Communication	2	2	
Cluster 5: Enterprising Skills					
1.	ULRS 3032	Entrepreneurship & Innovation	2	2	
Free Elective Courses					
1.	S*** ***3	Free Elective	3	3	
		TOTAL CREDITS of UNIVERSITY GENERAL COURSES (C)	**19**	**19**	
		TOTAL CREDITS TO GRADUATE (A + B + C)	**136**	**131**	

OTHER COMPULSORY COURSES - PROFESSIONAL SKILLS CERTIFICATE (PSC). Students are required to enroll and pass FIVE (5) PSC courses to graduate.			
COMPULSORY PSC COURSES (must take all THREE (3) courses)			
1.	GLRB 0010	Design Thinking for Entrepreneur	
2.	GLRM 0010	Talent and Competency Management	
3.	GLRL 0010	English Communication Skills for Graduating Students	
ELECTIVE PSC COURSE (must take any TWO (2) of these courses)			
1.	GLRT 0010	Data Analytics for Organisation	
2.	GLRM 0020	Professional Ethics and Integrity	
3.	GLRT 0020	Construction Measurement (Mechanical & Electrical)	
4.	GLRT 0030	OSHE for Engineering Industry and Laboratory	
5.	GLRT 0050	Quality Management for Built Environment and Engineering Professionals	
6.	GLRT 0060	Safety and Health Officer Introductory Course	
7.	GLRT 0070	Industrial Machinery and Lubrication	

COURSE SYNOPSIS

SKEE 1012: INTRODUCTION TO ELECTRICAL ENGINEERING

This course serves as a general introduction to electrical engineering programmes offered by the School of Electrical Engineering (SEE), Universiti Teknologi Malaysia (UTM). Students undertaking this course will be exposed to attributes of electrical engineers from both academic and practical points of view. Soft skills and knowledge that are necessary in the engineering world will be introduced to the students. The students will have a clearer understanding on the responsibilities of electrical engineers to the society. By exploring contemporary issues, the students would be able to suggest sustainable solutions to the mankind and its environment.

SKEE 1013: ELECTRICAL CIRCUIT ANALYSIS

This course introduces students to the basic laws, methods of analysis and theorems for direct current, DC and alternating current, AC circuit, such as Ohms Law, Kirchhoff's Current and Voltage Laws, Mesh and Nodal Analysis and Thevenin's and Norton's Theorems. Based on these, the students are expected to be able to solve for variables in any given DC and AC electric circuits. The students also exposed to the steady-state electrical circuit. Afterwards, the relevant concepts in transient circuit analysis for first and second order circuit are taught to the students. With the knowledge learned, the student would be able to apply the basic laws, theorem and methods of analysis for solving completely with confidence various problems in circuit analysis.

SKEE 1033: SCIENTIFIC PROGRAMMING

This course introduces the fundamentals of scientific programming languages and techniques used by engineers to solve engineering problems. Students will be introduced to common scientific programming languages and their comparative advantages and disadvantages. Emphasis is placed on fundamentals of programming, program design, verification and visualization. The goal is to provide the students with the skills in scientific computing, tools, techniques that can be used to solve their own engineering problems. Students will learn to implement algorithms using high level programming language. The programming skills acquired in this course will allow students to go beyond what is available in pre-packaged analysis tools, and code their own custom data processing, analysis and visualization for any engineering problem.

SKEE 1073: ELECTRONIC DEVICES & CIRCUITS

This course provides introduction to the basic operating principles and applications of discrete electronic devices and circuits. The course content starts with the fundamental solid-state principles and continues the discussions with the constructions and characteristics of diode, Bipolar Junction Transistor (BJT) and Enhancement Metal Oxide Semiconductor Field Effect Transistor (E-MOSFET). The application of diodes focusses on the basic power supply circuits whereas the applications of the transistors focus on the small-signal amplifier. The course content ends with an introduction to the operating principles of an ideal operational amplifier (op-amp) and discussion about op-amp circuits, performance and applications. To help the students understand the behaviour of the electronic devices and predict the behaviour of the electronic circuits, this course makes use of simulation software. The goal of this course is to develop excellent understanding of the devices operation for students to be applied in analogue circuit design.

SKEE 1103: C PROGRAMMING FOR ENGINEERS

This course introduces students to basic programming concepts and problem-solving techniques, with an emphasis on embedded systems. The course begins with an introduction to computer structures, before moving on to C programming concepts (editing, compiling, and debugging). Programs will be modeled with high level programming constructs (sequence, selection, looping) along with design tools (pseudocode and flowchart). Students will apply these ideas to arithmetic expressions, bit manipulations, arrays, strings, pointers, user-defined functions, and basic C library functions. By the end of the course, students should be able to run simple input/output demonstration programs on a single board computer to show their understanding.

SKEM 1113: ENGINEERING MECHANICS

This course introduces students with the basic principles of engineering mechanics with emphasis on the analysis and application to practical engineering problems. The fundamental knowledge in vectors and the concept of force, mass and weight are reviewed. The force system and equilibrium of particles are covered consecutively. Kinematics and kinetics of particles with their governing physical laws are also introduced and analysed such that the students will gain the ability to apply these basic principles to solve mechanic problems.

SKEM 1503: COMPUTER AIDED ENGINEERING DESIGN

This course introduces the use of engineering drawing as an effective way for communicating an engineering concept. It provides a platform where the engineers can share and exchange engineering design information. The information is prepared using a Computer-Aided Design (CAD) system, SolidWorks to produce two- (2D) and three-dimensional (3D) drawings. Techniques such as patterns, shelling, planes, ribs, revolve and assembly will be learned in the course. Finally, a 3D functional prototype will be developed using 3D printer.

SKEE 1233: DIGITAL ELECTRONIC SYSTEMS

This course teaches the principles of digital systems. From signal concepts and number systems and codes, it proceeds to logic gates, their relationship to Boolean algebra, logic simplification, and the integration of gates to form digital circuits for medium-scale integration and arithmetic. It covers combinational and sequential logic circuits, including finite state machines, emphasizing circuit design and analysis. This course uses an industry-standard engineering software tool to design and simulate digital circuits.

SKEM 2013: MECHANICS OF MATERIALS

This course considers the fundamental properties of materials composites. Students are introduced to the atomic and microstructure of materials and their relationship to mechanical and electrical properties. The course explores the mechanical concepts of stress, strain, elongation and material failure (including testing). Basic topics in mechanics of materials including: continuum stress and strain, truss forces, torsion of a circular shaft and beam bending. Design of engineering structures from a materials point of view will be also covered.

SKEE 2073: SIGNALS AND SYSTEMS

This course introduces the students the fundamental ideas of signals and system analysis. The signal representations in both time and frequency domains and their effects on systems will be explored. Specifically, the topics covered in the course include basic properties of continuous-time and discrete-time signals, the processing of signals by linear time-invariant (LTI) systems, Fourier series, Fourier and Laplace transforms. Important concepts such as impulse response, frequency response and system transfer functions as well as techniques of filtering and filter design, modulation, and sampling, are discussed and illustrated. This course will serve as a central building block for students in studying information processing in many engineering fields such as control systems, digital signal processing, communications, circuit design, etc.

SKEE 2133: ELECTRONIC INSTRUMENTATION AND MEASUREMENT

This course introduces students some of the metrological terminologies used in experimental methods, concept of metrology and its applications. The course will also provide the students with an understanding on the concept electrical measurement quantity using analogue and digital instruments. The interfaces of the instruments with embedded sensors and also the acquired signal quality analysis is introduced. Besides that, this course also introduces the type of electrical noise and the ways to reduce noise and interference. Finally, the fundamental principle of transducers, transducer operations, characteristic and functions will be discussed. P&ID diagram will also be introduced. This course includes hands-on activities using the latest embedded system related to electrical and electronic measurement.

SKEE 2433: PRINCIPLES OF ELECTRICAL POWER SYSTEMS

This course introduces fundamental concepts of power systems, magnetic circuits and transformer. Students should be able to identify components of the system from the course and describe their basic operations from the course having electromagnetic and circuit concepts learned in previous fundamental courses. These fundamental concepts are further elaborated in applications of magnetic circuits in transformers, power in ac circuits, three-phase system, power system generation and component modeling and analysis in power system transmission. At the end of the course, the students are expected to critically analyze the power system comprising of generation and transmission.

SKEE 2523: ELECTROMAGNETIC FIELD THEORY

This course presents several major collective understandings and theories within the area of electrostatic, magnetostatic and electromagnetic fields to the students. The abovementioned electromagnetic field theory is succinctly summarized via the Maxwell's equations. Here, the course is conducted with the assumption that the enrolled students are already equipped with the necessary mathematical foundations including multivariable calculus. Furthermore, they should also possess some familiarity with basic concepts covered in the typical introductory circuit theory course such as resistance, capacitance and inductance to list a few.

SKEE 2752: ELECTRONIC DESIGN LABORATORY

In this cource, the students will attend four 2nd year laboratories namely Electrotechnics, Basic Electronic, Digital Electronic and Instrumentation Laboratories. The students will attend a three-hour lab per week. The students are expected to complete 3 experiment topics for each lab in three weeks. In total, the student will perform 12 experiments. All experiments in the laboratories are emphasized on design case for a given complex engineering problem or project. The students will use appropriate software simulation tools to assist them during the design process.

SKEM 3123: HYDRAULIC AND PNEUMATIC SYSTEMS

This course intended to introduce the working principle of hydraulic and pneumatic systems. The hydraulic and pneumatic basic components and their functions will be described. Students will be taught how to analyse and design simple hydraulic and pneumatic circuits. Students will also be exposed to the design of electrical control circuits for electro-hydraulic and electro-pneumatic systems. Finally, the basics on how to design and implement simple hydraulic and pneumatic control systems using PLC will also be covered.

SKEM 3133: ELECTRICAL MOTORS AND DRIVES

Students will be introduced to general information on some fundamental power electronic devices and circuits, electric motor and the electric drives components with linear control method for mechatronic systems. The power electronics devices are introduced to build the understanding of drives as a controlled- switched circuit. Then, the dynamics of some basic mechatronics system treated as the load to the system will be covered and then the drives principles of DC motor and AC motor will be covered such that it matches the requirement of the system. To show the relationship between the theoretical and practical aspects of the subject, the development of modeling, analysis and application of DC and AC electric drives systems will be carried out. Matlab simulation, model validation and transient analysis of electric drive systems will be utilized and discussed.

SKEE 3133: SYSTEM MODELING AND ANALYSIS

This course introduces the students to the fundamental ideas and definitions of control systems, open loop and close loop control systems, process of control system design and representation. Students will be taught how to obtain mathematical models of actual physical systems such as electrical, mechanical and electromechanical systems in transfer function (frequency domain) and state space equations (time domain). Methods of system representation such as block diagram representation and signal flow graphs will be examined. The students will be exposed to technique of analysing control systems performance and stability in time domain. Finally, to simulate the stability and performance of the systems using software tools.

SKEE 3143: CONTROL SYSTEM DESIGN

The course begins with the root locus designs using root locus procedures and MATLAB. Then, PID controller will be designed using root locus approach. The PID controller and lead-lag compensator will be used to improve the transient and steady state performances in time domain using root locus approach. In frequency domain approach, the Bode plot method will be utilised. The lead, lag and lead- lag compensators are used in improving the performance of the control system using the frequency domain approach. Finally, applications of control engineering in various fields will be studied.

SKEM 3143: MECHANICAL SYSTEM DESIGN

This course introduces students to the fundamental concepts, principles, and techniques involved in designing mechanical components and systems. It aims to equip students with the ability to analyze failure theories related to machine design elements, including failures caused by static and fatigue loads. The course content covers various aspects, such as the design and selection of bolts, welding techniques, springs, ball and roller bearings, as well as gears and belts. By the end of this course, students will have developed the skills necessary to apply engineering knowledge to develop innovative and efficient designs that adhere to specific requirements and industry standards.

SKEE 3223: MICROPROCESSOR

This course introduces the principles and applications of microprocessors. Topics emphasized are processor architecture, assembly and HLL language and fundamentals of interfacing in a microprocessor-based embedded system. This course emphasizes on the understanding the fundamentals of microprocessor operation, writing coherent and error-free assembly and HLL language programs, and designing basic interfacing circuits. With the knowledge learned, the student would be able to design microprocessor-based systems using assembly language and HLL programs completely with confidence.

SKEE 3263: ELECTRONIC SYSTEMS

This course covers some topics in functional electronic circuits. The circuits are derived from a diverse electronic circuitry that exist in many electronic instrumentations. The function, the behaviour and the characteristics of the functional circuits are analysed. Design examples are presented to guide students with the necessary knowledge of how to design the functional electronic circuits based on certain predetermined specifications.

SKEE 3533: COMMUNICATION PRINCIPLES

This course introduces students on the basic principles of communication system. The fundamental concepts of analogue modulation in particular amplitude and frequency modulations will be covered. Topics include types of modulated waveforms, transmitter and receiver structures, and noise performance. The two most significant limitations on the performance of a communications system; bandwidth and noise will be discussed. The concept of sampling, quantization, and line coding techniques in rendering an information signal to be compatible with a digital system are explained prior to the study of coded pulse modulation and pulse code modulation (PCM). The waveforms and spectral analysis of band-pass digital modulations are introduced. The system performance in terms of signal to noise ratio (SNR) and bit error rate (BER) will also be covered. Finally, methods to utilize the communication resource efficiently (e.g., multiplexing, multiple access) are studied. The course will utilize parts of the Ericsson Educate initiative learning materials, and/or feature invited industry speaker(s). At the end of the course student should be able to explain, evaluate and solve problems related to communication systems.

SKEE 3732: COMMON THIRD YEAR LABORATORY

Third Year Laboratory is a required course for third year students in Bachelor of Engineering degree program. This course requires students to conduct twelve experiments in four different laboratories (Basic Power, Basic Communication,

Instrumentation, Microprocessor). The students are grouped into 3-4 students. Each week, they are required to conduct an experiment in the lab within 3 hours. Each group will submit only one short report at the end of each lab session. Each student is assigned to write only one long report based on one experiment that they have conducted for this course. This long report should be submitted within a week after the student performed the assigned experiment.

SKEE 3733: INTEGRATED DESIGN PROJECT

The course provides students with the opportunity to integrate technical knowledge and generic skills attained in the earlier years. This is to be achieved within the context of an engineering project conducted in a small team (typically three or four students) under the supervision of an academic staff and with optional of industry partner as advisor. Topics supplementing this course that include project management tools and practices, organizational structures, engineering standards as well as the social and environmental responsibility of professional engineers are covered in the Professional Ethics and/or Engineering Management courses offered prior to or concurrent with the course. The project produced from this course needs to address one or more relevant Sustainable Development Goals such as good health and well-being, quality education, industry, innovation and infrastructure depending on the nature of the project.

SKEE 3925: INDUSTRIAL TRAINING

Students will undergo an industrial training lasting for 12 weeks at an approved private, government or semi government agencies. Placement at the respective agencies will be initiated by the applications from the students. Approval of the application is at the discretion of the faculty. Undergraduates are expected to acquire hands on experience not only in the engineering aspects of work, but also to other related matters such as administration, accounting, management, safety, etc. during the industrial training period. Industrial Guidance, Independent and Dependent Learning discrete implementation can make this course a work-based learning course.

SKEM 4143: ROBOTICS

This course introduces students the basic principles underlying the design, analysis, and synthesis related to robotic systems. Students are introduced to various classifications and types of robots. Techniques of deriving and analyzing robot arm kinematics, dynamics, and trajectory planning are discussed. By adapting the knowledge obtained, students will be able to construct dynamic models of robots, evaluate and analyze robot arm forward and inverse kinematics, as well as be able to correctly design and simulate robot arm trajectory.

SKEM 4333: MECHATRONIC SYSTEM DESIGN

This course introduces the pertinent aspects of mechatronics including system modelling, simulation, sensors, actuation, real-time computer interfacing and control, needed to develop a good understanding of the basic principles used in mechatronic system design. This course tries to balance between theoretical and practical aspects, and real implementation is emphasized. Case studies, based on problem-solving approach through demonstrations and lab exercises, are used throughout the course. From the material covered, the students will be able to analyze and select the appropriate sensors, actuators and interface, and design the PID control and its digital implementation correctly.

SKEE 4012: PROFESSIONAL ENGINEERING PRACTICE

This course introduces and exposes the students to the concepts, theories, and practice of Professional Engineer. It highlights the works of professionals in engineering, relevant acts and regulations, engineering code of ethics, engineers' roles and responsibilities, engineering ethics, the impact of the work of engineer on society, and knowledge to cater the needs for sustainable development. In terms of knowledge of accreditation of engineering programme, the internationalization of engineers and sustainability, elements of EAC, Washington Accord and the UN's sustainable development goals (SDGs) are also discussed. Based on this knowledge, the students will work on projects to analyse real engineering issues and cases, both individually and in groups.

SKEE 4542: ENGINEERING MANAGEMENT PRINCIPLES

Today's technological society is constantly changing and with the change comes a need for the engineer to be able to address the technological societal challenges and opportunities for the future. Engineers are a key element today in the role to maintain technological leadership and a sound economy while the world becomes flatter in today's global economy. To do this the engineer needs to remain alert to changing products, processes, technologies, and opportunities and be prepared for a creative and productive life and position of leadership. This course introduces the engineer to the ways in which principles of management, project management and financial management have been and are applied in the kinds of work they are almost likely to encounter. Today these principles are needed by the engineering manager and those they manage. The basic outline of the course looking at the four main management functions followed by the functions of project management. Finally, the course further discusses on financial management in achieving organization goals and objectives efficiently and effectively.

SKEE 4813: METHODOLOGY OF RESEARCH AND DEVELOPMENT

This course introduces the scientific method for conducting research and development projects, particularly in electrical engineering (EE). It covers topics such as problem formulation and objective, literature review, research methodology and design, data collection and analysis, research management and ethics. It also emphasizes technical writing skills for scientific

publications, research proposal and thesis. The main objective is to equip the students with a solid background of methods to plan and conduct research and development project, which will benefit their undergraduate final year project. The general principles of this course are applicable to other disciplines besides EE.

SKEE 4826: FINAL YEAR PROJECT

The Final Year Project (FYP) aims to equip students with the knowledge and skills necessary to conduct research-based projects, perform analysis, and interpret data for complex engineering problems. It emphasizes the application of engineering principles, modern tools, and IT resources to solve complex engineering challenges while considering the limitations involved. Students will learn how to analyze, investigate, and synthesize information effectively to develop innovative solutions. Students are exposed to project management planning and execution. Students will learn how to effectively utilize resources and manage projects to achieve desired outcomes. With these skills, it is hoped that the students will gain knowledge and experience in planning, designing and solving problems systematically. Students will have the necessary skills to solve complex engineering challenges, work effectively in multidisciplinary teams, and deliver successful projects with a strong focus on ethical and professional practices. Thus, when they graduate, they will be ready to work as reliable and productive engineers.

SKEL 3233: DIGITAL SIGNAL PROCESSING

This course introduces concepts in digital signal processing. Continuous-time signals and systems will be reviewed. Consecutively, introduction to digital signal processing, the basic idea, benefits, and applications are presented. Discrete-time signals and systems are described based on signal definition, periodicity, stability, causality, convolution, difference equations, infinite impulse response (IIR), finite impulse response (FIR) and signal flow graphs. Spectrum representation of discrete-time signals will cover sampling theorem, the discrete-time Fourier transform (DTFT) and its properties, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT). Another domain presented is z- transform, which consists of topics on derivations, the region of convergence, transformation properties, poles and zeros, and inverse z-transform. At the end of the course, analysis and design of digital filter cover filter basics, analogue filter prototypes, and design of IIR filter and FIR filter.

SKEE 3433: POWER ELECTRONICS AND DRIVES

This course introduces students to the fundamentals of power electronics, which include power semiconductor switches, rectifier (AC-DC), choppers (DC-DC), and inverters (DC-AC). Emphasis will be on the power converter operations and analysis of their steady state performances. The course also exposes students to some basic converters design and the selection of suitable converters for certain application. In addition, the course covers the operation and selection of converters for DC and AC drive systems. At the end of the course student should be able to critically design power converters at given specification using application software.

SKEE 4153: DIGITAL CONTROL SYSTEMS

This course introduces students the basic principles underlying the analysis, synthesis and design of digital control systems. Students are introduced to sampling theorem and discretization of continuous time system, data reconstructions, z-transform, mathematical modeling of discrete-time and digital systems, time domain and various stability analysis methods for discrete-time and digital systems, and on the design of various discrete-time and digital controllers. By adapting the knowledge obtained, students will be able to derive the mathematical model of discrete-time control systems and analyze accurately its stability and the time response, as well as the students will be able to design correctly the suitable digital controller to control the discrete-time systems.

SKEE 4173: INDUSTRIAL PROCESS CONTROL

This course provides an introduction to process control system application and th wide applicability in the industry. The course initiates with modelling of process plants using fundamental laws of physics and chemistry as well as empirical process modelling. To enhance the performance of an existing process control system, controllers (PID, feedforward, cascade and inferential control) are introduced, designed, tuned and applied. Tuning techniques of Ziegler-Nichols and Cohen-coon are also utilized. Finally, the concept of supervisory, automatic control and data retrieval which relates to IoT in a process plant is introduced. In summary, this course offers students an initial exposure to the process industry and the coveted opportunity to explore more on its endless application.

SKEE 4513: SPECIAL TOPIC IN ELECTRICAL ENGINEERING

The Special Topic in Electrical Engineering course offers an in-depth exploration of emerging and advanced concepts within the electrical engineering field which will be taught by the visiting professor. This course is intended for students with a solid foundation in electrical engineering principles and looking to expand their knowledge in specific areas of interest. It is designed to allow students to explore specialized areas of electrical engineering beyond the scope of the regular curriculum. This course aims to foster critical thinking, problem-solving skills for complex engineering problems, and an understanding of cutting-edge technologies shaping the future of electrical engineering. All these components are vital to understanding the operation of presentday devices and any future development in the field. At the end of the course, students will be prepared for further research, industry positions, or advanced studies in electrical engineering.

SKEL 4213: SOFTWARE ENGINEERING

This course introduces the theoretical principles and practical aspects large scale software development. The theoretical principles covered include understanding customer requirements, software development process, program design, collaborative development and testing. Emphasis is given to object-oriented analysis and design (OOAD) as well as the use of UML in the design activities.

SKEM 4113: MODERN CONTROL THEORY

This is a module of modern control theory for linear dynamical systems. It focuses on analysis and synthesis of controllers in the time domain. The module introduces students to the techniques and analysis of dynamical systems using state-space models. The major topics covered are: Introduction to State-Space Model; Solution of State-Space Model; Canonical Forms of State-Space Model; Controllability and Observability; State Feedback and State Estimation; Linear Quadratic Optimal Control and Stability. MATLAB software is utilised throughout the course. Design on case study will be explored.

SKEM 4123: INDUSTRIAL ENGINEERING

This course introduces the students from the fundamental engineering problem to the concept of industrial engineering. In general, Industrial Engineering is concerned with the design, improvement, and installation of integrated systems of people, materials, information, equipment and energy. It draws upon specialized knowledge and skill in the mathematical and physical together with the principals and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems. This course also introduce students how Industrial Engineers manage the integrated production and service delivery systems that assure performance, reliability, maintainability, schedule adherence and cost control.

SKEM 4133: MACHINE VISION SYSTEMS

This course introduces the concepts of machine vision, vision-based track and trace systems and the introduction to building a machine vision system for inspection. The students will also learn image representation and properties, where essential basic concepts widely used in image analysis will be introduced. The students are then taught data structures because data and algorithms are the two basic parts of any program. Next, several important image pre-processing techniques are also will be introduced to the students, followed by image segmentation. The main objective of segmentation is to divide an image between the object(s) of interest and the background. After that, the student will be introduced to shape representation and description. Shape representation and description consist of methods to extract a numeric feature vector or a non-numeric syntactic description word which characterizes the properties of a region of interest. The next topic of discussion is object recognition. This topic will discuss several methods used in pattern recognition. The student will also learn image understanding, an internal image model representing the machine vision's concept about the process image of the world. To conclude the course, two projects on machine vision application will be discussed with the students. The application of some machine vision algorithms will be demonstrated using MATLAB in the class. By completing this course, the student will be able to understand machine vision problems and apply the learned methods to solve machine vision problems.

SKEM 4153: ROBOT TECHNOLOGY FOR AUTOMATION

This course introduces students to the main aspects of the key technologies in the design and installation of robotic systems, automated work cells, computer integrated manufacturing systems, work cell support systems, robot and system integration, as well as safety design in robot applications. The students will learn machine interference and cycle time analysis when designing and analyzing the performance of the robot work cell. In addition to that, the students will be exposed to the simulation tool in designing and analyzing the robot work cell by using simulation software such as Flexsim.

SKEM 4163: AUTONOMOUS ROBOTS

As technology advances, it has been envisioned that in the very near future, robotic systems will become part and parcel of our everyday lives. Even at the current stage of development, semiautonomous or fully automated robots are already indispensable in a staggering number of applications. To bring forth a generation of truly autonomous and intelligent robotic systems that will meld effortlessly into the human society involves research and development on several levels, from robot perception, to control, to abstract reasoning. This course tries for the first time to provide a comprehensive treatment of autonomous mobile systems and examines the fundamental constraints, technologies, and algorithms of autonomous robotics. The focus of this course will be on computational aspects of autonomous wheeled mobile robots. The following topics will be covered: major paradigms in robotics, methods of locomotion, kinematics, simple control systems, sensor technologies, stereo vision, feature extraction, modelling uncertainty of sensors and positional information, localization, SLAM, obstacle avoidance and 2-D path planning.

SKEM 4173: ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) involves the development of algorithms derived from human and animal intelligence that have capabilities such as learning, reasoning, generalization, adaptation, reproduction, etc. Nowadays, these techniques are getting popular due to the large number of successful reports of implementations. AI techniques have also made their way into many domestic and industrial products and provided solutions to many difficult engineering problems. In this course, students are exposed to several AI techniques i.e. Artificial Neural Network (ANN), Fuzzy Logic, Machine Learning (ML), Deep Learning

(DL) and optimization methods (such as Genetic Algorithm (GA) and Particle Swarm Optimization (PSO)), and how they are used as a stand-alone approach or in any combination of the methods in solving engineering and non-engineering problems.

SKEM 4183: INDUSTRIAL NSTRUMENTATION AND APPLICATIONS

This course presents the principles of industrial instrumentations. Students will be taught about various instruments used for different types of measurement. The course will enable students to understand the process of selecting measuring instruments and final control elements for performing different kinds of applications. At the end of the course student should be able to design industrial instruments according to the given specifications.

SKEM 4193: ADVANCED TRANSDUCERS AND SENSORS

This course is an introduction the advanced transducers and sensors. This course introduces students to the major views and theories in transducers and sensors. It will examine some key principles of measurement and the importance of transducers on process industries. Students are required to demonstrate competencies in the use of various transducers depending on project requirement and able to show proficiency in choosing transducers for different measurement and applications. Key components studied in detail are a review of powerful measurement techniques and basic principles and typical problems of sensor elements, detailed up-to-date reviews of the features of temperature transducers, displacement sensors, flow sensors, level sensors, position sensors, motion sensors and biometrics. Special topic in Flow Measurement Techniques use Process Tomography Applications.

SKEM 4223: EMBEDDED SYSTEM

This course introduces the principles and applications of embedded system. The topics emphasize the microcontroller system architecture, software programming using C and the system design. The content covers internal peripherals such as general input and output, analogue to digital converter, serial communication interface, timer/counter and interrupt. The students will learn the technique to interface the microcontroller system with other devices in the embedded system for real world application. Students will also being introduce to ARM based embedded system and application.

SKEM 4233: NANOTECHNOLOGY AND APPLICATIONS

In this course, students will be presented with concepts, opportunities, and issues related to the nanoscale world. Students will be exposed to the fundamental principles of various equipment used in observing the nanoworld. Next, knowledge related to manipulation, characterization, and fabrication of micro and nano-objects will be discussed. Then, students will be exposed to the analysis of microfluidic devices using the finite element analysis (FEA) tool. Finally, students will be exposed to the design and development of microfluidic devices using the soft lithography technique. At the end of the course, students are expected to acquire a good understanding and ability to analyze the fundamental principles of various equipment used in the nanoworld. Students must be able to differentiate between various fundamental working principles used by various nano equipment. Furthermore, students should be able to use FEA and microfabrication tools to design and develop the microfluidic device.

SKEM 4243: BIOMEMS & MICROANALYTICAL SYSTEMS

This course is designed to expose students to the most current revolution of instrumentation into different scale of measurement. Microdevices have involved actively in analytical chemistry measurement, bioanalysis and environmental analysis measurement. This course introduces students to the major views and theories micro-analytical instruments and BIOMEMS and its application. It will examine some key principles of measurement and the microfabrication techniques micro instruments. Students are required to demonstrate competencies in explaining various fabrication techniques and understand the characteristic of micro scale measurement.

SKEM 4313: PLC AND SCADA SYSTEM DESIGN

This course is divided into parts: (1) Automation and (2) Scada system. This is an advance subject in control engineering for final year electrical engineering students. The main aim is to develop concepts in industrial control engineering to the students. Fundamental concepts in manufacturing and automation, building blocks of automation. Simple modeling and analysis process transducers and controllers, drivers and final control elements. Industrial logic control system, sequence control using electronic logic components and programmable logic controllers (PLC) in simple process, control system and automated control system. SCADA is the process of a plant and / or a method of gathering of data from devices in the field. This the process of collecting data into the actual business, and using it in real time. There are using standard communication protocols (eg IEC 60870, DNP3 and TCP/IP) and hardware and software. Many SCADA applications use PLCs as the RTU of choice, when communicating with field devices. This subject covers the essentials of SCADA and PLC systems, which are often used in close association with each other. A selection of case studies are used to illustrate the key concepts with examples of real world working SCADA and PLC systems in the water, electrical and processing industries.

SKEM 4323: ADVANCED CONTROL THEORY

This course introduces students how to develop the mathematical model and analyse the Multivariable System. The students will utilize this knowledge in designing the controllers such as Linear Quadratic Regulator (LQR), Linear Quadratic Gaussian (LQG) and H-infinity. MATLAB will be used as a platform for design.

SKEM 4343: SYSTEM IDENTIFICATION AND ESTIMATION

This course is an introduction to the alternative modelling using system identification and parameter estimation approach. It covers an introduction to system identification technique, acquiring and pre-processing data, nonparametric model estimation methods, parametric model estimation methods, partially known estimation methods, model estimation methods in closed loop systems, recursive model estimation methods, analysing, validating, and converting models and system identification case study. This requires an in-depth understanding of control system engineering, modern control system and digital control system. The emphasis will be on the theoretical basis as well as practical implementations. Key components studied in detail are time response analysis, frequency response analysis, correlation analysis, power spectrum density analysis, model structure, parametric model, parameter estimation method, test signals and model validation methods.

SKEM 5703: CONTROL SYSTEMS ENGINEERING

This course introduces the students to the fundamental concepts of control systems engineering. Students will be exposed with techniques of modelling of physical systems involving linear and nonlinear systems including mechanical, electrical and mechatronic systems. Both the frequency domain and time domain (state-space) are covered. Several criteria for performance and stability analyses of control systems will be taught. Modelling and analysis of control system in discrete time for digital control will also be introduced. Student will also be exposed with MATLAB for design, development and analysis of simulation models. Finally, a feedback control system with controller to achieve control system objectives are described. Several case studies of the applications of controllers will be used to enhance the student understanding.

SKEM 5713: ARTIFICIAL INTELLIGENCE AND APPLICATIONS

Artificial intelligence (AI) involves the development of algorithms derived from human & animal intelligence that have capabilities such as learning, reasoning, generalization, adaptation, reproduction, etc. Nowadays, these techniques are getting popular due to the large number of successful reports of implementations. AI techniques have also made their way into many domestic & industrial products & provided solutions to many difficult engineering problems. In this course, students are exposed to several AI techniques i.e. Artificial Neural Network (ANN), Fuzzy Logic, Genetic Algorithm (GA) & Particle Swarm Optimization (PSO), & how they are used in solving engineering & non-engineering problems.

SKEM 5753: ADVANCED INSTRUMENTATION AND MEASUREMENT

This course is an introduction to the advanced instrumentation and measurement. Key components studied in detail are a review of powerful measurement techniques and basic principles and typical problems of sensor elements, detailed up-to-date reviews of the features of temperature sensors, displacement sensors, flow sensors, level sensors, position sensors, motion sensors and biometrics. This course also provides a detailed knowledge on error and determination of uncertainties in measurement. Besides that, this course introduces the multi sensor, Fusion application, wireless sensor network and Internet of Things. Finally, the basic concepts of safety instrumented system, standards and risk analysis techniques will be discussed.

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Course Approval

More than 18 credits

Students are not allowed to take more than 21 credit hours

21 credits

Academic Advisor + Dean

PROF.DR. JAFRI BIN DIN
Dean

20 credits

Academic Advisor + Deputy Dean (AA)

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