BACHELOR OF ENGINEERING (ELECTRICAL-MECHATRONICS)

PROGRAMME SPECIFICATIONS

The Bachelor of Engineering (Electrical-Mechatronics) is a program with honours that has been established and offered for more than two decades by UTM. The program is a four-year program completed with one year final year project. The programme is offered only at the UTM Main Campus in Johor Bahru. The duration of study 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	SEEM
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) - SEEM

No	Classification	Credit Hours	Percentage
i.	University Courses a) General b) Language c) Entrepreneurship d) Co-Curriculum	 26 8 2 3	 28.7%
ii.	School/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 (SEEM) with a minimum CGPA of 2.0.
- Complete Professional Skills Certificates (PSC).

Programme Educational Objectives (PEO)

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	Intended 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.

COURSE MENU

Bachelor of Engineering (Electrical-Mechatronics) - SEEM

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 1693	Engineering Mathematics I	3	
SEEE 1012	Introduction to Electrical Engineering	2	
SEEE 1013	Electrical Circuit Analysis	3	
SECP 1103	C Programming Techniques	3	
UHLB 1112	English Communication Skills	2	
UHMS 1182	Appreciation of Ethics and Civilizations (Local Students)	2	
UHIS 1022 OR UHMS 1182	Philosophy and Current Issues OR Appreciation of Ethics and Civilizations (for International Students)		
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**15**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 1793	Differential Equations	3	
SEEE 1073	Electronic Devices and Circuits	3	SEEE 1013
SEEE 1223	Digital Electronics	3	
SEEM 1113	Engineering Mechanics	3	
SEEM 1502	Computer Aided Engineering Drawing	2	
UHIS 1022	Philosophy and Current Issues (for Local Students)	2	
UHLM 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
SEEE 1022	Introduction to Scientific Programming	2	
SEEE 2073	Signals and Systems	3	
SEEE 2423	Fundamentals of Electrical Power Systems	3	SEEE1013
UHMT 1012	Graduate Success Attributes	2	
UHLB 2122	Academic Communication Skills	2	
UKQF 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	
SEEE 2133	Electronic Instrumentation & Measurement	3	
SEEE 2263	Digital Systems	3	SEEE 1223
SEEM 3123	Hydraulic and Pneumatic Systems	3	SEEM 1113
SEEE 2742	2nd Year Electronic Design Lab	2	
UBSS 1032	Introduction To Entrepreneurship	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**64**	

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

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SEEE 3143	Control System Design	3	SEEE 3133
SEEE 3263	Electronic Systems	3	SEEE 1073
SEEM 3133	Electrical Motors and Drives	3	
SEEM 4333	Mechatronics System Design	3	
SEEM 3742	Specialized 3rd Year Laboratory	2	
UHLB 3132	Professional Communication Skills	2	
UKQT 3001	Extracurricular Experiential Learning (ExCEL)	1	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**98**	

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

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SEEM 4723	Capstone Project	3	
SEEM 4812	Final Year Project Part I	2	
SEEM 4143	Robotics	3	SSCE 1993
SEEL 4223	Digital Signal Processing I	3	SEEE 2073
SEE* 4**3 / SEE*5**3	Field Elective 1 / PRISMS Elective 1	3	
SHMS 4542	Engineering Management	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**120**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SEEM 4824	Final Year Project Part II	4	SEEM 4812
SEEE 4012	Professional Engineering Practice	2	
SEE* 4**3 / SEE*5**3	Field Elective 2 / PRISMS Elective 2	3	
SEE* 4**3 / SEE*5**3	Field Elective 3 / PRISMS Elective 3	3	

UHIT 2302	Science and Technology Thinking	2	
UHL* 1112	Electives of Foreign Language	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**136**	

Elective Courses

Code	Course	Credit	Pre-requisite
SEEE 4113	Modern Control System	3	SEEE 3143
SEEE 4153	Digital Control Systems	3	SEEE 3143
SEEE 4433	Power Electronic and Drives	3	SEEE 2423
SEEI 3133	Industrial Instrumentations and Applications	3	SEEE 2133
SEEI 4173	Advanced Transducers and Sensors	3	SEEI 3133
SEEI 4223	BioMEMS and Microanalytical Systems	3	SEEI 3133
SEEI 4233	Nanotechnology and Application	3	
SEEI 4313	PLC and SCADA System Design	3	SEEE 3143
SEEI 4323	Advanced Control Theory	3	SEEE 4113
SEEI 4343	System Identification and Estimation	3	SEEE 4113
SEEI 4363	Industrial Control Networks	3	SEEE 3143
SEEL 4213	Software Engineering	3	SECP 1103
SEEM 4133	Machine Vision Systems	3	
SEEM 4153	Robot Technology for Automation	3	SEEM 4143
SEEM 4173	Artificial Intelligence	3	
SEEM 4223	Embedded Systems	3	SEEE 3223
SEET 4633	Coding of Multimedia Signals	3	SEET 3583
SEEM 4163	Autonomous Robot	3	SEEM 4143
SEEM 4123	Industrial Engineering	3	

SEEM Elective Courses for PRISM (CHOOSE MAXIMUM 3)			
Code	**Course**	**Credit**	**Pre-requisite**
SEEM 5753	Advanced Instrumentation and Measurement	3	
SEEM 5713	Artificial Intelligence and Applications	3	
SEEM 5703	Control Systems Engineering	3	

PRISMS ELECTIVE COURSES

For students who intend to enroll into PRISMS programme, refer to the PRISMS Section for a list of related elective courses associated with the postgraduate programmes.

Requirements

Students who are eligible to apply for PRISMS are those with academic qualification who are in Year 3 Semester 2 with cumulative average grade value of CGPA 3.3 and above. Students can apply for PRISMS in Year 3 Semester 2 through the Program Integrasi Sarjana Muda-Sarjana (PRISMS) application form and must be recommended by the Academic Advisor, approved by the Program Director and certified by the Chair of School or Dean of Faculty.

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) - SEEM

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√)IF PASSED
BACHELOR OF ENGINEERING (ELECTRICAL – MECHATRONICS)					
1.	SEEE 1012	Introduction to Electrical Engineering	2	2	
2.	SEEE 1013	Electrical Circuit Analysis	3	3	
3.	SEEE 1022	Introduction to Scientific Programming	2	2	
4.	SEEE 1073	Electronic Devices and Circuits	3	3	
5.	SEEE 1223	Digital Electronics	3	3	
6.	SEEE 2073	Signals and Systems	3	3	
7.	SEEE 2133	Electronic Instrumentation & Measurement	3	3	
8.	SEEE 2263	Digital Systems	3	3	
9.	SEEE 2423	Fundamentals of Electrical Power Systems	3	3	
10.	SEEE 2523	Electromagnetic Field Theory	3	3	
11.	SEEE 2742	2nd Year Electronic Design Lab	2	2	
12.	SEEE 3133	System Modeling & Analysis	3	3	
13.	SEEE 3143	Control System Design	3	3	
14.	SEEE 3223	Microprocessor	3	3	
15.	SEEE 3263	Electronic Systems	3	3	
16.	SEEE 3533	Communication Principles	3	3	
17.	SEEE 3732	Common 3rd Year Laboratory	2	2	
18.	SEEE 4012	Professional Engineering Practice	2	2	

19.	SEEL 4223	Digital Signal Processing I	3	3	
20.	SEEM 1113	Engineering Mechanics	3	3	
21.	SEEM 1502	Computer Aided Engineering Drawing	2	2	
22.	SEEM 3123	Hydraulic and Pneumatic Systems	3	3	
23.	SEEM 3133	Electrical Motors and Drives	3	3	
24.	SEEM 3742	Specialized 3rd Year Laboratory	2	2	
25.	SEEM 4143	Robotics	3	3	
26.	SEEM 4333	Mechatronics System Design	3	3	
27.	SEEM 4723	Capstone Project	3	3	
28.	SEEM 4812	Final Year Project Part I	2	2	
29.	SEEM 4824	Final Year Project Part II	4	4	
30.	SEEM 4926	Practical Training	6	6	
31.	SEE* 4**3 / SEE*5**3	Field Elective 1 / PRISMS Elective 1	3	3	
32.	SEE* 4**3 / SEE*5**3	Field Elective 2 / PRISMS Elective 2	3	3	
33.	SEE* 4**3 / SEE*5**3	Field Elective 3 / PRISMS Elective 3	3	3	
34.	SECP 1103	C Programming Techniques	3	3	
35.	SHMS 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					
Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)					
1.	UHMS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	2	
	UHIS 1022 OR UHMS 1182	Philosophy and Current Issues (for International Students) OR Appreciation of Ethics and Civilizations (for International Students			
2.	UHIS 1022	Philosophy and Current Issues (for Local Students)	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			
Cluster 2: Generic Skills					
1.	UHMT 1012	Graduate Success Attributes	2	2	
2.	UBSS 1032	Introduction to Entrepreneurship	2	2	
Cluster 3: Knowledge Enhancement					
1.	UHIT 2302	The Thought of Science and Technology	2	2	
Cluster 4: Co-Curriculum and Service Learning					
1.	UKQF 2**2	Elective of Co-Curricular Service Learning	2	2	
2.	UKQT 3001	Extracurricular Experiential Learning (ExCEL)	1	1	
Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)					
1.	UHLB 1112	English Communication Skills	2	2	
2.	UHLB 2122	Academic Communication Skills	2	2	
3.	UHLB 3132	Professional Communication Skills	2	2	
4.	UHL* 1112	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)			
Students are required to enrol and pass FIVE (5) PSC courses, to be eligible to graduate. Enrol the PSC courses as follows:			
COMPULSORY PSC COURSES (Enrol All 3 Courses)			
1	GLRB0010	Design Thinking for Entrepreneur	
2	GLRM0010	Talent and Competency Management	
3	GLRL0010	English Communication Skills for Graduating Students (ECS)	
ELECTIVE PSC COURSES (Choose Any 2 Courses only)			
1	GLRT0010	Data Analytics for Organization	
2	GLRM0020	Professional Ethics and Integrity	
3	GLRT0020	Construction Measurement (Mechanical & Electrical)	
4	GLRT0030	OSHE for Engineering Industry and Laboratory	
5	GLRT0040	OSHE for Construction Industry and Laboratory Works	
6	GLRT0050	Quality Management for Build Environment and Engineering Professionals	
7	GLRT0060	Safety and Health Officer Introductory Course	
8	GLRT0070	Industrial Machinery and Lubrication	
Or any other elective PSC courses offered by UTM iLeague. Information on PSC Courses: https://ileague.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

SEEE 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.

SEEE 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.

SEEE 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.

SEEE 1073 - Electronic Devices & Circuits

Pre-requisite: SEEE 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.

SEEE 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.

SEEE 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.

SEEE 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.

SEEE 2263 - Digital Systems

Pre-requisite: SEEE 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.

SEEE 2423 - Fundamentals Of Electrical Power Systems
Pre-requisite: SEEE 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.

SEEE 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.

SEEE 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.

SEEE 3133 - System Modeling And Analysis
Pre-requisite: SEEE 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.

SEEE 3143 - Control System Design
Pre-requisite: SEEE 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.

SEEE 3223 - Microprocessor
Pre-requisite: SEEE 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.

SEEE 3263 - Electronic Systems
Pre-requisite: SEEE 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.

SEEE 3533 - Communication Principles
Pre-requisite: SEEE 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.

SEEE 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.

SEEE 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.

SEEE 4113 - Modern Control System

Pre-requisite: SEEE 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.

SEEE 4153 - Digital Control Systems

Pre-requisite: SEEE 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.

SEEE 4433 - Power Electronics and Drives

Pre-requisite: SEEE 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.

SEEI 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.

SEEI 4313 - PLC and Scada System Design
Pre-requisite: SEEE 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.

SEEI 4343 - System Identification and Estimation
Pre-requisite: SEEE 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.

SEEI 4363 - Industrial Control Networks
Pre-requisite: SEEE 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.

SEEL 4213 - Software Engineering
Pre-requisite: SECP 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.

SEEL 4223 - Digital Signal Processing 1
Pre-requisite: SEEE 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.

SEEM 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.

SEEM 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.

SEEM 3123 - Hydraulic and Pneumatic Systems
Pre-requisite : SEEM 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.

SEEM 3133 - Electric Motor and Drives
Pre-requisite : SEEE 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.

SEEM 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.

SEEM 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.

SEEM 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.

SEEM 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.

SEEM 4153 - Robot Technology for Automation
Pre-requisite : SEEM 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.

SEEM 4163 - Autonomous Robot
Pre-requisite : SEEM 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.

SEEM 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.

SEEM 4223 - Embedded Systems

Pre-requisite : SEEE 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.

SEEM 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.

SEEM 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.

SEEM 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.

SEEM 4824 - Final Year Project Part II
Pre-requisite : SEEM 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.

SEEM 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 school 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 school. 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.

SEET 4633 - Coding of Multimedia Signals
Pre-requisite: SEET 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.

SEEM 5753 - Advanced Instrumentation and Measurement
This course is an introduction to the advanced instrumentation and measurement. Key components studied in details 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.

SEEM 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.

SEEM 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.