Bachelor of Engineering (Electrical-Mechatronics)

BACHELOR OF ENGINEERING (ELECTRICAL-MECHATRONICS) PROGRAMME SPECIFICATIONS

The Bachelor of Engineering (Electrical-Mechatronics) is offered either on a full-time or part-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru while the part-time 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 four (4) years to a maximum of six (6) years.

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

General Information

1. Awarding Institution			Universiti Teknologi Malaysia	
2. Teaching Institution			Universiti Teknologi Malaysia	
3. Programme Name			Bachelor of Engineering (Electrical - Mechatronics)	
4. Final Award			Bachelor of Engineering (Electrical - Mechatronics)	
5. Programme Code			SKEM	
6. Professional or Statutory Body of Accreditation			Board of Engineers Malaysia (BEM)	
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 : 4 yrs Maximum : 6 yrs	
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	-	18	-
Short	4	-	10	-

Course Classification

Bachelor of Engineering (Electrical - Mechatronics) - SKEM

No.	Classification	Credit Hours	Percentage
i.	University Courses a) General b) Language c) Entrepreneurship d) Co-Curriculum	26 8 2 3	28.7%

ii.	Faculty/Programme Core	88	64.7%
iii.	Programme Electives	9	6.6%
	Total	**136**	**100%**
A	Engineering Courses a) Lecture/Project/Laboratory b) Workshop/Field/Design Studio c) Industrial Training d) Final Year Project	 83 2 6 6	71.3%
Total Credit Hours for Part A		**97**	
B	Related Courses a) Applied Science/Mathematic/Computer b) Management/Law/Humanities/Ethics/Economy c) Language d) Co-Curriculum	 17 11 8 3	28.7%
Total Credit Hours for Part B		**39**	
Total Credit Hours for Part A and B		**136**	100%
Total Credit Hours to Graduate		**136 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 136 credit hours (SKEM) with a minimum CGPA of 2.0.
- Complete Professional Skills Certificates (PSC).

Entry Requirements

The student intake for the Bachelor degree programmes is divided into two groups, which are first year admission and the direct entry admission to the second and upper year.

Admission Requirement for Candidates from Matriculation Programme, Ministry of Education, Malaysia (MOEM) / 'Sains Asasi' Programme from UM and 'Asasi' Programme from UiTM.

University Entrance Requirement:

- Passed the Sijil Pelajaran Malaysia (SPM) or equivalent with credit (grade C) in Bahasa Melayu/Bahasa Malaysia;
- Passed the MOEM's Matriculation programme or UM's 'Sains Asasi' or UiTM's Asasi programme with PNGK of at least 2.00 and also pass all the specific courses;

Programme Entrance Requirement:

e. Obtained at least a PNGK of 2.80 at the Matriculation/'Asasi' level;

AND

f. Obtained at least a grade of 'B' (3.00) at the Matriculation/'Asasi' level in the following two (2) courses:

   i. Mathematics / Engineering Mathematics

   ii. Physics / Engineering Physics

   OR

   Obtained at least a grade of 'B' (3.00) in Mathematics and 'B+' (3.33) at the Matriculation/'Asasi' level in the following two (2) courses:

   v. Chemistry / Engineering Chemistry

   vi. Biology

AND

c. Obtained at least a grade of 'C' in the following courses at the SPM level:

   i. Mathematics

   ii. Physics

   OR

   The candidates who satisfy the requirement in part (b.) above using Biology and Chemistry / Engineering Chemistry at the Matriculation level need to obtain at least a grade of 'B+' for the

Physics subject at the SPM level.

AND

f. The candidates are not colour blind or disable so as not to hamper from doing practical work.

Admission Requirement for STPM Candidates

University Entrance Requirement:

- Passed the Sijil Pelajaran Malaysia (SPM) or equivalent with good grades;
- Passed with credit in Bahasa Melayu/ Bahasa Malaysia at Sijil Pelajaran Malaysia (SPM) level or equivalent;
- Passed the Sijil Tinggi Pengajian Malaysia (STPM) or equivalent in a single sitting with at least:

  i. Grade '**C**' (NGMP 2.00) in General Studies/ General Paper;

  AND

  ii. Grade '**C**' (NGMP 2.00) in two (2) other courses.

Programme Entrance Requirement:

k. Obtained at least a PNGK of 2.80 at the STPM level

AND

l. Obtained at least a grade of 'B' (NGMP 3.00) at the STPM level in the following two (2) courses:

   i. Mathematics T / Further Mathematics

   ii. Physics

   OR

   Obtained at least a grade of 'B' (NGMP 3.00) in Mathematics T and a grade of 'B+' (NGMP 3.33) at the STPM level in the following two (2) courses:

   i. Chemistry

   ii. Biology

AND

m. Obtained at least a grade of 'C' in the following courses at the Sijil Pelajaran Malaysia (SPM) level:

   i. Mathematics

ii. Physics

OR

The candidates who satisfy the requirement in part (b.) above using Biology and Chemistry at the STPM level must obtain at least a grade of 'B+' for the Physics subject at the SPM level.

AND

n. The candidates should satisfy Band 2 MUET.

AND

o. The candidates are not colour blind or disable so as not to hamper from doing practical work.

Admission Requirement for Direct Entry (Diploma / Equivalent) Candidates

University Entrance Requirement:

- Passed the Sijil Pelajaran Malaysia (SPM) or equivalent with credit in Bahasa Melayu/ Bahasa Malaysia;
- Passed the Diploma or equivalent programme recognized by the Government and approved by the Senate of UTM

OR

Passed the STPM for the year 2015 or before with at least:

i. Grade '**C**' (NGMP 2.00) in General Studies/ General Paper;

AND

ii. Grade '**C**' (NGMP 2.00) in two (2) other courses.

OR

Passed the MOEM's Matriculation programme or UM's 'Sains Asasi' or UiTM's Asasi programme for the year 2015 or before with PNGK of at least 2.00 and also pass all the specific courses;

Programme Entrance Requirement:

i. Holds a Diploma in Electrical Engineering (Power / Communication / Electronics / Mechatronics) from UTM or Public Institute of Higher Learning (IPTA) or Private Institute of Higher Learning (IPTS) or equivalent with PNGK of at least 3.00;

AND

j. Obtained at least a grade of 'C' in the following courses at the Sijil Pelajaran Malaysia (SPM) level:

   i. Mathematics

   ii. Physics

   OR

   Obtained at least a grade of 'B' at the Diploma level in any of the Mathematics and Physics subjects.

k. Obtained at least a Band 2 in Malaysian University English Test (MUET);

l. The candidates are not colour blind or disable so as not to hamper from doing practical work.

Subject to the University's Academic Regulation, credit exemption will be given to direct entry students after registration according to the grade of the courses obtained and the courses are recognized by the Faculty and University. The actual year of entry and duration of study are subject to credit exemptions approved by the University.

Programme Educational Objectives (PEO)

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

Code	Intended Educational Objectives
PEO1	Become Electronic Engineers who are competent, innovative, and productive in addressing customer needs.
PEO2	Grow professionally with proficient soft skills.
PEO3	Demonstrate high standards of ethical conduct, positive attitude, and societal responsibilities.

Programme Learning Outcomes (PLO)

After having completed the programme, graduates should be able to demonstrate the following competencies:

Code	Programme Learning Outcomes
PLO1	Ability to apply knowledge of mathematics, science and electrical/electronic engineering to the solution of complex engineering problems.
PLO2	Ability to perform research-based analysis, conduct experiments and interpret data for complex engineering problems.
PLO3	Ability to identify, formulate, conduct research literature to analyse complex engineering problems using engineering knowledge.
PLO4	Ability to apply engineering practice and use modern engineering, and IT tools for complex engineering problem with an understanding the limitations of the technology.
PLO5	Ability to design solutions for complex engineering problems and design systems and processes that meet specified needs with appropriate consideration for public health and safety, culture, society, and environment.
PLO6	Ability to articulate ideas, communicate effectively, in writing and verbally, on complex engineering activities with the engineering community and with society at large.
PLO7	Ability to function effectively as an individual, as a member or as a leader in diverse teams.
PLO8	Ability to recognise the need for, and have the preparation and

	ability to engage in independent and life-long learning in the broadest context of technological change.
PLO9	Ability to comprehend the impact of global and contemporary issues, the role of engineers on society including, health, safety, legal and cultural issues, and the consequent responsibilities relevant to professional engineering practices and engineering problems.
PLO10	Ability to comprehend and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental contexts.
PLO11	Ability to grasp and execute responsibility professionally and ethically in professional engineering practices.
PLO12	Ability to demonstrate knowledge and understanding of engineering and management principles, and economic decision-making to manage projects in multidisciplinary environments.

PROFESSIONAL SKILLS CERTIFICATE (PSC)

Students are given a chance to enrol in certificate programmes offered by the Centres of Excellence in the University and the School of Professional and Continuing Education (SPACE) during semester breaks

1. How to Get Yourself Employed (HTGYE)
2. ISO 9001: 2008 Quality Management System Requirement (ISO)
3. Occupational Safety and Health Awareness (OSHA)
4. How to Manage Your Personal Finance (HTMYPF)
5. Test of English Communication Skills for Graduating Students (TECS):
   (i) TECS 1001 (Paper I – Oral Interaction)
   (ii) TECS 1002 (Paper II - Writing)

COURSE MENU

Bachelor of Engineering (Electrical - Mechatronics) - SKEM

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 1693	Engineering Mathematics I	3	
SKEE 1012	Introduction to Electrical Engineering	2	
SKEE 1013	Electrical Circuit Analysis	3	
SCCP 1103	C Programming Techniques	3	
ULAB 1122	Academic English Skills	2	
UHAS 1172	Malaysian Dynamics (Local Students)	2	
UHAK 1022	Malaysian Studies (Arts, Custom and Belief of Malaysians) (International Students)		
	TOTAL CREDIT	15	
	CUMULATIVE CREDITS	15	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 1793	Differential Equations	3	
SKEE 1073	Electronic Devices and Circuits	3	SKEE 1013
SKEE 1223	Digital Electronics	3	
SKEM 1113	Engineering Mechanics	3	
SKEM 1502	Computer Aided Engineering Drawing	2	
UICI 1012	Islamic and Asian Civilizations (Local Students)	2	
ULAM 1012	Malay Language for Communication 2 (International Students)		
	TOTAL CREDIT	16	
	CUMULATIVE CREDITS	31	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 1993	Engineering Mathematics II	3	SSCE 1693
SKEE 1022	Introduction to Scientific Programming	2	

SKEE 2073	Signals and Systems	3	
SKEE 2423	Fundamentals of Electrical Power Systems	3	SKEE1013
UHAK 1012	Graduate Success Attributes	2	
ULAB 2122	Advanced Academic English Skills	2	
UKQ# 2##2	Elective of Co-Curriculum Service Learning	2	
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	48	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 2193	Engineering Statistics	3	
SKEE 2133	Electronic Instrumentation & Measurement	3	
SKEE 2263	Digital Systems	3	SKEE 1223
SKEM 3123	Hydraulic and Pneumatic Systems	3	SKEM 1113
SKEE 2742	2nd Year Electronic Design Lab	2	
UHAK 1032	Introduction To Entrepreneuship	2	
	TOTAL CREDIT	16	

	CUMULATIVE CREDITS	64	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 2393	Numerical Methods	3	
SKEE 3133	System Modeling & Analysis	3	
SKEE 3223	Microprocessor	3	SKEE 1223
SKEE 3533	Communication Principles	3	SKEE 2073
SKEE 2523	Electromagnetic Field Theory	3	SSCE 1993
SKEE 3732	Common 3rd Year Laboratory	2	
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	81	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SKEE 3143	Control System Design	3	**SKEE 3133**
SKEE 3263	Electronic Systems	3	**SKEE 1073**
SKEM 3133	Electrical Motors and Drives	3	
SKEM 4333	Mechatronics System	3	

	Design		
SKEM 3742	Specialized 3rd Year Laboratory	2	
ULAB 3162	English for Professional Purpose	2	
UKQ 3001	Extracurricular Experiential Learning (ExCEL)	1	
	TOTAL CREDIT	17	
	CUMULATIVE CREDITS	98	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Pre-requisite**
SKEM 4926	Practical Training	6	
	TOTAL CREDIT	6	
	CUMULATIVE CREDITS	104	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SKEM 4723	Capstone Project	3	
SKEM 4812	Final Year Project Part I	2	
SKEM 4143	Robotics	3	SSCE 1993

SKEL 4223	Digital Signal Processing I	3	SKEE 2073
SKE# 4##3	Field Elective 1	3	
SHAS 4542	Engineering Management	2	
	TOTAL CREDIT	16	
	CUMULATIVE CREDITS	120	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SKEM 4824	Final Year Project Part II	4	SKEM 4812
SKEE 4012	Professional Engineering Practice	2	
SKE# 4##3	Field Elective 2	3	
SKE# 4##3	Field Elective 3	3	
UICL 2302	Science and Technology Thinking	2	
ULAX 1112	Electives of Foreign Language	2	
	TOTAL CREDIT	16	
	CUMULATIVE CREDITS	136	

Elective Courses

Code	Course	Credit	Pre-requisite
SKEE 4113	Modern Control System	3	SKEE 3143
SKEE 4153	Digital Control Systems	3	SKEE 3143
SKEE 4433	Power Electronic and Drives	3	SKEE 2423
SKEI 3133	Industrial Instrumentations and Applications	3	SKEE 2133
SKEI 4173	Advanced Transducers and Sensors	3	SKEI 3133
SKEI 4223	BioMEMS and Microanalytical Systems	3	SKEI 3133
SKEI 4233	Nanotechnology and Application	3	
SKEI 4313	PLC and SCADA System Design	3	SKEE 3143
SKEI 4323	Advanced Control Theory	3	SKEE 4113
SKEI 4343	System Identification and Estimation	3	SKEE 4113
SKEI 4363	Industrial Control Networks	3	SKEE 3143
SKEL 4213	Software Engineering	3	SCSP 1103
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

SKET 4633	Coding of Multimedia Signals	3	SKET 3583
SKEM 4163	Autonomous Robot	3	SKEM 4143
SKEM 4123	Industrial Engineering	3	

GRADUATION CHECKLIST

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

Bachelor of Engineering (Electrical - Mechatronics) - SKEM

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√)IF PASSED
BACHELOR OF ENGINEERING (ELECTRICAL – MECHATRONICS)					
1	SKEE 1012	Introduction to Electrical Engineering	2	2	
2	SKEE 1013	Electrical Circuit Analysis	3	3	
3	SKEE 1022	Introduction to Scientific Programming	2	2	
4	SKEE 1073	Electronic Devices and Circuits	3	3	
5	SKEE 1223	Digital Electronics	3	3	
6	SKEE 2073	Signals and Systems	3	3	
7	SKEE 2133	Electronic Instrumentation & Measurement	3	3	
8	SKEE 2263	Digital Systems	3	3	

9	SKEE 2423	Fundamentals of Electrical Power Systems	3	3	
10	SKEE 2523	Electromagnetic Field Theory	3	3	
11	SKEE 2742	2nd Year Electronic Design Lab	2	2	
	SKEE 3133	System Modeling & Analysis	3	3	
12	SKEE 3143	Control System Design	3	3	
13	SKEE 3223	Microprocessor	3	3	
14	SKEE 3263	Electronic Systems	3	3	
15	SKEE 3533	Communication Principles	3	3	
16	SKEE 3732	Common 3rd Year Laboratory	2	2	
17	SKEE 4012	Professional Engineering Practice	2	2	
18	SKEL 4223	Digital Signal Processing I	3	3	
19	SKEM 1113	Engineering Mechanics	3	3	
20	SKEM 1502	Computer Aided Engineering Drawing	2	2	
21	SKEM 3123	Hydraulic and Pneumatic Systems	3	3	
22	SKEM 3133	Electrical Motors and Drives	3	3	
	SKEM 3742	Specialized 3rd Year Laboratory	2	2	

23	SKEM 4143	Robotics	3	3	
25	SKEM 4333	Mechatronics System Design	3	3	
27	SKEM 4723	Capstone Project	3	3	
28	SKEM 4812	Final Year Project Part I	2	2	
29	SKEM 4824	Final Year Project Part II	4	4	
30	SKEM 4926	Practical Training	6	6	
31	SKE* 4**3	Field Elective 1	3	3	
32	SKE* 4**3	Field Elective 2	3	3	
33	SKE* 4**3	Field Elective 3	3	3	
34	SCCP 1103	C Programming Techniques	3	3	
35	SHAS 4542	Engineering Management	2	2	
		TOTAL CREDIT OF ENGINEERING COURSES(a)	**100**	**94**	
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 CREDIT OF MATHEMATICS COURSES (b)	**15**	**15**	
UNIVERSITY GENERAL COURSES					
Kluster 1: PenghayatanFalsafah, Nilai & Sejarah (Faculty of Social Sciences and Humanities)					
1	UHAS 1172	Malaysia Dynamics (Local Students)	2	2	
	UHAK 1022	Malaysia Studies (Arts, Custom and Belief of Malaysians) (International Students)			
2	UICI 1012	Islamic and Asian Civilisation (Local Students)	2	2	
	ULAM1012	Malay Language for Communication 2 (International Students)			
Kluster 2: Kemahiran Insaniah (Soft Skills)					
1	UHAK 1012	Graduate Success Attributes	2	2	

2	UHAK 1032	Introduction to Entrepreneurship	2	2	
Kluster 3: PerluasanIlmu					
1	UICL 2302	The Thought of Science and Technology	2	2	
Kluster 4: Kurikulum Pembelajaran Servis					
1	UKQ# 2##2	Co-Curriculum & Service Learning	2	2	
2	UKQ 3001	Extracurricular Experiential Learning	1	1	
Kluster 5: Kemahiran Bahasa (Language Skill) (Language Academy, Faculty of Social Sciences and Humanities)					
1	ULAB 1122	Academic English Skills	2	2	
2	ULAB 2122	Advanced Academic English Skills	2	2	
3	ULAB 3162	English for Professional Purposes	2	2	
4	ULAX 1122	Elective Of Foreign Language	2	2	
		TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)	21	21	
		TOTAL CREDIT TO GRADUATE (a + b + c)	**136**	**130**	

OTHER COMPULSORY COURSES			
Professional Skills Certificate (PSC) (UTMSPACE/ School)			
1	GLL 1001	How to Get Your Self Employed	
2	GLL 1029	ISO 9001:2008 Quality Management System Requirement	
3	GLL 1040	Occupational Safety, Health and Environment	
4	GLL 1041	How to Manage Your Personal Finance	
Test of English Communication Skill (TECS) (Language Academy, Faculty of Social Sciences and Humanities)			
1	TECS 1001	Oral Interaction	
2	TECS 1002	Writing	

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 1022 : INTRODUCTION TO 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 (e.g. MATLAB, Mathematica, FORTRAN). 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
Pre-requisite: SKEE 1013 Electrical Circuit Analysis

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 focuses 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 Multisim simulation software. The goal of this course is to develop excellent understanding of the devices operation for students to be applied in analogue and digital circuit design.

SKEE 1223 : DIGITAL ELECTRONICS

This course teaches the fundamental principles of digital systems. From the signal concepts and the importance of numbers systems and codes, it then proceeds to logic gates, their relationship to Boolean algebra and the integration of gates to form complex circuits. The course emphasizes on techniques to design, analyse, plan, and implement simple digital systems using gates and MSI circuits. Simulation software Quartus II version 13 will also be introduced to facilitate learning process.

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 application. The course will also provide understanding the concept electrical measurement quantity using analogue and digital instruments. The interfaces of the instruments with embedded sensors and also the quality of the signals acquired are 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 also introduces to cover the basic process of the system.

SKEE 2263 : DIGITAL SYSTEMS
Pre-requisite: SKEE 1223 Digital Electronics

This course is a continuation from basic digital logic techniques course. The objective of the course is to introduce students to basic techniques to design and implement complex digital systems It emphasizes on techniques to design, analyse, plan, and implement complex digital systems using programmable logic. To facilitate learning process, computer-aided design (CAD) software is used throughout the course. Actual environment problems and solutions are provided.

SKEE 2423 : FUNDAMENTALS OF ELECTRICAL POWER SYSTEMS
Pre-requisite: SKEE 1013 Electrical Circuit Analysis

This course introduces fundamental concepts of electric machines and power system. 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 electric machines - transformers, direct current machines, synchronous machines and induction machines, power in ac circuits, three-phase system, power system component modeling and analysis. At the end of the course, the students are expected to critically analyze the power

system comprising of generation, transmission, and distribution components.

SKEE 2523 : ELECTROMAGNETIC FIELD THEORY
Pre-requisite: SSCE 1993 Engineering Mathematics 2

This course introduces students to some major views and theories in the area of electrostatic, magnetostatic and electromagnetic fields. This elementary electromagnetic field theory is summarized in Maxwell's equations. It is assumed that students already have appropriate mathematical background including multivariable calculus and some familiarity with the basic concepts typically covered in an introductory circuit theory course such as resistance, capacitance and inductance.

SKEE 2742 : 2ND YEAR ELECTRONIC DESIGN LABORATORY

All students will attend three second year laboratories which are the Electrotechnic, Basic Electronic and Digital Electronic Labs. The students will attend a three hour lab per week. The students are expected to complete four experiment topics for each lab in a direct of four week duration. Thus, the student will perform altogether 12 experiments in a semester. All experiments in the laboratories are emphasized on design case for a given complex engineering problem or project. The students will use software simulation tools to assist in their design tasks.

SKEE 3133 : SYSTEM MODELING AND ANALYSIS
Pre-requisite: SKEE 2073 Signals & Systems

This course introduces the students to the fundamental ideas and definitions of control systems, open loop and close loop control systems, transfer functions and transient and steady state responses. Students will be taught how to obtain mathematical models of actual physical systems such as electrical, mechanical and electromechanical systems in the transfer function form. Methods of system representation such as block diagram representation and signal flow graphs will be discussed. The students will also be exposed to techniques of analysing control systems performance and stability in time and frequency domains. Finally, an introduction to the design and analysis of control systems using MATLAB will also be given.

SKEE 3143 : CONTROL SYSTEM DESIGN
Pre-requisite: SKEE 3133 System Modeling and Analysis

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.

SKEE 3223 : MICROPROCESSOR
Pre-requisite: SKEE 1223 Digital Electronics

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
Pre-requisite: SKEE 1073 Electronic Devices and Circuits

This course covers some topics in functional electronic circuits. The circuits are derived from a diverse electronic circuitry that exists in many electronic instrumentation. 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
Pre-requisite: SKEE 2073 Signals & Systems

This course introduces the students the basic principles of communication system. The fundamental concepts of analogue modulation in particular

amplitude and frequency modulations will be strongly emphasized. 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 bandpass digital modulations are introduced. The system performance in terms of SNR and bit error rate (BER) will also be covered. Finally, multiplexing, a method to utilize the communication resource efficiently is studied where two main multiplexing techniques will be explored; time-division and frequency-division multiplexing.

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 six different laboratories (Basic Power, Basic Machine, Basic Communication, Instrumentation, Microprocessor and Basic Control). 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 4012 : PROFESSIONAL ENGINEERING PRACTICE

This course introduces and exposes the students to the concepts, theories and the practice of Professional Engineer. It highlights to the students profession of 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 and the internationalization of engineers, elements of EAC and Washington are also discussed. Based on this knowledge, the students will work on projects to analyze real engineering issues and cases, both individually and in groups.

SKEE 4113 : MODERN CONTROL SYSTEM
Pre-requisite: SKEE 3143 Control System Design

This course introduces students the modern modeling approach of physical system namely state space. Students are introduced to state space modeling and analysis of several forms of state space representation, conversion and similarity transformation. Students are exposed to solution of state space equation, controller and observer design using pole placement method and optimal control system.

SKEE 4153 : DIGITAL CONTROL SYSTEMS
Pre-requisite: SKEE 3143 Control System Design

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 4433 : POWER ELECTRONICS AND DRIVES
Pre-requisite: SKEE 2423 Fundamentals of Electrical Power Systems

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.

SKEI 4233: NANOTECHNOLOGY AND APPLICATION

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 device using finite element analysis (FEA) tool. Finally, students will be exposed to the design and development of microfluidic device using photolithography technique. In the end of the course, students are expected to acquire good understanding and able to analyse the fundamental principles of various equipment used in 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 microfluidic device.

SKEI 4313: PLC AND SCADA SYSTEM DESIGN
Pre-requisite: SKEE 3143 Control 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.

SKEI 4343: SYSTEM IDENTIFICATION AND ESTIMATION
Pre-requisite: SKEE 4113 Modern Control System

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 details 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.

SKEI 4363 : INDUSTRIAL CONTROL NETWORKS
Pre-requisite: SKEE 3143 Control System Design

The aim of this course is to present basic concepts in industrial control networks to students. It will highlight the basic system of interconnected equipment used to monitor and control the physical equipment in industrial environment. Fundamental concepts in conventional and industrial networks are initially described. Industrial control network components such as PLC, DCS and SCADA are also studied. The hierarchical and architecture of every level in industrial control networks are also discussed. The types of network protocols which are often used in industrial environment at every level are described.

SKEL 4213: Software Engineering
Pre-requisite: SCSP 1103 C Programming Techniques

This course introduces various issues of system and software engineering. Focus is on software development process, program design, collaborative development and testing, which are the fundamental aspects of software engineering. Special emphasis will be given to object-oriented analysis and design (OOAD) as well as the use of UML in the design activities.

SKEL 4223: Digital Signal Processing 1
Pre-requisite: SKEE 2073 Signal and System

This course introduces concepts in digital signal processing. Continuous-time signals and systems will be reviewed. Consecutively, introduction to digital signal processing, 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, and Discrete Fourier Transform (DFT). Another domain presented is Z-transform which consists of topics on derivations, region of convergence, transformation properties, poles and zeros, and inverse z-transform. At the end of the course, analysis and design of digital filters covers filter basics, analog filter prototypes and design of IIR filter and FIR filter.

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 1502 : COMPUTER AIDED ENGINEERING DRAWING

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, SolidWorksto 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.

SKEM 3123 : HYDRAULIC AND PNEUMATIC SYSTEMS
Pre-requisite : SKEM 1113 Engineering Mechanics

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 : ELECTRIC MOTOR AND DRIVES
Pre-requisite : SKEE 2413 Basic Power and Electric Machines

Students will be introduced to general information on electric motor and the electric drives components with linear control method for mechatronic systems. 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.

SKEM 3742 : SPECIALIZED 3RD YEAR LABORATORY

The purpose of this course is to provide students with practical experience in the use of equipment, experimental data analysis, and to develop basic skill in laboratory report writing. The students will be exposed to the common electrical engineering equipment and measurement techniques. At least 10 experiments from participating third year laboratories such as Control, Microprocessor and Industrial Electronic. At the end of the course students should be able to develop skills in report writing, improve their communication skills and know how to work in a team.

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 students the concepts of machine vision as well as the introduction to building a machine vision inspection. The students will also learn image's representation and properties where essential basics concepts widely used in image analysis will be introduced. The students then taught data structures because data and algorithm are the two basic related parts in 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 object(s) of interest and background. After that, student will be introduced to shape representation and description. Basically, shape representation and description consists of methods to extract a numeric feature vector or a non-numeric syntactic description word which characterizes 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 also will learn image understanding, an internal image model that represents the machine vision's concept about the process image of the world. To conclude the course, one project on machine vision application will be discussed with the students. 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 visions problems.

SKEM 4143 : ROBOTICS
Pre-requisite :SSCE 1993 Differential Equations

This course introduces students the basic principles underlying the design, analysis and synthesis of robotic systems. Students are introduced to various classifications and types of industrial robots, methods of deriving and analyzing robot kinematics, inverse kinematics, and dynamic model, as well as on the design of robot trajectory planning. Students are also

introduced to the various robot sensors and vision systems. By adapting the knowledge obtained, students will be able to derive and analyze accurately the forward kinematics, the inverse kinematics, and the dynamics for various industrial robots, as well as the students will be able to design correctly the robot's trajectory.

SKEM 4153 : ROBOT TECHNOLOGY FOR AUTOMATION
Pre-requisite : SKEM 4143 Robotics

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 RobotStudio simulation software.

SKEM 4163 : AUTONOMOUS ROBOT
Pre-requisite : SKEM 4143 Robotics

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, semi-autonomous 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, ranging from fundamental technical issues to practical system integration and applications. The students will be presented with a coherent picture of autonomous mobile systems at the systems level, and will also gain a better understanding of the technological and theoretical aspects involved within each module that composes the overall system. The chapters emphasize the different aspects of autonomous mobile systems, starting from sensors and control, and gradually moving up the cognitive ladder to planning and decision making, finally ending with the integration of the four modules in application case studies of autonomous systems.

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, 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 4223 : EMBEDDED SYSTEMS
Pre-requisite : SKEE 3223 Microprocessor

This course introduces the principles and applications of embedded system. The topics emphasized are 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 4333 : MECHATRONICS SYSTEM DESIGN

This course introduce 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 analyse and select the appropriate sensors, actuators and interface, and design the PID control and its digital implementation correctly.

SKEM 4723 : CAPSTONE 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.

SKEM 4812 : FINAL YEAR PROJECT PART I

The aim of the Final Year Project (FYP) is to give students opportunity to apply the knowledge that they have gained while studying in SKE to solve practical engineering problems in the area of Mechatronic Engineering. By doing so, it is hoped that the students will gain knowledge and experience in solving problems systematically thus when they graduate, they will be ready to work as reliable and productive engineers. The FYP is spread over two semesters (one year), and this is the first part of the final year project. Student will be assigned a supervisor and project's topic at the beginning of the semester. Students are expected to do their work independently and their progress will be monitored closely by their supervisor.

SKEM 4824 : FINAL YEAR PROJECT PART II
Pre-requisite : SKEM 4812 Final Year Project Part 1

The aim of the Final Year Project 2 (FYP2) 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 thus when they graduate, they will be ready to work as reliable and productive engineers.

SKEM 4926: PRACTICAL TRAINING

Students will undergo a practical training lasting for a minimum of 10 weeks

at an approved private, government or semi-government agency. The Faculty will release the list of participating agencies. Placement at the respective agency 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.

SKET 4633: Coding of Multimedia Signals
Pre-requisite: SKET 3583 Digital Communication System

This course is an introduction to the coding and processing of digital multimedia signals. It covers current techniques for coding of multimedia signals such as audio, images, and video. Current video compression standards and formats will be discussed and introduced in this course. It focuses on the challenges of mobile video communication and provides methods in solving the issues.