Bachelor of Mechatronic Engineering with Honours

School of Electrical and Electronic Engineering

2023/2024

https://ee.eng.usm.my

Bachelor of Mechatronic Engineering with Honours

School of Electrical and Electronic Engineering

2023/2024

www.usm.my

USM Vision

Transforming Higher Education for Sustainable Tomorrow

USM Mission

USM is pioneering, transdisciplinary research intensive university that empowers future talents and enables the bottom billions to transform their socio-economic well-being

School of Electrical and Electronic Engineering Mission

To provide quality education and sustainable research that produces professionals with the necessary knowledge, skills and character that is required for the advancement of engineering and technology

STUDENT'S PERSONAL INFORMATION

Full Name	
Identity Card (IC) / Passport No.	
Current Address	
Permanent Address	
Email Address	
Telephone No. (Residence)	
Mobile Phone No. (if applicable)	
School	
Programme of Study	

CONTENT **PAGE**

1.0 SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

http://ee.eng.usm.my

1.1 INTRODUCTION

Since the academic session of 2000/2001, the School of Electrical and Electronic Engineering offers two study programmes, i.e the Electronic Engineering Programme leading to the Bachelor of Engineering (Honours) (Electronic Engineering) and Electrical Engineering Programme leading to the Bachelor of Engineering (Honours) (Electrical Engineering). As of 2002/2003, another programme has been offered, which is the Mechatronic Engineering Programme leading to the Bachelor of Engineering (Honours) (Mechatronic Engineering). The duration of the three mentioned programmes are four years or eight semesters.
Starting Academic Session 2021/2022, the three programmes were renamed as Bachelor of Electronic Engineering with Honours, Bachelor of Electrical Engineering with Honours and Bachelor of Mechatronic Engineering with Honours.

Electronic Engineering
The Electronic Engineering Programme covers Microelectronics, Computers, Communications and Control and Automation.

Microelectronics:
- includes Design and Analysis of Electronic Circuits, Digital Systems Design, Semiconductors, Electronic Devices and Circuits and various aspects of Integrated Electronics.

Computers:
- includes Computer Organization, Computer Networking, Microprocessor Systems Design, Digital Signal Processing and Software Engineering.

Communications:
- includes Theory of Communication Systems, Antenna and Propagation, Microwave Engineering, Radar and Satellite Communications.

Control and Automation:
- includes Analysis and Design of Control Systems, Robotics and Automation, exposure to automation industrial sector.

Electrical Engineering
The Electrical Engineering Programme covers Power Generation (both conventional and unconventional methods), Transmission, Distribution and Consumption, Electrical Machines, Analysis, Design, Applications, Power System Stability, High Voltage Engineering, Renewable Energy, Electrical Instrumentation and Measurement, and Power Electronics.

Mechatronic Engineering
The Mechatronic Engineering Programme covers fundamentals of electrical, electronic, mechanical and computer engineering, system and control engineering, mechatronic system and design, sensors and transducers, robotics, machine vision and manufacturing.

1.2 OBJECTIVES AND PHILOSOPHY

The vision of Universiti Sains Malaysia is:-
“Transforming Higher Education for a Sustainable Tomorrow”

The mission of Universiti Sains Malaysia is:-

"USM is pioneering, transdisciplinary research intensive university that empowers future talents and enables the bottom billions to transform their socio-economic well-being"

The mission of the School of Electrical and Electronic Engineering is:-
"To provide quality education and sustainable research that produces professionals with the necessary knowledge, skills and character that is required for the advancement of engineering and technology".

In line with these vision and missions, the offering of the Electronic, Electrical and Mechatronic Engineering programmes were designed to produce Electrical, Electronic and Mechatronic engineers with professional qualifications, skilled and knowledgeable, credible and able to find solutions to various engineering problems through innovative thinking.

Based on this philosophy, the goals of the curriculum of every study programmes have been designed to fulfil the national agenda, as well as industrial and current technological advancement needs. Hence, the curriculum has been organized to possess the following characteristics:

- recognized by Board of Engineers Malaysia (BEM), The Institution of Engineers Malaysia (IEM) as well as to be internationally acclaimed
- proper and balanced integration of practical and theoretical aspects
- with a complete choice of many well planned and advanced specialisation
- to develop persons of sound character who are knowledgeable, competent and innovative

With the above characteristics, USM graduates will become graduate engineers of excellence, calibre and able to achieve the high level of professionalism as engineers or researchers in their respective fields.

1.3 IMPLEMENTATION OF OUTCOME BASED EDUCATION (OBE)

Starting from the 2006/2007 academic session, the new intake of students will undergo a set of curriculums known as Outcome Based Education. Briefly, OBE is a method of curriculum design and teaching that focuses on what students can actually do after they are taught.

Under OBE, there are three Programme Educational Objectives (PEOs) as follows: -

Bachelor of Electronic Engineering with Honours

1. Graduates who are employed in the Electronic Engineering related fields.
2. Graduates who are innovative, pursue continuous career development, and participate in society related activities.
3. Graduates who have leadership qualities, ethical values and awareness in sustainability issues.

Bachelor of Electrical Engineering with Honours

1. Graduates who are employed in the Electrical Engineering related fields.
2. Graduates who are innovative, pursue continuous career development, and participate in society related activities.
3. Graduates who have leadership qualities, ethical values and awareness in sustainability issues

Bachelor of Mechatronic Engineering with Honours

1. Graduates who are employed in the Mechatronic Engineering related fields.
2. Graduates who are innovative, pursue continuous career development, and participate in society related activities.
3. Graduates who have leadership qualities, ethical values and awareness in sustainability issues.

Also under the OBE, each programme should have Programme Outcomes (POs) that describe what students are expected to know and be able to perform or attain by the time of graduation. The School is adopting the POs as stated by Washington Accord and Engineering Accreditation Council in its EAC Standard 2020 as follows: -

PO1- Engineering Knowledge
Ability to apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation as specified in WK1 to WK4 respectively to the solution of complex engineering problems.

PO2- Problem Analysis
Ability to identify, formulate, conduct research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4).

PO3- Design/Development of Solutions
Ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations (WK5).

PO4- Investigation
Ability to conduct investigation of complex problems using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PO5- Modern Tool Usage
Ability to create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations (WK6).

PO6- The Engineer and Society
Ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems (WK7).

PO7- Environment and Sustainability
Ability to understand and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental contexts (WK7).

PO8 – Ethics
Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (WK7).

PO9- Individual and Team Work
Ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

PO10- Communication
Ability to communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11- Project Management and Finance
Ability to demonstrate knowledge and understanding of engineering and management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12- Life Long Learning
Ability to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

1.4 MAIN ADMINISTRATIVE STAFF

Professor Ir. Ts. Dr. Shahrel Azmin bin Sundi @ Suandi
Dean

Assoc. Prof. Ir. Dr. Rosmiwati binti Mohd Mokhtar
Deputy Dean (Academic, Career and International)

Assoc. Prof. Dr. Muhammad Nasiruddin Mahyuddin
Deputy Dean (Research, Innovation and Industry-Community Engagement)

Assoc. Prof. Dr. Haidi bin Ibrahim
Programme Chairman
(Electronic Engineering)

Assoc. Prof. Ir. Dr. Mohamad Kamarol bin Mohd Jamil
Programme Chairman
(Electrical Engineering)

Assoc. Prof. Dr. Khoo Bee Ee
Programme Chairman
(Mechatronic Engineering)

Dr. Mohd Nazri bin Mahmud
Programme Chairman
(Mix Mode Postgraduate Programme)

Assoc. Prof. Dr. Dzati Athiar binti Ramli
Programme Chairman
(Quality & Commercialisation)

Mr. Samsuri bin Musa
Senior Assistant Registrar

Mdm. Nur Husna binti Mansor
Senior Assistant Registrar

1.5 LIST OF ACADEMIC STAFF

Name	Tel. Ext	E-mail
PROFESSORS		
Faisal Rafiq bin Mahamd Adikan, Dato' Dr.	6085	rafiq@usm.my
Mohd Fadzil bin Ain, Ir. Dr.	5815	eemfadzil@usm.my
Mohd Rizal bin Arshad, Ir. Ts. Dr.	6015	eerizal@usm.my
Nor Ashidi bin Mat Isa, Ir. Dr.	6051	ashidi@usm.my
Shahrel Azmin bin Sundi @ Suandi, Ir. Ts. Dr.	6000	shahrel@usm.my
Widad binti Ismail, Dr.	6050	eewidad@usm.my
ASSOCIATE PROFESSORS		

Bakhtiar Affendi bin Rosdi, Dr.	6083	eebakhtiar@usm.my
Dahaman bin Ishak, Ir. Dr.	5810	dahaman@usm.my
Dzati Athiar binti Ramli, Dr.	6028	dzati@usm.my
Haidi bin Ibrahim, Dr.	5822	haidi@usm.my
Junita binti Mohamad Saleh, Dr.	6027	jms@usm.my
Khoo Bee Ee, Dr.	6032	beekhoo@usm.my
Mohamad Kamarol bin Mohd Jamil, Ir. Dr.	6064	eekamarol@usm.my
Mohamad Khairi bin Ishak, Dr.	5737	khairiishak@usm.my
Mohd Fadzli bin Mohd Salleh, Dr.	6058	fadzlisalleh@usm.my
Muhammad Nasiruddin bin Mahyuddin, Dr.	5843	nasiruddin@usm.my
Nor Asiah binti Muhamad, Ir. Dr. (on secondment to other agency)	5726	norasiah.m@usm.my
Nor Muzlifah binti Mahyuddin, Dr.	5789	eemnmuzlifah@usm.my
Nur Syazreen binti Ahmad, Dr.	6014	syazreen@usm.my
Patrick Goh Kuan Lye, Dr.	6033	eepatrick@usm.my
Rosmiwati binti Mohd Mokhtar, Ir. Dr.	6003	eerosmiwati@usm.my
Syed Sahal Nazli Alhady bin Syed Hassan, Dr.	6019	sahal@usm.my
Teh Jiashen, Ir. Ts. Dr.	6016	jiashenteh@usm.my
Wan Mohd Yusof Rahiman bin Wan Abdul Aziz, Dr.	6024	wanrahiman@usm.my
Zaini binti Abdul Halim, Dr.	6061	zaini@usm.my
Zuraini binti. Dahari, Dr.	6048	eezuraini@usm.my

SENIOR LECTURERS

Abdul Sattar bin Din, Dr.	5796	sattar@usm.my
Aeizaal Azman bin Abdul Wahab, Dr.	5762	aeizaal@usm.my
Ahmad Nazri bin Ali, Dr.	6020	nazriali@usm.my
Intan Sorfina binti Zainal Abidin, Dr.	5795	intan.sorfina@usm.my

Mohamad Adzhar bin Md Zawawi, Dr.	6052	adzhar@usm.my
Mohamad Tarmizi bin Abu Seman, Ir. Dr.	6063	mohdtarmizi@usm.my
Mohamed Fauzi bin Packeer Mohamed, Dr.	6097	fauzi.packeer@usm.my
Mohamed Salem Mohamed Othman, Dr.	5842	salemm@usm.my
Mohd Khairunaz bin Mat Desa, Dr.	5873	khairunaz@usm.my
Mohd Nazri bin Mahmud, Dr.	6059	nazriee@usm.my
Mohd Shahrimie bin Mohd Asaari, Dr	6086	mohdshahrimie@usm.my
Mohd Tafir bin Mustaffa, Dr.	6029	tafir@usm.my
Muhammad Firdaus bin Akbar Jalaludin Khan, Dr.	6087	firdaus.akbar@usm.my
Muhammad Najwan bin Hamidi, Dr.	6018	najwan@usm.my
Muhammad Hafeez bin Mohamed Hariri, Ir. Dr.	6054	muhammadhafeez@usm.my
Noramalina binti Abdullah, Dr.	6022	eenora@usm.my
Nor Azlin binti Ghazali, Dr.	5786	azlin.ghazali@usm.my
Nor Rizuan bin Mat Noor, Dr.	6077	nrmn@usm.my
Nur Zatil ‘Ismah binti Hashim, Dr.	6034	zatil.hashim@usm.my
Ooi Chia Ai, Dr.	6076	chia.ai@usm.my
Tay Lea Tien, Dr.	6082	tay@usm.my
Teoh Soo Siang, Ir. Dr.	6081	eeteoh@usm.my
Wan Amir Fuad Wajdi bin Othman, Dr.	6062	wafw_othman@usm.my

ACADEMIC FELLOWS

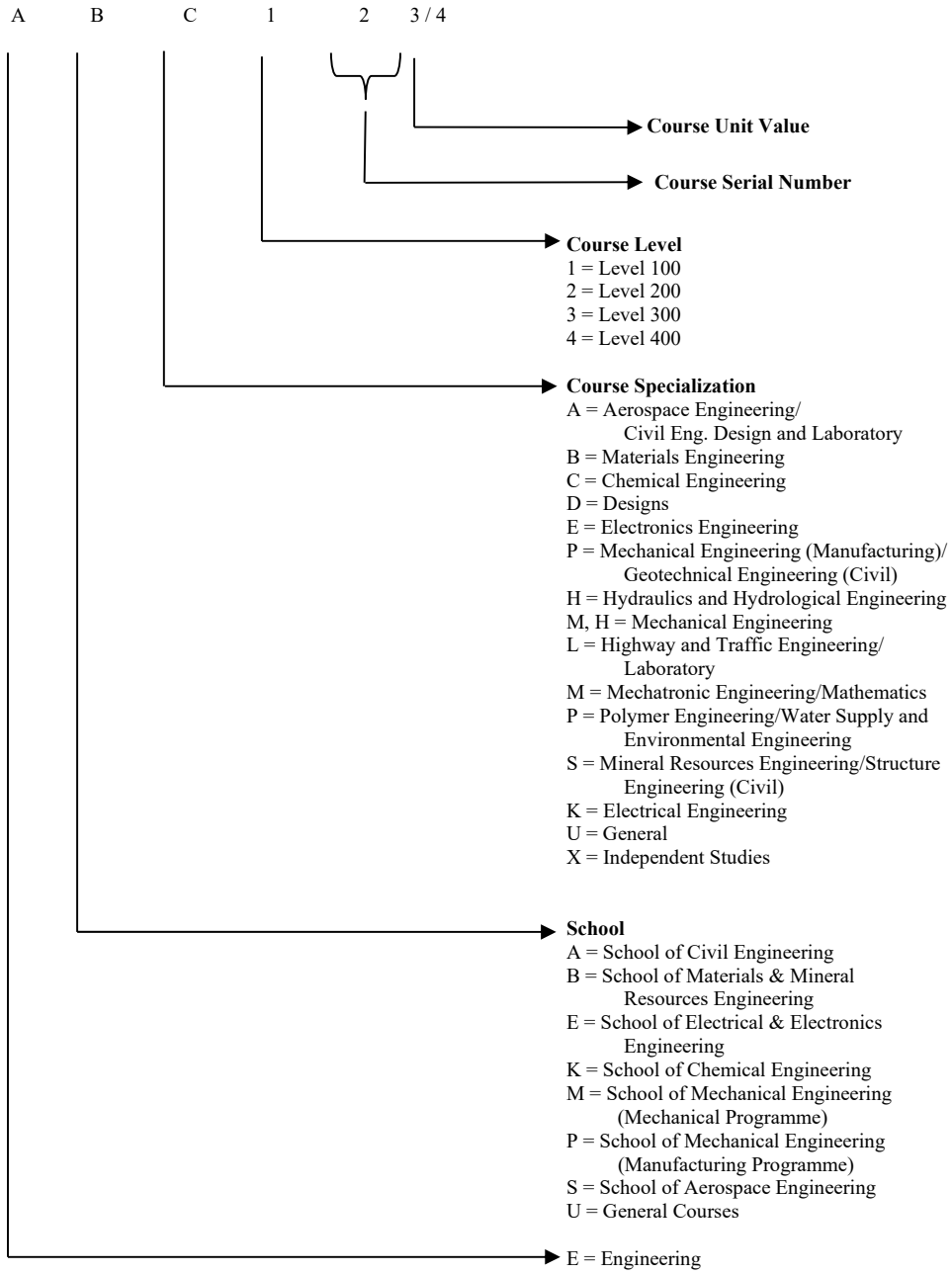
Gomesh Nair A/L Shasidharan, Ir. Dr.	5813	gomesh@usm.my
Siti Fatimah binti Abd. Rahman, Dr.	6079	fatimahrahman@usm.my

RESEARCH OFFICERS

Mohamad Nazir bin Abdullah, Mr.	5802	eemnazir@usm.my
Mohd Nadzri bin Mamat, Mr.	5801	eenadzri@usm.my
Roslina binti Hussin, Mdm.	6025	eeroslina@usm.my
Suardi bin Kaharuddin, Mr.	6057	suardi@usm.my

1.6 COURSE CODE

Each course offered by the respective School is denoted by the following code of ABC 123/4. The alphabets and numbers represent:-



1.7 PROGRAMME STRUCTURE

The Structure of the Engineering Degree Programme is as follows:-

Course	Units	Remarks
(i) CORE	108	
(ii) ELECTIVE	12	Students may select these courses from the list as determined by the respective school
(iii)UNIVERSITY REQUIREMENT	15	
Compulsory (14 units)		
(a) Bahasa Malaysia	2	
(b) English Language	4	
(c) Philosophy and Current Issues	2	For international students, courses Appreciation of Ethics and Civilisations and Core Entrepreneurship are to be replaced by Malaysian Studies (4 units)
(d) Appreciation of Ethics and Civil Civilisations	2	
(e) Core Entrepreneurship	2	
(f) Co-curriculum	2	
Optional Course (1 Units)		
(a) Optional	1	

Note: For graduation, students are required to complete at least 135 units, with 'pass' grade for all the courses.

1.8 COURSE OFFERING

Students are required to register for the undergraduate courses in two semesters for each academic session that is Semester 1 and Semester 2. Courses are offered and examined in the same semester. Courses offered are categorized into four levels, via levels 100, 200, 300 and 400, suitable to the requirements of a four-year study programme.

Core Courses

Core course is a compulsory course package which aims at giving a deeper understanding of an area of specialization major. Students need to accumulate 108 units of the core courses which have been identified by each school.

Elective Courses

Students need to accumulate no less than 12 units from the list of courses suggested and acknowledged by the school.

Optional Courses

Optional courses are courses chosen by the students from among those that are outside of their programmes of study.

The main objective of an Optional course is as a substitute course for students who do not take Co-curriculum courses or Skill/Analysis courses.

Audit Courses

In principle, the university allows students to register for any courses on an audit basis for the purpose of enhancing the students' knowledge in specific fields during the duration of their study. However, the units of any such audit courses will not be taken into consideration for graduation purposes.

The registration procedures for courses on an audit basis are as follows: -

(a) Students can register for courses on an audit basis for the purpose of augmenting his/her knowledge in specific fields. Registration for the said course must be within the course registration week.

(b) Only students of active status are allowed to register for courses on an audit basis.

(c) Courses registered for on an audit basis are designated as code 'Y' courses. This designation will be indicated on the relevant academic transcript. A space at the bottom of the academic transcript will be reserved for listing the courses registered for on an audit basis.

(d) Courses registered for on an audit basis will not be taken into consideration in determining the minimum and maximum units of courses registered for.

(e) Students must fulfil all course requirements. Student who register for courses on an audit basis, are not obligated to sit for any examinations pertaining to that course. A grade 'R' will be awarded irrespective as to whether the student had or had not sat for the examination.

Laboratory Work/Practical, Engineering Practice and Industrial Training

Programmes in the School of Engineering place a great emphasis on laboratory work/practical. Laboratory work/practical is an important and essential aspect in most courses. There are also courses that the assessment is based on 100% works in laboratory work/practical. It aims to provide students with a better understanding of the subject matter delivered through lectures.

Students are required to submit laboratory/practical reports which are part of the course work assessment for courses delivered through lectures and the laboratory/practical component only. Attendance is compulsory for all levels of study and students may be barred from taking the written examination if their attendance is unsatisfactory.

Apart from attending classes (lectures and laboratory/practical), students must also undergo the Engineering Practice Course and Industrial Training.

General Objectives of Engineering Practice

(a) To expose to the students about the importance and the link between the theoretical and practical aspects of engineering, and to familiarise them with the environment/theoretical situations in use, available resources and their scarcity so that the academic aspects of a course can be understood better and used more effectively.

(b) To raise awareness of the environment/industrial situations, practices, resources and their scarcity. Therefore, students will have the opportunity to equip themselves to face future challenges in their academic studies as well as in their future training.

The Engineering Practice will be conducted in the following manner:

The training will be conducted on and off campus. There are two levels which are compulsory for all engineering students:

(i) Engineering Practice Course

The Engineering Practice Course is a basic training course on mechanical, manufacturing and electrical engineering. The training includes engineering workshops, introduction to manufacturing processes and electrical circuit. Engineering students will also be exposed to methods of engineering planning and project implementation. The duration of the training is 14 weeks and during this period, students will be supervised by the academic staff on duty.

(ii) Industrial Training

This course is conducted over 10 weeks during the long break after Semester II at level 300. Students are exposed to the actual operations of industries, locally and abroad. It is hoped that students will be able to learn and experience useful knowledge and skills while undergoing training as they have already taken the Engineering Practice Course.

It is hoped that the training will provide students with a good foundation in engineering. This is a 5-unit course and students will be awarded a Pass/Fail grade upon completion

1.9 GRADUATION REQUIREMENTS

Starting from the Academic Session 2015/2016, the intakes of this session for all programmes offered by the School of Electrical and Electronic Engineering are required to obtain a minimum of Grade C for each course taken.

Students must also fulfil the following requirements to graduate:

(a) Fulfil the minimum residential requirement (8 semesters) during the course of studies.

(b) Fulfil all the credit requirements of the courses and required units for each component (Core, Elective, Option and University Courses).

(c) Obtain an overall CGPA of 2.00 and above for Core courses.

(d) Obtain an overall CGPA of 2.00 and above for all courses.

(e) Achieve a minimum grade C or a grade point of 2.00 for all University Requirement Courses.

1.10 EXAMINATION SYSTEM

Examinations are held at the end of every semester. Students have to sit for the examination of the courses they have registered for except for courses with 100% coursework. Students are required to settle all due fees and fulfil the standing requirements for lectures/tutorials/practical and other requirements before being allowed to sit for the examination of the courses they have registered for. Course evaluation will be based on the two components of coursework and final examinations. Coursework evaluation includes tests, essays, projects, assignments and participation in tutorials.

1.10.1 Duration of Examination

Evaluated Courses	Examination Duration
2 units	1 hour for coursework of more than 40%
2 units	2 hours for coursework of 40% and below
3 units or more	2 hours for coursework of more than 40%
3 units or more	3 hours for coursework of 40% and below

1.10.2 Barring from Examination

Students will be barred from sitting for the final examination if they do not fulfil at least 70% of the course requirements, such as absence from lectures and tutorials, and have not completed/fulfilled the required components of coursework. A grade 'X' would be awarded for a course for which a student is barred. Students will not be allowed to repeat the course during the *Courses During the Long Vacation* (KSCP) period.

1.10.3 Grade Point Average System

Students' academic achievement **for registered core, elective and university requirement courses** will be graded as follows:

Alphabetic Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Grade Points	4.00	3.67	3.33	3.00	2.67	2.33	2.00	1.67	1.33	1.00	0.67	0

Students who obtained a grade 'C-' and below for a particular course would be given a chance to improve their grades by repeating the course during the KSCP (see below) or normal semester. Students who obtained a grade 'C' and above for a particular course are not allowed to repeat the course whether during KSCP or normal semester.

The achievement of students in any semester is based on Grade Point Average (GPA) achieved from all the registered courses in a particular semester. GPA is the indicator to determine the academic performance of students in any semester.
CGPA is the Cumulative Grade Point Average accumulated by a student from one semester to another during the years of study.

The formula to compute GPA and CGPA is as follows:

$$\text{Grade Point Average} = \frac{\sum_{i=1}^{n} U_i M_i}{\sum_{i=1}^{n} U_i}$$

where:

n = Number of courses taken
U_i = Course units for course i
M_i = Grade point for course i

Example of calculation for GPA and CGPA:

	Course	Unit	Grade Point (GP)	Grade (G)	Total GP
Semester I	ABC XX1	4	3.00	B	12.00
	ABC XX2	4	2.33	C+	9.32
	BCD XX3	3	1.67	C-	5.01
	CDE XX4	4	2.00	C	8.00
	EFG XX5	3	1.33	D+	3.99
	EFG XX6	2	2.67	B-	5.34
		20			43.66

GPA = $\frac{43.66}{20}$ = 2.18

	Course	Unit	Grade Point (GP)	Grade (G)	Total GP
Semester II	ABC XX7	3	1.00	D	3.00
	ABB XX8	4	2.33	C+	9.32
	BBC XX9	4	2.00	C	8.00
	BCB X10	4	2.67	B-	10.68
	XYZ XX1	3	3.33	B+	9.99
		18			40.99

GPA = $\frac{40.99}{18}$ = 2.28

CGPA = $\frac{\text{Total Accumulated GP}}{\text{Total Accumulated Unit}} = \frac{43.66 + 40.99}{20 + 18} = \frac{84.65}{38} = 2.23$

From the above examples, the CGPA is calculated as the total grade point accumulated for all the registered courses and divided by the total number of the registered units.

1.10.4 Courses During the Long Vacation *(Kursus Semasa Cuti Panjang)* (KSCP)

KSCP is offered to students who have taken a course earlier and obtained a grade of 'C-', 'D+', 'D', 'D-', 'F' and 'DK' only. Students who obtained a grade 'X' or 'F*' are not allowed to take the course during KSCP.

The purpose of KSCP is to:

1. Give an opportunity to students who are facing time constraints for graduation.
2. Assist students who need to accumulate a few more credits for graduation.
3. Assist probationary students to enhance their academic status.
4. Assist students who need to repeat a prerequisite course, which is not offered in the following semester.

However, this opportunity is only given to students who are taking courses that they have attempted before and achieved a grade as stipulated above, provided that the course is being offered. Priority is given to final year students. Usually, formal lectures are not held, and teaching is via tutorials.

The duration of KSCP is 3 weeks, i.e. 2 weeks of tutorial and 1 week of examination, all held during the long vacation. The KSCP schedule is available on the University's Academic Calendar.

<u>The Implementation of KSCP</u>

(i) Students are allowed to register for a maximum of 3 courses and the total number of units registered must not exceed 10.

(ii) Marks/grades for coursework are taken from the highest marks/the best grades obtained in a particular course in the normal semester before KSCP. The final overall grade is determined as follows:

Final Grade = The best coursework marks or grade + Marks or grade for KSCP examination

(iii) GPA calculation involves the **LATEST** grades (obtained in KSCP) and also involves courses taken in the second semester and those repeated in KSCP. If the GPA during KSCP as calculated above is 2.00 or better, the academic status will be active, even though the academic status for the second semester was probation status. However, if the GPA for KSCP (as calculated above) is 1.99 or below, the academic status will remain as probation status for the second semester.

(iv) Graduating students (those who have fulfilled the graduation requirements) in the second semester are not allowed to register for KSCP.

1.10.5 Academic Status

Active Status: Any student who achieves a GPA of 2.00 and above for any examination in a semester will be recognised as ACTIVE and be allowed to pursue his/her studies for the following semester.

Probation Status: A probation status is given to any student who achieves a GPA of 1.99 and below. A student who is under probation status for three consecutive semesters (P1, P2, FO) will not be allowed to pursue his/her studies at the university. On the other hand, if the
CGPA is 2.00 and above, the student concerned will be allowed to pursue his/her studies and will remain at P2 status.

1.10.6 Termination of Candidature

Without any prejudice to the above regulations, **the University Examination Council has the absolute right to terminate any student's studies if he/she does not fulfil the accumulated minimum credits.**

The University Examination Council has the right to terminate any student's studies due to certain reasons (a student who has not registered for the courses, has not attended the examination without valid reasons), as well as medical reasons can be disqualified from pursuing his/her studies.

1.10.7 Examination Results

Full results (with grade) will be announced by the University through the Campus Online portal (campusonline.usm.my) after the School Examination Council meeting which is approximately one month after the final examination.

Students can print their official semester results document namely 'SEMGRED' through the Campus Online portal (campusonline.usm.my) on the same day/date of the results announcement.

2.0 MECHATRONIC ENGINEERING PROGRAMME

2.1 BACHELOR OF MECHATRONIC ENGINEERING WITH HONOURS STRUCTURE 2023/2024

	100		200		300		400		
CORE (T)	EEE105/3 Circuit Theory I		EEE125/3 Basic Circuit Lab		EEE228/3 Signal And System		EEE226/3 Microprocessor I		EEE350/3 Control Systems		EEE354/3 Digital Control Systems		EEE433/3 Object Oriented Programming for Engineering Applications		EEM499/6 Undergraduate Project	
	EEE123/3 Computer Programming for Engineers		EEE130/3 Digital Electronic I		EEE236/2 Complex Analysis for Engineers		EEK260/3 Electrical Machines		EEK361/3 Power Electronics		EEE382/3 Probability & Engineering Statistics		EEM420/3 Industrial Quality Control			
	EEM102/2 Mechatronic Engineering Practice	Mid Semester Break	EEM103/4 Electronic Devices & Analog Circuits	Long Vacation	EEM223/3 Thermofluids	Mid Semester Break	EEM222/4 Fundamentals of Dynamics & Mechanisms	Long Vacation	EEM353/3 Mechanical Engineering Design	Mid Semester Break	EEM323/3 Instrumentation & Measurement Systems	EEL303/5 Industrial Training	EEM427/3 Machine Vision	Mid Semester Break		
	EMD111/2 Engineering Drawing and Computer Aided Design		EMM102/3 Static		EEM242/2 Mechatronic Lab I		EEM253/2 Mechatronic Design I		EEM355/3 Mechatronic Systems		EEM343/3 Robotics		EEM425/3 Mechatronic System Design			
	EUM113/3 Engineering Calculus		EUM114/3 Advanced Engineering Calculus		EEM201/3 Principles & Mechanics of Materials		EUP222/3 Engineer in Society				EEM344/2 Mechatronic Laboratory II		EEM441/2 Instrumentation & Control Laboratory			
	13		16		13		15		12		14	5	14		6	108
UNIVERSITY REQUIREMENT (U)	LKM400/2 Malay Language IV (For Malaysian student)		WUS101/2 Core Entrepreneurship (For Malaysian student)		HFF225/2 Philosophy and Current Issues		HFE224/2 Appreciation of Ethics and Civilisations (For Malaysian Student)		LSP/2 English Language		KO-K/1 (For International Student)					15
	LKM100/2 Malay Language I (For International student)		KO-K/1 (For International Student)		LSP/2 English Language		SEA205E/4 Malaysia Studies (For International student)									
	WAR122/2: Integrity and Anti-Corruption (For Malaysian Student)				Option/1											
ELECTIVE (E)	**Note:** **Choose ONE Elective course from Semester 5, 6 and 7 , respectively.**								EEE303/4 Data Communication & Networking		EEE349/4 Embedded System and IoT		EEM426/4 Big Data Analytics			12
									EEM349/4 Computational Intelligence		EEM340/4 Autonomous System		EEE453/4 Control System Design			
									EEM354/4 Manufacturing Management & Technology		EEM341/4 Design of Experiments		EEM423/4 Reliability Engineering			
	17/15		18/17		18		17/19		18		18/19	5	18		6	135
	TOTAL MINIMUM UNIT FOR GRADUATION															135

2.2 COURSE – PROGRAM OUTCOME MATRIX (MECHATRONIC ENGINEERING)

Core Courses Offered to Mechatronic Engineering Programme				Program Outcomes											
				Engineering knowledge	Problem Analysis	Design/ development of solutions	Investigation	Modern Tool Usage	The Engineer and Society	Environment and Sustainability	Ethics	Individual and Team work	Communication	Project Management and Finance	Lifelong learning
Year	**Sem**	**Code**	**Course**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	EUM113	Engineering Calculus	X	X										
		EMD111	Engineering Drawing & Computer Aided Design*					X							
		EEM102	Mechatronic Engineering Practice					X					X		
		EEE105	Circuit Theory I	X	X										
		EEE123	Computer Programming for Engineers		X	X									X
	2	EUM114	Advanced Engineering Calculus	X	X										
		EEE125	Basic Circuit Lab			X						X	X	X	
		EEE130	Digital Electronic I	X	X										
		EMM102	Static*	X	X										
		EEM103	Electronic Devices & Analog Circuit	X	X										
2	1	EEE236	Complex Analysis		X		X								
		EEM242	Mechatronic Laboratory I			X					X	X	X		
		EEE228	Signal and System	X	X										
		EEM223	Thermofluids	X	X										
		EEM201	Principles and Mechanics of Materials	X	X										
	2	EEM253	Mechatronic Design I	X		X		X					X		
		EEE226	Microprocessor I			X					X	X			X
		EEK260	Electrical Machines	X	X	X									
		EEM222	Fundamentals of Dynamics & Mechanism	X	X	X									
3	1	EEM355	Mechatronic System	X	X										
		EEK361	Power Electronics	X	X	X		X							
		EEE350	Control System		X		X	X							
		EEE382	Probability & Engineering Statistics			X			X						
		EEM353	Mechanical Engineering Design	X	X	X						X			
	2	EEM323	Instrumentation & Measurement System	X	X	X	X								
		EEE354	Digital Control System		X		X	X							
		EUP222	Engineer in Society**						X		X				X
		EEM344	Mechatronic Laboratory II				X				X	X	X		
		EEM343	Robotics	X	X	X		X		X					
	SB	EEL303	Industrial Training						X			X		X	X
4	1	EEM441	Instrumentation & Control Laboratory			X	X	X			X	X	X		
		EEM427	Machine Vision	X		X		X							
		EEE433	Object Oriented Programming for Engineering Applicat	X		X				X					
		EEM420	Industrial Quality Control	X	X	X				X			X	X	
		EEM425	Mechatronic System Design			X			X	X		X	X	X	X
	2	EEM499	Undergraduate Project				X		X				X	X	X
Note: *Offered by School of Mechanical Engineering, **Offered by School of Civil Engineering															
Elective Courses															
3	1	EEE303	Data Communication & Networking				X	X							
		EEM349	Computational Intelligence	X	X			X							
		EEM354	Manufacturing Management & Technology		X	X	X								
	2	EEE349	Embedded System and IoT	X	X	X									
		EEM340	Autonomous System	X		X		X					X		
		EEM341	Design of Experiments		X	X	X							X	
4	1	EEM426	Big Data Analytics	X		X									
		EEM423	Reliability Engineering	X	X	X									
		EEE453	Control System Design			X		X							

3.0 COURSE DESCRIPTION

3.1 LEVEL 100

Codes	Courses	Synopsis
EEE105/3	Circuit Theory I	This course is teaching the fundamental of electric circuit and its analysis for DC and AC systems which comprises of topics such as Circuit Variables and Elements, Resistive Circuits, Techniques of Circuit Analysis, Inductance and Capacitance, First-Order Response of RL and RC Circuits, Sinusoidal Steady-State Analysis, AC Power Analysis and Three Phase Circuit.
EEE123/3	Computer Programming for Engineers	This course is fundamental not only to computer related subjects but also to other subjects that require complex calculations and computer simulations. It exposes students to the organization of personal computer, step-by-step procedures, programming terminologies and program commands that are required in solving engineering problems based on computer program using C++ programming language.
EEE125/3	Basic Circuit Laboratory	This course comprises of 15 experiments that will be conducted by the students. The experiments are on multimeter applications, the measurement of voltage, current and resistance in a dc circuit, oscilloscope and function generator, transformer, capacitor, inductor and power measurement in ac circuits, superposition, Thevenin and Norton theorems, diode in series and parallel configuration, to analyze and study the characteristic of BJT.
EMD111/2	Engineering Drawing & Computer Aided Design	This course prepares the student with a better understanding on the fundamental concept and standard of engineering drawings, and also to develop the skill in producing technical sketching and drawing. The scope covers the standards and principal techniques to produce technical drawing on paper using drawing instruments. The techniques involve such as geometric construction, freehand sketching, orthographic projection, sectional views, machine and working drawings. It is also implementing the computer aided design (CAD) applications to prepare engineering drawing from three dimensional parts and assemblies.
EEE130/3	Digital Electronic I	This course covers digital electronic systems, major logic devices and combination and sequential logic circuits.
EEM103/4	Electronic Devices & Analog Circuit	This course provides introduction on semiconductor material and p-n junction, diode and its application, operation and biasing techniques for Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET) as well as introduces the analysis of single and multi stage amplifiers.
EEM102/2	Mechatronic Engineering Practice	This course is divided to two major components: Electrical/Electronic and Mechanical components. The components are on the skill and technique on how to use PSpice and ORCAD software in simulation and design the electrical and electronic circuitry, fabrication technique for Printed Circuit Board (PCB), basic electrical wiring and mechanical engineering practice skill such as welding, measurement, lathe and milling.
EMM102/3	Static	This course is an introductory to engineering mechanics where the Laws of Mechanics are applied to calculate and predict forces and motions of machines and structures. The course is the key prerequisite to sequences of courses dealing with mechanics of machines, stress analysis and design of mechanical systems. The students will learn the concept and notation of forces and moments, free body diagram, equilibrium of a particle, force system resultant, equilibrium of rigid body, structural analysis, dry friction, centre of gravity, centroid, second moment of area and mechanical properties of materials.

Codes	Courses	Synopsis
EUM113/3	Engineering Calculus	This course reviews the topics on calculus of one and multivariable. It also covers the solutions of first and second order ordinary differential equation analytically and numerically.
EUM114/3	Advanced Engineering Calculus	This course covers the topics on linear algebra, Fourier series, partial differential equations, and vector calculus. Numerical techniques for solving systems of linear equations and partial differential equations are also given.

3.2 LEVEL 200

Codes	Courses	Synopsis
EEM201/3	Principles of Mechanics of Materials	This course reviews the topics on atomic structures, material characteristic, plastic and elastic behavior and phase diagram. The concept of shear and moment diagram and their relationship with stress and deflection.
EEE226/3	Microprocessor I	Introducing fundamental architecture and programming of microprocessor and microcontroller. That understanding can be used to build a simple application using the microprocessor and microcontroller.
EEE228/3	Signal and System	This subject gives exposure to students to learn the fundamental of signals and systems from mathematical modeling, analyses methods of analog and digital systems, sampling and modulation processes. In addition, this course also covers the knowledge, analysis and the applications of Fourier systems and Z transform.
EEE236/2	Complex Analysis	This course reviews the topics on complex number, complex function, analytic function, complex differentiation and integration, series expansion and Residue Theorem, as well as complex conformal mapping.
EEK260/3	Electrical Machines	This course covers the topics of magnetic circuit fundamental, transformer, dc generator, dc motor, three-phase synchronous motor, three-phase synchronous generator, three-phase and single-phase induction motors.
EEM222/4	Fundamentals of Dynamics and Mechanisms	Introduction to dynamics, particle kinematics, particle kinetics, rigid body kinematics, plane rigid body movement – force and acceleration, energy and momentum methods, 3D rigid body kinetics, balancing on rotation mass, gear systems – gear tooth and gear networks, crank system and follower, mechanism – kinematics diagram, movement ability, position, velocity and acceleration analysis.
EEM223/3	Thermofluids	This course is intended to encompass the knowledge of thermodynamics and fluid mechanics principles. The students will be given an introductory course of both principles such as laws in thermodynamics and static/dynamic in fluid mechanics. The knowledge of grounding principles will provide students with ability to understand how the concepts of thermodynamics theory can be used on human made machine.
EEM242/2	Mechatronic Laboratory I	This course is divided into three parts which are experiments related to digital electronic, experiments related to analog electronic and experiments using FPGA applications.
EEM253/2	Mechatronic Design I	The purpose of this course is to give exposure to the student theory of mechatronic system design and experimental implementations. Student will design a mechatronic system using fundamental knowledge such as programmable logic controller, sensors and actuators, computer simulation of mechatronic systems, and computer-aided mechatronic design.

EUP222/3	Engineer in Society	This course provides an introduction to the fundamental principles on project and financial management, ethics and laws related to environment and Occupational Safety and Health Act (OSHA), professional practice as well as the 10 commandments of project management. Problem solving through success or failure of actual case studies are reviewed

3.3 LEVEL 300

Codes	Courses	Synopsis
EEE350/3	Control Systems	The purpose of this course is to expose the students to transfer functions and mathematical model of physical systems. In addition, students will be exposed to knowledge on dynamics of open- and closed-loop systems in time and frequency domain, analysis techniques and feedback properties.
EEE354/3	Digital Control System	This course teaches techniques to analyze and design of digital control systems.
EEE382/3	Probability & Engineering Statistics	This course reviews the topics on probability, discrete, continuous and bivariate probability distributions, confidence interval and hypothesis for mean and the difference between two population means, simple and multiple linear regressions, non-linear regression and non-parametric statistics.
EEK361/3	Power Electronics	This course is offered to provide sound knowledge on the power electronics circuits and devices. The course explains in detail the ideal and practical characteristics of the power diode, thyristor and transistors. Power electronics circuits such as controlled and uncontrolled rectifier, dc-dc converter and ac voltage controller will be covered. Practical design consideration for power electronics circuits such as current and voltage protection and thermal protection will also be explained.
EEM323/3	Instrumentation and Measurement Systems	This course reviews the topics on measuring devices, data acquisition and interfacing.
EEE303/4	Data Communication & Networking	This course offers students to learn the concepts of data communications, data-link layer protocols, MAC layer protocols and network topologies.
EEM343/3	Robotics	Overview of robots and specifically, industrial robotic arm. Robot kinematics and dynamics covering the forward and inverse approaches, and Jacobian Matrices. Trajectory Planning and General Control and Sensing modules used by Industrial Robotic Arm.
EEM344/2	Mechatronic Laboratory II	Students will conduct experiments in the laboratory as follows: 1. Mechatronic Laboratory (Experiments on sensors, actuators and signal conditioning) 2. Power Laboratory (experiments on direct current motor and alternating current motor) 3. Thermofluids Laboratory (Experiments on fluid mechanics)
EEM349/4	Computational Intelligence	This course involves four main areas in Computational Intelligence, which are Machine Learning, Artificial Neural Network, Artificial Swarm Intelligence and Fuzzy Systems.
EEM353/3	Mechanical Engineering Design	Students are exposed to design, analysis and selection of mechanical subsystem and element such as mechanical linkages, cam, gear, bearing, power transmission component and lubrication. Students are exposed to design activities, processes and techniques of simple industrial machinery or product.

EEM354/4	Manufacturing Management and Technology	The coverage of this course starts with some general topics regarding manufacturing such as what manufacturing is and what processes and systems are used to accomplish it. This course then covers special processes that are used in manufacturing as well as the manufacturing support systems for planning and controlling production operations.
EEM355/3	Mechatronic System	This course reviews the topics on basic mechatronic system and drive system.
EEL303/5	Industrial Training	Industrial attachments give early exposure for students on the life as engineers according to their chosen disciplines. The course primary mission is to allow the students to apply what they learned in the university as well as to gain knowledge on new and upcoming technologies.
EEM341/4	Design of Experiments	This course covers the introduction to basic principles and strategies of experimentation, simple comparative experiments, randomized design, paired comparison design, experiments for comparing several treatment, random effects model, fixed effect model, completely randomize design, randomized complete block design, multi-factor experiments, two-factor factorial designs, general factorial designs, two-level factorial designs.
EEM340/4	Autonomous System	In this course, the student will be introduced to autonomous robotics system including robot features, sensors, application areas and current research into autonomous robotics. Among the topics which will be covered are robotic hardware systems, kinematics and inverse kinematics, sensors, sensor data interpretation and sensor fusion, path planning, configuration spaces, position estimation, intelligent systems, spatial mapping, human-robot Interaction basics, HRI experimentation design, intelligent interaction, multi-agent systems and applications. Robot Operating System (ROS) software will also be used to do the autonomous robotic application simulation.
EEE349/4	Embedded System and IoT	This course is about designing and developing embedded systems and Internet of Things (IoT). It focuses on embedded platform architecture including platform overview, memory technology, device interface and device interconnect. In device interconnect, Inter-Integrated Circuit, Serial Peripheral interface, Audio Buses, Inter IC Sound and Universal Asynchronous Receiver/transmitter (UART) will be covered. This course also focuses on the existing applications of the IoT. Data from sensors will be processed and displayed by using IoT technology. Standards, protocols and application for IoT will be introduced. Access to the IoT via internet Gateways will be studied. Practical exposure to embedded system and IoT devices and software will be provided via lab assignments and mini-project.

3.4 LEVEL 400

Codes	Courses	Synopsis
EEE433/3	Object Oriented Programming for Engineering Applications	This course encompasses object-oriented programming concepts involved in C++ programming language. The learned concepts will be applied to solve engineering problems
EEE453/4	Control Systems Design	This course covers the basic concepts of control systems, state-space variables, and state-space modelling of dynamical systems. It also covers design and analysis of control systems using state-space method, system identification, optimal control, and advanced control techniques.
EEM420/3	Quality Technique	This course encompasses the use of modern quality techniques and to achieve continuous quality improvements of a product or process for the case of manufacturing industries. The knowledge and skills gained can be applied in the

		various types of manufacturing industries for solving quality-related problems systematically and on the basis of sound data analysis.
EEM427/3	Machine Vision	This course introduces basic concepts of machine vision systems in industry. The students will learn how to design automated system after understanding the fundamental concepts. Students are exposed to the basic image processing techniques and hardware requirement for automated inspection system.
EEM423/4	Reliability Engineering	This course introduces basic concepts of reliability engineering; Concepts of probability and basic statistics; Lifetime modelling; Model fitting; Model selection; Reliability of systems; Statistical experiments; Reliability in design; Reliability in manufacturing; Reliability tests.
EEM425/3	Mechatronic System Design	The course comprises solving complex engineering problem by designing viable solutions that integrates components in core areas of Mechatronic Engineering and meeting specific needs with appropriate considerations such as sustainability, public health and safety, society, cultural and environment issues.
EEM441/2	Instrumentation and Control Laboratory	This course is divided into two parts – (i) Instrumentation and (ii) Control. The first part emphasis on sensing, interfacing and designing detection and signal conditioning circuits. Meanwhile the second part focuses on FPGA programming for measurement and control of an instrumentation system. Students will undergo laboratory training to enhance teaching and learning of two main courses EEM323/3 Instrumentation and Measurements Systems, and EEE350/3 Control System which are taught in theory. Laboratory exercises will provide information and build a clear understanding of the practical aspects related to the theory they have learned in EEM323 and EEE350.
EEM499/6	Undergraduate Project	A small-scale research project will be undertaken by every final year student. The aim is to train the student to identify some problems related to mechatronic engineering and introducing them with the techniques of investigation, solving problems, writing a technical report and presentation of the results in the form of thesis and seminar.
EEM426/4	Big Data Analytics	The course includes fundamental technologies in big data storage and processing and also techniques to generate predictive models in big data applications. The course provides exposures on the application of Apache Spark and Python to manage and analyze big data for predictive analytics.


USM
UNIVERSITI
SAINS
MALAYSIA
APEX