SCHOOL OF AEROSPACE ENGINEERING

UNIVERSITI SAINS MALAYSIA

2025/2026

SCHOOL OF AEROSPACE ENGINEERING

BACHELOR OF AEROSPACE ENGINEERING WITH HONOURS

KAMI MEMIMPIN

Transforming Higher Education
for a Sustainable Tomorrow

2025/2026

https://www.usm.my

Bachelor of Aerospace Engineering with Honours

2025/2026 Academic Session

USM Vision

Transforming Higher Education for a Sustainable Tomorrow

USM Mission

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

CONTENTS **PAGE**

1.0 INTRODUCTION

This Engineering Handbook is specially prepared for the undergraduate engineering students of Universiti Sains Malaysia who will commence their first-year studies in the academic year of 2024/2025.This handbook contains concise information that is useful in helping students to understand the university's system of study as well as to adopt oneself to university life.

Information in this handbook covers various aspects such as the programme structure of the Bachelor of Engineering degree, the academic system, types of courses, synopsis of the courses, student status, examination and evaluation system, information about the engineering schools, reference materials and academic staff list. This information would give a clear picture to the students to plan their academic studies, understand the field of studies and adapt themselves to the teaching and learning environment of the university.

Universiti Sains Malaysia offers Bachelor of Engineering with Honours programmes through its six schools of engineering:

- School of Aerospace Engineering
- School of Chemical Engineering
- School of Civil Engineering
- School of Electrical and Electronic Engineering
- School of Materials and Mineral Resources Engineering
- School of Mechanical Engineering

1.1 History and Development

In 1972, Universiti Sains Malaysia established the School of Applied Science at the Main Campus in Penang and offered basic fields of engineering studies. The fields of studies offered at the time were Electronic Technology, Polymer Technology, Food Technology, Materials Technology and Mineral Resources Technology.

In 1984, the School of Applied Science was restructured and given a new name, the School of Engineering Science and Industrial Technology. This restructuring, which corresponded to the development of Malaysia's Industrial Masterplan that is in turn related to the country's human utilization needs, gave birth to three new schools. They were the School of Industrial Technology which focused on offering studies in fields such as polymer and food technologies, the School of Electrical and Electronics Engineering and the School of Materials and Mineral Resources Engineering.

The expansion that took place required an increase in the physical space of the campus. Since the physical area of USM in Penang at the time was rather limited, a new area in the state of Perak was identified as the site for the development of a branch campus.

A decision was reached whereby all fields of engineering studies were transferred to Perak while the School of Industrial Technology remained in Penang. In 1986, the School of Electrical and Electronics Engineering and the School of Materials and Mineral Resources Engineering moved to a temporary campus at the old Ipoh Town Council building while waiting for the construction of the USM branch campus in Bandar Baru Seri Iskandar, Perak Tengah District, Perak to be completed. The temporary campus was named USM Perak Branch Campus (USMKCP – USM Kampus Cawangan Perak).

In 1987, construction began at the site of USM Perak Branch Campus in Bandar Baru Seri Iskandar. On 1st January 1989, the scope of engineering studies was expanded further with the establishment of two new schools of engineering: The School of Civil Engineering and the School of Mechanical Engineering.

By the end of November 1989, all four USM engineering schools began moving to USM Perak Branch Campus in Seri Iskandar in stages and the moving process finally ended in April 1990. The Ipoh Town Council building which housed USM's temporary campus was handed back to the Town Council in a glorious ceremony that was graced by the DYMM Seri Paduka Baginda Yang Dipertuan Agong, Sultan Azlan Shah.

In 1992, USM established its fifth engineering school, the School of Chemical Engineering. Two years later, efforts to offer studies in the field of Aerospace Engineering went underway. On 17th of May 1998, the USM Aerospace Engineering Unit was established and on the 1st of March 1999 the unit was upgraded to the School of Aerospace Engineering. Then, in 1997, the government decided to transfer USMKCP back to Penang. The new campus site was located in Seri Ampangan, Nibong Tebal, Seberang Perai Selatan, Penang while USMKCP's campus site in Seri Iskandar was taken over by the Universiti Teknologi Petronas (UTP).

The Engineering Campus moved in stages in 2001. USM's Engineering Campus in Seri Ampangan, Nibong Tebal began its operations in the 2001/2002 Academic Session in June 2001. In the same year, USM was appointed as one of the four research universities by the Ministry of Higher Education [MoHE] through a rigorous evaluation process thus elevating its status to the top among more than 100 public and private universities and colleges in Malaysia. In the same year, USM was rated as the only "excellent" (or 5-Star) university in the Academic Reputation Survey conducted by the Malaysian Qualification Agency (MQA).

On 4th of September 2008, USM was granted with an APEX (the Accelerated Programme for Excellence) status by the Malaysian's government. This status requires USM to transform its system in order to move up its World University Rankings with a target of top 100 in five years and top 50 by 2020. USM's transformation plan, entitled "Transforming Higher Education for a Sustainable Tomorrow" will embark on numerous transformational journeys,

including revamping most of its activities pertaining to nurturing and learning, research and innovation, services, students and alumni and the management of the university as a whole.

The University takes steps to improve the three core pillars of its strengths, [i] concentration of talent, [ii] resources and [iii] acculturation of supportive governance.

1.2 Philosophy and Objective

The philosophy and objective of the Bachelor of Engineering programme at the Universiti Sains Malaysia is to produce qualified engineering graduates in various fields who are able to find solutions to diverse problems through innovative thinking.

The engineering programme at USM aims to produce professional engineers who are responsible towards research and development, project management, production planning and control and accreditation of equipment in various fields in the country.

Thus, all courses that are being offered in the engineering programme blend together the theoretical and practical aspects of learning according to the relevant needs of the industrial public sectors. The fields of engineering studies in USM are up to date and challenging so as to fulfil the nation's industrial development needs. Students will also be equipped with fundamentals of business practice such as finance, marketing and management as well as co-curricular activities so that the students could adapt themselves well to the current state of affairs.

1.3 Outcome Based Education

All bachelor engineering programmes at the Universiti Sains Malaysia have adopted the Outcome Based Education (OBE) since the academic year of 2006/2007. The OBE emphasises that the professional attributes of the graduates satisfy the current and future needs of the country and global market in general. For this, the programme educational objectives of each programme offered at the Engineering Schools are developed through interviews and surveys from the stakeholders including industries, government, parents, students, alumni and the university lecturers. This signifies that the programmes offered in USM are relevance to the current need of industries and society and for the preparation of high-quality future talents.

With the agreed programme educational objectives, the curricular structure of each programme is planned accordingly to ensure that our graduate possess the quality attributes as suggested by the Engineering Accreditation Council (EAC) and Board of Engineer Malaysia (BEM) are achieved. The attributes are listed in Section 4.2.2.

1.4 Continuous Quality Improvement System

To realize the Outcome Based Education, a few mechanisms have been identified to be incorporated into the continuous quality improvement system for the Bachelor of Engineering programmes. Feedbacks are obtained from industries through the Industrial Advisory Panel which consist of at several engineers or managers from industrial sectors.

Feedbacks from the students are obtained from the Lecturer-Student Committee and interview session with each student before their convocation. Whereas feedbacks from the alumni are obtained from the USM Alumni Relations Unit and the School's alumni communities through email, webpage, social media and direct and indirect surveys. All these feedbacks are incorporated for deliberations and approval by the Curriculum Review Committee which convenes annually to identify any particular course or programme that need to be revamped or to undergo minor/major changes. Registration of courses is an important process during the period of study at the university. It is an important step for the students to enrol and enable the students to sit for the examination at the end of each semester. Signing up for the right courses each semester will help to facilitate the graduation of each student from the first semester till the final semester.

1.5 External Examiner

Universiti Sains Malaysia has appointed external examiners to:

- Advice the School/Centre concerned regarding matters pertaining to the structure and contents of its undergraduate programmes, research and administration related to examinations. Attention is also focused towards post-graduate programmes where applicable.
- Scrutinize and evaluate all draft question papers prepared by Internal Examiners.
- Visit the university during the period of the examinations in order to be familiar with the work of the school/center, the available physical facilities and also to participate in activities related directly to the conduct of the examinations. In order to make the visit more meaningful and to obtain a better understanding of the University, an External Examiner who has been appointed for a term of three academic sessions should visit the school/center during the first academic session of his appointment.
- Scrutinize and evaluate such answer scripts as may be required by the Dean/Director of the School/Centre concerned and to ensure that the standards set by Internal Examiners (of the discipline to which he/she is appointed) are the same as those at other Universities of International standing.
- Ensure uniformity in the evaluation of answer scripts by the Internal Examiners between candidates of the same standard.
- Examine the oral component or viva-voce where required.

- Hold seminars/meetings with the academic staff/students if required.

1.6 Industry Advisory Board

The engineering schools have set up an Industrial Advisory Board for all offered engineering programmes and various meetings have and will be conducted from time to time. Each school has appointed prominent members from the industry and relevant institutions to be in the Advisory Board. The Industrial Advisory Board members will discuss and give their input on the Industrial Training; Outcome Based Education (OBE) implementation, curriculum development, the requirement of soft skills and other relevant issues to the School to improve the quality of programmes and graduates.

1.7 Division of Industry and Community Network

To foster closer, effective, meaningful and sustainable linkages and partnership with the industry and the community, i.e. the world outside Universiti Sains Malaysia, a new division, the Division of Industry & Community Network was established within the Chancellery in September 2007. This new division is headed by a Deputy Vice Chancellor (Industry and Community Network). The function of this division is to match between the knowledge/expertise, facilities and resources of the university to the needs, aspirations and expectations of the industry and the community to result in a win-win situation.

1.8 Stakeholder

In line with the Engineering Accreditation Council (EAC) requirements for involvement of stakeholders in establishing the programme educational objectives, their inputs have been continuously gathered from surveys and direct communications. The University has identified the stakeholders as follows:

- Academic Staff (University)
- Employers (industry and government)
- Alumni
- Students
- Parents

1.9 Teaching Delivery Method

A variety of teaching and learning (delivery) modes, assessment and evaluation methods are designed, planned and incorporated within the curriculum to effectively develop a range of intellectual and practical skills, as well as positive attitudes. The assessments to evaluate the achievement of the Programme Outcomes by the students are done both at the programme as well as at course levels. The implemented teaching and learning methods enable students to take a full responsibility for their own learning and prepare themselves for lifelong learning and knowledge acquisition.

1.10 Courses 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 courses are compulsory courses that cover the fundamental and advanced elements of aerospace engineering. These group of courses include laboratory courses, Industrial Training (internships at relevant industries in Malaysia or abroad), and Final Year Projects (supervised research projects). These courses aim 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 who do not choose a Minor area are required to take Elective courses. These courses are advanced courses offered in the 3rd and 4th years of study that students can select from to offer in-depth knowledge and skills in selected areas of specialization. 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 including Co-curricular Courses. The students have to complete a small number of credits in these types of courses, offered to offer broad educational experience beyond the normal academic scopes.

University Requirements Courses

These courses are compulsory non-engineering courses aimed towards developing students with important skills, understanding, and appreciation in areas such as communication, social sciences, and entrepreneurship.

Please note that the medium of instruction for all science and engineering courses at USM is English. Exceptions to this policy are for non-English language courses and some university courses. For these university courses, the medium of instruction is in Bahasa Malaysia. Nonetheless, sessions taught in English are offered specifically for international students

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 fulfill 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.

1.11 Programme Structure

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

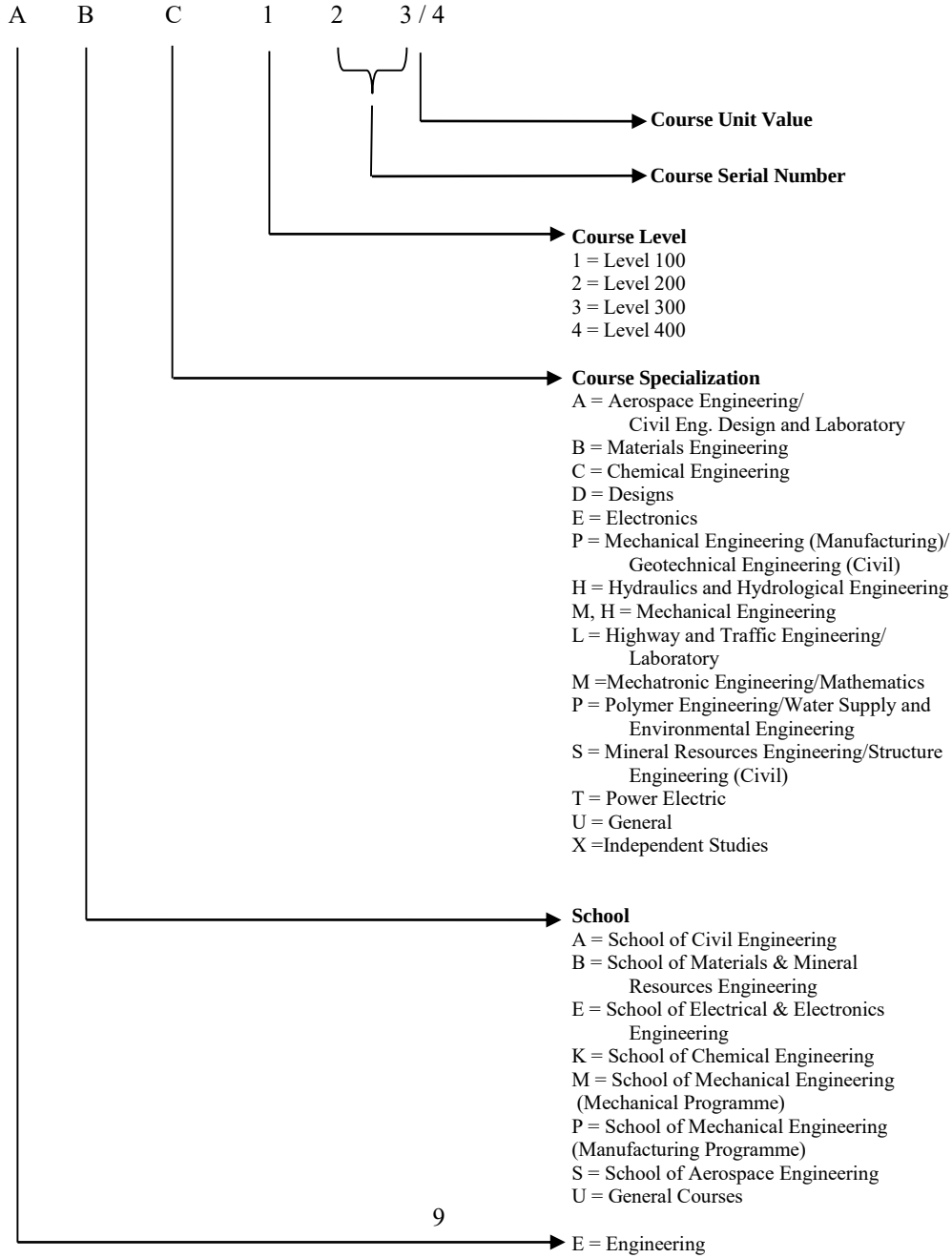
	Course	Units	Remarks
(i)	CORE	**108**	
(ii)	ELECTIVE	**12**	Students may select these courses from the list as determined by the respective school.
(iii)	UNIVERSITY REQUIREMENTS Compulsory (12 Units)	**15**	
	For local students		
	(a) Bahasa Malaysia IV(LKM400)	2	
	(b) English Language LSP300 &LSP404)	4	
	(c) Philosophy and Current Issues (HFF225)	2	
	(d) Appreciation of Ethnic & Civilization (HFE224)	2	
	(e) Entrepreneurship (WUS101)	2	
	For International students		
	(a) Bahasa Malaysia I (LKM100)	2	
	(b) English Language (LSP300 &LSP404)	4	
	(c) Philosophy and Current Issues (HFF225)	2	
	(d) Malaysian Studies (SEA205e)	4	
	Optional Course (3 Units)		
	(a) Co-curriculum/Optional/Skills.	3	
	TOTAL UNITS	**135**	

Note:

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

1.12 Course code

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



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 familiarize 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 ten (10) weeks during the long break after

Semester II at level 300 and must be conducted before the final semester. This is a five (5) credits course, and students will be awarded a Pass/Fail grade upon completion. It can be fulfilled in two (2) approaches: the conventional and/or Work Based Learning (WBL). The training shall be adequately structured, supervised and recorded in logbooks/report. During the industrial training, the students will be exposed not only the knowledge but also a real working experience and environment of the actual operations of industries.

2.0 ACADEMIC SYSTEM AND GENERAL INFORMATION

2.1 Course Registration Activity

Registration of courses is an important activity during the period of study at the university. It is the first step for the students to sit for the examination at the end of each semester. Signing up for the right courses each semester will help to facilitate the graduation process based on the stipulated duration of study.

2.1.1 Course Registration Secretariat for the Bachelor's Degree and Diploma Programmes

Student Data and Records Unit
Academic Management Division
Registry
Level 1, Chancellory Building

Tel. No.	:	04-653 2925/2924
E-Mail	:	sdrp@usm.my
Website	:	http://bpa.usm.my/index.php

2.1.2 Course Registration Platform

1. E-Registration

E-Registration is a platform for online course registration. The registration is done directly through https://campusonline.usm.my**.** Course registration for both semesters begins after the release of the official examination results of each semester.

The online registration for Long Vacation Semester (KSCP) begins officially after the release of the 2nd semester examination result.

The date of the E-Registration will be announced to the students via CampusOnline during the revision week of every semester and details of the activity will be displayed in the USM's official website.

All courses are allowed to be registered through E-Registration, except for co-curriculum courses. The registration of co-curriculum courses is managed by the Director of the Centre for Co-Curriculum Programme at the Main Campus or the Coordinator of the Co-Curriculum Programme at the Engineering Campus and the Coordinator of the Co-Curriculum Programme at the Health Campus.

Students are required to preregister their co-curriculum courses before the actual E-Registration activity. They are allowed to follow the respective course once the preregistration is approved. The list of the co-curriculum courses taken will be included in their course registration data.

Access to *E-Daftar* System

a. *E-Daftar* System can be accessed through the Campus Online portal **(https://campusonline.usm.my)**.

b. Students need to use their USM Identity to access the profile website that contains the E-Daftar menu.

c. Students can print the course registration confirmation slip upon completion of the registration process or after updating the course registration list (add/ drop) within the *E-Daftar* period.

2. Course Registration Activity at the School

Registration activities conducted at the Schools/Centres are applicable to students who are academically active and under Probation (P1/P2) status. Students who encounter difficulties in registering their courses during the E-Registration period are allowed to register the courses at their respective school/centre during the official period of course registration.

The official period for registration is as follows:

Period	Description	Notes
1st week to 3rd week	Course registration at the School/Centre level	No penalty is imposed.
4th to 6th week	Course registration at the Student Records Unit	For each late registration, students will be assessed a fine of RM50 unless a fine exemption is granted.
Week 7 onward	Course registration at the Examination and Graduation Unit level	

2.1.3 Course Registration General Information

1. Information that students can access related to the registration activity:

   a. The website of the respective School, for the updated information of the courses offered or course registration procedure.

   b. List of the courses to be registered and number of units (unit value) for each course (refer to Students Handbook for Study Programme).

Academic Status	PNG	Minimum Units	Maximum Units
Active	2.00 & Above	9	20
P1	1.99 & Below	9	12
P2		9	10

   c. Students with arrears are not allowed to register any courses. You may only register courses after paying off your arrears.

2. Type of course codes during registration:

   T = Core courses
   E = Elective/ Open Elective courses
   U = University courses
   } Grade and number of units obtained from these courses are considered for graduation

   Two (2) other course codes are:

   Y = audit courses
   Z = prerequisite courses
   } Grade and number of units obtained are not considered for graduation

3. Academic Advisor's advice and approval are necessary.

4. Students are not allowed to register or repeat any course with grade 'C' and above.

5. Medical, Dentistry and Pharmacy students are not allowed to register or resit any course with grade 'B-' and above.

2.1.4 Information/Document Given to All Students through Campus Online Portal (https://campusonline.usm.my)

1. The information of the Academic Advisor.

2. Academic information such as academic status, GPA value, CGPA value and year of study.

3. Cangred and Course Registration Form.

4. List of courses offered by all Schools/Centres.

5. Teaching and Learning Timetable for all Schools/Centres/Units from the three campuses.

6. List of pre-registered courses which have been added into the students' course registration record (if any).

7. Reminders about the University course registration policies/general requisites.

2.1.5 Registration of Language and Co-Curricular Courses

1. Registration of Language courses through *E-Daftar* is allowed.

   a. However, if any problem arises, registration for language courses can still be carried out/updated during the official period of OCR at the office of the School of Languages, Literacies and Translation.

   b. All approval/registration/dropping/adding of language courses is under the responsibility and administration of the School of Languages, Literacies and Translation.

   c. Any problems related to the registration of language courses can be referred to the School of Languages, Literacies and Translation. The contact details are as follows:

General Office	: 04-653 4542	for Main Campus students
Malay Language Programme Chairperson	: 04-653 4214	
English Language Programme Chairperson	: 04-653 3153	
Foreign Language Programme Chairperson	: 04-653 3150	
Engineering Campus Programme Chairperson	: 04-599 5400/5430	
	: 04-599 5402/5407	
Health Campus Programme Chairperson	: 09-767 1262	

2. Registration of **co-curricular courses through *E-Daftar*** is not allowed.

   a. Registration for co-curricular courses is either done through pre-registration before the semester begins or during the

first/second week of the semester. Co-curricular courses will be included in the students' course registration account prior to the *E-Daftar* activity if their pre-registration application is successful.

b. All approval/registration/dropping/adding of co-curricular courses is under the responsibility and administration of:

Director of the Centre for Co-Curricular Programme, Main Campus (04-653 5242/5248)

Deputy Director of the Centre for Co-Curricular Programme, Engineering Campus (04-599 5097/5094)

Deputy Director of the Centre for Co-Curricular Programme, Health Campus (09-767 2371/6625)

3. **Dropping of Language and Co-Curricular courses, if necessary, must be made within the first week**. After the first week, a fine of RM50.00 will be imposed for each course.

2.1.6 Registration of 'Audit' Courses (Y code)

Registration for the 'Audit' course (Y code) **is not allowed on the *E-Daftar***. It can be done during the official period of OCR at the School or Centre involved.

Students who are interested must complete the course registration form which can be printed from the Campus Online Portal or obtained directly from the School. Approval from the lecturers of the courses and the Dean/ Deputy Dean (Academic) of the respective school is required.

Registration of 'Audit' courses (Y code) is not included in the calculation of the total registered workload units. Grades obtained from 'Audit' courses are not considered in the calculation of CGPA and total units for graduation.

2.1.7 Registration of Prerequisite Courses (Z code)

Registration of Prerequisite courses (Z code) is included in the total registered workload (units). Grades obtained from the Prerequisite courses are not considered in the calculation of CGPA and units for graduation.

2.1.8 Late Course Registration and Late Course Addition

Late course registration and addition are only allowed during the first and up to the third week with approval from the Dean. Application to add a course after the third week will not be considered, except for special cases approved by the University. A RM50.00 fine will be imposed on students if reasons given for late registration are not accepted by the University or School.

2.1.9 Dropping of Courses

Dropping of courses is allowed until the **end of the sixth week**.

For this purpose, students must meet the requirements set by the University as follows:

1. Students who intend to drop any course are required to fill in the dropping of course form. The form needs to be signed by the lecturer of the course involved and the Dean/Deputy Dean (Academic, Career International Affairs) of the School. The form has to be submitted to the general office of the School/Centre which offers that particular course.

2. Students who wish to drop language courses must obtain the signature and stamp of the Dean/Deputy Dean (Academic, Career and International Affairs) of the School of Languages, Literacies and Translation.

3. Students who wish to drop the Co-Curricular courses must obtain the approval of the Director/Coordinator of the Co-Curricular Programme.

4. The option to drop courses must not be misused. Lecturers have the right not to approve the course that the student wishes to drop if the student is not serious, such as poor attendance record at lectures, tutorials and practical, as well as poor performance in coursework. The student will be barred from sitting for the examination and will be given grade 'X' and is not allowed to repeat the course during the *Courses during the Long Vacation* (KSCP) period.

2.1.10 Course Registration Confirmation Slip

The course registration confirmation slip printed/obtained after course registration should be checked carefully to ensure there are no errors, especially the code type of the registered courses.

Any data errors for course registration must be corrected immediately whether during the period of *E-Daftar* (for students with active status only) or during the registration period at the Schools.

2.1.11 Revising and Updating Data/Information/ of Students' Personal and Academic Records

Students may check their personal and academic information through the Campus Online portal.

Students are advised to regularly check the information displayed on this website.

1. Students may update their correspondence address, telephone number and personal email through the Campus Online portal.

2. Students must notify the Student Data and Records Unit of any application to update personal data, such as the **spelling of names, identification card number, passport number and address (permanent address and correspondence address).**

3. The office of the Student Data and Records Unit must be notified of any application for correction of academic data such as information on major, minor, MUET result and the course code (besides data on the examination results).

2.1.12 Academic Advisor

Each School will appoint an Academic Advisor for every student. Academic Advisors will advise their students under their responsibility on academic matters.

2.2 Interpretation of Unit/Credit/Course

2.2.1 Unit

Each course is given a value, which is called a **UNIT**. The unit is determined by the scope of its syllabus and the workload for the students. In general, a unit is defined as follows:

Type of Course	Definition of Unit
Theory	1 unit is equivalent to 1 contact hour per week for 13 – 14 weeks in one semester
Practical/Laboratory/ Language Proficiency	1 unit is equivalent to 1.5 contact hours per week for 13 – 14 hours in one semester
Industrial Training/ Teaching Practice	1 unit is equivalent to 2 weeks of training

Based on the requirements of Malaysian Qualifications Framework (MQF):

One unit is equivalent to 40 hours of student learning time

[1 unit = 40 hours of Student Learning Time (SLT)]

2.2.2 Accumulated Credit Unit

Units registered and passed are known as credits. To graduate, students must accumulate the total number of credits stipulated for the programme concerned.

2.3 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. The examination can be held face to face or online.

2.3.1 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

2.3.2 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.

2.3.3 Examination Special Needs

Students with Disabilities (OKU) who require special needs while sitting for exams can inform the School to get special permission to sit for exams in the Quarantine Room at the Examination Operations Office.

If a student falls ill during the exam, the student is only allowed to continue the exam in the exam hall or quarantine room or Pusat Sejahtera (subject to the approval of the Pusat Sejahtera Director).

Students who fall ill on the day of the exam and do not attend the exam must submit a medical certificate (from a government hospital/clinic or panel clinic/USM clinic) to the exam secretariat via email exam@usm.my within 48 hours after the end of the examination.

2.3.4 Grade Point Average System

Students' academic achievement for registered 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

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

	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

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

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

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.

2.3.5 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>

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

2. 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

3. 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.

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

2.3.6 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 for academic status.

2.3.7 Penalty for not attending the examination

Students who do not attend the examination for any of the courses they have registered for must provide Medical Certificates to the Principal Assistant Registrar, Examination and Graduation Unit, Academic Management Division by email exam@usm.my within 48 hours (for full-time students) and 7 days (for Distance Learning Education programme students) after the examination being held. The reasons provided will be considered by the Examination Board of the School/Centre and endorsed by the University Examination Board as below:

1. Students will be granted a DK grade (with permission) for accepted reasons by the University Examination Board. DK grade will be granted to the students who submit Medical Certificates (from hospital/government clinic or panel clinic/USM clinic) or submit any reason that can be accepted by the University Examination Board. DK grade will be exempted from the GPA/CGPA calculations of the student.

2. Candidates who fail to sit for the examination without any reason will be granted an F* grade.

2.3.8 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.

2.3.9 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 one month after the final examination.

Students can print the official semester results document through the Campus Online portal (campusonline.usm.my) on the same day of the results announcement.

Examination results for students with outstanding debts will be withheld until the student clears the outstanding debts.

2.3.10 Re-checking of Examination Result

Students can apply for the rechecking of their examination result for the course(s) taken during the semester. The application form can be obtained from BPA official website. The appeal form must be submitted along with a copy of the official receipt / e-payment statement amounting to RM25.00 for each examination paper. The appeal period is two (2) weeks after the official result is announced.

The rechecking process is only to ensure that all answers in the scripts have been marked and consistently graded and the calculation of marks awarded are correct. The answer script of the course will not be reevaluated.

The school will confirm any changes in the students' examination results. If there are any changes in the grades, students may request a refund of RM25.00. The Examination and Graduation Unit will make amendments to the results of the course and students can check their updated status in the respective Campus Online portals.

2.4 Unit Exemption

2.4.1 Unit Exemption

Unit exemption is defined as the total number of units given to students who are pursuing their studies in USM that are exempted from the graduation requirements. Students only need to accumulate the remaining units for graduation purposes. Only passes or course grades accumulated or acquired in USM will be included in the calculation of the Cumulative Grade Point Average (CGPA) for graduation purposes.

2.4.2 Regulations and Implementation of Unit Exemption

1. Diploma holders from recognised Public and Private Institutions of Higher Learning:

   a. Unit exemption may only be granted for courses taken at diploma level including courses under the General Studies Component (MPU) such as Philosophy and Current Issues and Appreciation of Ethics and Civilisations.

      However, unit exemptions are not permitted for Language courses under the U1 Group of the General Studies Component (MPU).

   b. Courses for unit exemption may be combined (in two or more combinations) in order to obtain exemption of one course at degree level. However, if the School would like to approve only one course at the diploma level for unit exemption of one course at degree level, the course at diploma level must be equivalent to the degree course and have the same number of or more units.

   c. Courses taken during employment (in-service) for diploma holders cannot be considered for unit exemption.

   d. The minimum achievement at the diploma level that can be considered for unit exemption is a minimum grade 'C' or 2.0 or equivalent.

   e. The total number of semesters exempted should not exceed two semesters.

   f. **To obtain exemption unit for industrial training**, a student must have continuous work experience for at least two years

in the area. If a student has undergone industrial training during the period of diploma-level study, the student must have work experience for at least one year.

The students are also required to produce a report on the level and type of work performed. Industrial training unit exemption cannot be considered for semester exemption as the industrial training is carried out during the long vacation in USM.

2. USM Supervised IPTS (Private Institutions of Higher Learning) /External Diploma Graduates:

   a. Students from USM supervised IPTS/External Diploma graduates are given unit exemption as stipulated by the specific programme of study. **Normally, unit exemption in this category is given as a block according to the agreement** between USM (through the School that offers the programme) with the IPTS.

   b. **Students from recognised local or foreign IPTA** (Public Institutions of Higher Learning)/IPTS who are studying at the Bachelor's Degree level may apply to study in this university and if successful, may be considered for unit exemption, subject to the following conditions:

      [1] Courses taken in the previous IPT are equivalent (at least 80% of the course must be the same) to the courses offered in USM.

      [2] Students taking courses at the Advanced Diploma level in IPT that are recognised to be equivalent to the Bachelor's Degree course in USM may be considered for unit exemption as in Section 2.5.

      [3] The total maximum unit exemption allowed should not exceed 30% of the total unit requirement for graduation.

2.4.3 Total Number of Exempted Semesters

Semester exemption is based on the total units exempted as below:

Total Units Exempted	Total Semesters Exempted
8 and below	None
9 – 32	1
33 to 1/3 of the total units for graduation	2

2.4.4 Application Procedure for Unit Exemption

Any student who would like to apply for unit exemption is required to complete the Unit Exemption Application Form which can be obtained from the Examination and Graduation Section or the respective Schools.

The form must be approved by the Dean of the School prior to submission to the Examination and Graduation Section for consideration and approval.

2.5 Credit Transfer

Credit transfer is defined as the recognition of the total number of credits obtained by USM students taking courses in other IPTAs (Public Institution of Higher Learning) within the period of study at USM and is combined with credits obtained at USM to fulfil the unit requirements for his/her programme of study. The transferred examination results or grades obtained in courses taken at other IPTAs will be taken into consideration in the Cumulative Grade Point Average (CGPA) calculation.

1. <u>Category of Students Who Can Be Considered for Credit Transfer</u>

USM full-time Bachelor Degree level students who would like to attend specific Bachelor Degree level courses at other IPTAs.

USM full-time diploma level students who would like to attend specific diploma level courses at other IPTAs.

2. Specific Conditions

a. Basic and Core Courses

Credit transfer can only be considered for credits obtained from other courses in other IPTAs that are equivalent (at least 80% of the content is the same) with the courses offered by the programme.

Courses that can be transferred are only courses that have the same number of units or more. For equivalent courses but with less number of units, credit transfers can be approved by combining a few courses. Credits transferred are the same as the course units offered in USM. The average grade of the combined courses will be taken into account in the CGPA calculation.

b. Elective or Option Courses

Students may take any appropriate courses in other IPTAs subject to permission from the School as well as the approval of the IPTAs.

The transferred credits are credits obtained from courses at other IPTAs. No course equivalence condition is required.

c. Minor Courses

For credit transfer of minor courses, the School should adhere to either condition (i) or (ii), and take into account the programme requirement.

3. General Conditions

a. The total maximum units transferred should not exceed one-third of the total number of units for the programme.

b. Credit transfer from other IPTAs can be considered only once for each IPTA.

c. The examination results obtained by a student who has taken courses at other IPTAs will be taken into account for graduation purposes. Grades obtained for each course will be combined with the grades obtained at USM for CGPA calculation.

d. Students who have applied and are approved for credit transfer are not allowed to cancel the approval after the examination result is obtained.

e. Students are required to register for courses at other IPTAs with not less than the total minimum units as well as not exceeding the maximum units as stipulated in their programme of study. However, for specific cases (e.g. students on an extended semester and only require a few units for graduation), the Dean may allow such students to register less than the minimum units and the semester will not be considered for the residential requirement. In this case, the CGPA calculation will be similar to that requirement of the KSCP.

f. USM students attending courses at other IPTAs who fail any course will be allowed to re-sit the examinations of the courses if there is such a provision in that IPTA.

g. If the method of calculation of examination marks in the other IPTAs is not the same as in USM, grade conversions will be carried out according to the existing scales.

h. USM students who have registered for courses at other IPTAs but have decided to return to study in USM must adhere to the existing course registration conditions of USM.

2.5.1 Application Procedure for Attending Courses/Credit Transfer

USM students who would like to apply to attend courses/credit transfer at other IPTAs should apply using the Credit Transfer Application Form.

The application form should be submitted for the Dean's approval for the programme of study at least three months before the application is submitted to other IPTAs for consideration.

2.6 Academic Integrity

"Integrity without knowledge is weak and useless. Knowledge without integrity is dangerous and dreadful." - Samuel Johnson

Academic honesty is important because it is the main pillar in ensuring that manners and ethics with regards to higher education integrity are preserved.

Universiti Sains Malaysia encourages its students to respect and ensure that any matter relating to academic integrity are well-preserved. Universiti Sains Malaysia always encourages its students to ensure that manners, ethics and integrity would be essential in academics while focusing on their studies in Universiti Sains Malaysia.

The following are practices or acts that are considered as conducts of lack of integrity in academics:

1. Cheating

Cheating in the academic context includes copying during examination, usage of information without authorization or in a dishonest manner. There are numerous ways and methods of cheating which include among others:

a. Copying answers from others during tests or exams.

b. Any suspicious action that can be described as cheating or an attempt to cheat in an exam.

c. Using unauthorized materials or devices without authorization such as hand-written notes or any smart electronic device during test or exam.

d. Asking or allowing another student to take a test or exam on behalf and vice-versa.

e. Sharing answers in assignments or projects.

f. Purposely tampering with the marks/grade given in any course work, and then re-submit it for remarking/regrading.

g. Give the command, to force, persuade, deceive or threaten others to conduct research, writing, programming or any task for a student's personal gain.

h. Submitting any identical or similar work in more than one course without consulting or prior permission from the lecturers concerned.

2. Plagiarism

The reputation of an academic institution depends on the ability to achieve and sustain academic excellence through the exercise of academic integrity. Academic integrity is based on honesty, trust, fairness, respect, and responsibility, which form the basis of academic work.

One aspect of the loss of academic integrity is due to plagiarism, which is the act of presenting published and unpublished ideas, writings, works or inventions of others in written or other medium, as one's own original intellectual endeavours without any clear acknowledgement of or reference to the author of the source.

POLICY ON PLAGIARISM OF UNIVERSITI SAINS MALAYSIA

University Sains Malaysia Policy on Plagiarism describes the University's strong commitment to uphold academic integrity in relation to plagiarism. It will come into effect when there is an infringement of academic conduct relating to plagiarism.

This policy acts as a guideline to educate and prevent plagiarism and can be used as the guideline if the University's staff and students violate any rules and regulations of the University.

The policy applies to all students, former students, staff and former staff which include fellows, post-doctorates, visiting scholars, as well as academic, non-academic, research, contract and temporary staff who study, serve or have served, or have graduated from the University.

Plagiarism is defined as the act of presenting, quoting, copying, paraphrasing or passing off of ideas, images, processes, works, data, own words or those of other people or sources without proper acknowledgement, reference or quotation of the original source(s). The acts of plagiarism include, but are not limited to, the following:

a. Quoting verbatim (word-for-word replication of) works of other people.

b. Paraphrasing another person's work by changing some of the words, or the order of the words, without due acknowledgement of the source(s).

c. Submitting another person's work in whole or part as one's own.

d. Auto-plagiarising or self-plagiarising (one's own work or previous work) that has already been submitted for assessment or for any other academic award and pass it as a new creation without citing the original content.

e. Insufficient or misleading referencing of the source(s) that would enable the reader to check whether any particular work has indeed been cited accurately and/or fairly and thus to identify the original writer's particular contribution in the work submitted.

The University will take action on every report and offence relating to plagiarism and if the student is found guilty, the student can be charged by the university according to the Students Disciplinary Rules.

3. Fabrication

Fabrication refers to a process of invention, adaptation or copying with the intention of cheating. This is an act of deceiving other people. Fabrication is somewhat related to matters which have been 'created' or altered.

Invention or task outcome or academic work without acknowledgement, alteration, falsification or misleading use of data, information or citation in any academic work constitutes fabrication. Fabricated information neither represents the student's own effort nor the truth concerning a particular investigation or study and thus violates the principle of truth in knowledge. Some examples are:

a. Creating or exchanging data or results, or using someone else's results, in an experiment, assignment or research.

b. Citing sources that are not actually used or referred to.

c. Listing with intent, incorrect or fictitious references.

d. Forging signatures of authorization in any academic record or other university documents.

e. Developing a set of false data.

4. Collusion

Collusion refers to the cooperation in committing or to commit or to do work with negative intentions. Some examples of collusion include:

a. Paying, bribing or allowing someone else to do an assignment, test/exam, project or research for you.

b. Doing or assisting others in an assignment, test/exam, project or research for something in return.

c. Permitting your work to be submitted as the work of others.

d. Providing material, information or sources to others knowing that such aids could be used in any dishonest act.

5. Other violations relating to academic integrity

a. Late to lecture, tutorial, class or other forms of teaching modes relating to their courses.

b. Sending or submitting late any assignment relating to their courses.

c. Hire someone else to do the assignment or thesis.

d. Carrying out business by providing service to write assignment or thesis of the students.

e. Any other violations that USM deemed as violating academic integrity.

2.6.1 Consequences of Violating Academic Integrity

Students are responsible in protecting and upholding academic integrity in USM.

If in any specific event a student or students would encounter any incident that denotes academic dishonesty, the student(s) need to submit a report to the relevant lecturer. The lecturer is then responsible to investigate and substantiate the violation and report the matter to the Dean of the School.

1. If any violation of academic integrity is considered as not of a serious nature, the Dean of the School may take administrative action on the students.

2. However, if the violation is deemed serious by the School, this matter shall be brought to the attention of the Secretariat of University Student Disciplinary Committee (Academic Cases) at Legal Office, Level 2, Building E42, Chancellory II, Universiti Sains Malaysia for further disciplinary action as specified in the disciplinary procedures

3. If a student is caught copying or cheating during examination, the Investigation Committee of *Copying/Cheating in Examination* will pursue the matter according to the University's procedures. If the investigation found that there is a case, the student(s) will be brought to the Student's Disciplinary Committee of the University. In this matter, the rule on conduct during the examination shall be applied.

4. Any student who has been found guilty in the Student's Disciplinary Committee (Academic Cases) may be graded as fail or grade "F" in the said subject tried.

5. Rule 48 in the Kaedah-Kaedah Universiti Sains Malaysia (Discipline of Students) 1999 provides that a student who commits a disciplinary offence and is found guilty of the offence shall be liable to any one or any appropriate combination of two or more of the following punishments as follows:

a. a warning;

b. a fine not exceeding Ringgit Malaysia Two Hundred (RM200.00);

c. exclusion from any specific part or parts of the University for a specified period;

d. suspension from being a student of the University for a specified period;

e. expulsion from the University.

2.7 USM Mentor Programme

The Mentor Programme acts as a support aid that involves staff undergoing special training as consultants and guides to the USM community who would like to share their feelings and any psychosocial issues that could affect their social activities. This programme helps individuals to manage psychosocial issues in a more effective manner, which will eventually improve their well-being in order to achieve a better quality of life.

Objectives

1. To serve as a co-operation and mutual assistance mechanism for dealing with stress, psychosocial problems and many more in order to ensure the well-being of the USM community.

2. To inculcate the spirit of unity and the concept of helping one another by appointing a well-trained mentor as a social agent who promotes a caring society for USM.

3. To produce more volunteers to assist those who need help.

4. To prevent damage in any psychosocial aspect before they reach a critical stage.

2.8 Student Exchange Programme

2.8.1 Study Abroad Scheme

The student exchange programme is an opportunity for USM students to study for one or two semesters abroad at any USM partner institutions. Ideally, students are encouraged to participate in the exchange programme within their third to fifth semester (3 year degree programme) and within the third to seventh semester (4 year degree programme).

USM students who wish to follow the SBLN programme must discuss their academic plans with the Dean or Deputy Dean of their respective Schools and also with the International Mobility & Collaboration Centre (IMCC) (to ensure that credits obtained from the external higher education institution can be transferred as part of the credit accumulation for graduation).

Any student who follows the SBLN programme and violates any disciplinary act in the external higher education institution, can be penalised in accordance with the University (Discipline of Students) Rules if the matter is referred to USM.

For further information, please visit www.imcc.usm.my or contact the International Mobility and Collaboration Centre (IMCC) at +604 – 653 2777/2774.

2.8.2 Student Exchange Programme in Local Higher Education Institutions (RPPIPT)

This is a programme that allows students of Higher Learning Institutions to do an exchange programme for a semester among the higher institutions themselves. Students can choose any relevant courses and apply for credit transfers.

USM students who want to participate in RPPIPT have to discuss their academic plans with the Dean or Deputy Dean of their respective Schools and the Division of Academic and International (to ensure that credits obtained from the higher education institution in Malaysia can be transferred as part of the credit accumulation for graduation).

Any student who participates in RPPIPT and violates any of the institution's disciplinary rules can be penalised according to the University (Discipline of Students) Rules if the matter is referred to USM.

For further information, please contact the Academic & International Division at +604 – 653 3126.

2.9 Ownership of Students' Dissertation/Research Project/Thesis and University's Intellectual Property

The copyright of a dissertation/research project/thesis belongs to the student. However, as a condition for the conferment of a degree, the student gives this right unconditionally, directly but not exclusively, and free of royalties to the university to use the contents of the work/thesis for teaching, research and promotion purposes. In addition, the student gives non-exclusive rights to the University to keep, use, reproduce, display and distribute copies of the original thesis with the rights to publish for future research and the archives.

2.10 Teaching Assessment

Starting from Semester 1, Academic Session 2015/2016, USM has implemented the Teaching Assessment System as a medium for students to evaluate the teaching of their courses.

Every student is **REQUIRED** to complete the assessment form for both the course and the lecturer. The teaching assessment system will be open from Week 7 of each semester until the last day of the revision week and can be accessed through the **eLearning Portal**. Students who fail to complete this evaluation will have their examination results for that semester withheld.

3.0 UNIVERSITY COURSE REQUIREMENTS

3.1 Summary of University Course Requirements

Students are required to take 15-22 credits for the following University courses/options for University needs:

<table>
<tr><th colspan="3" rowspan="2">UNIVERSITY COURSE REQUIREMENTS</th><th colspan="2">CREDIT TOTAL</th></tr>
<tr><th>Local Students</th><th>International Students</th></tr>
<tr><td colspan="3">General Studies (MPU)</td><td></td><td></td></tr>
<tr><td>U1</td><td colspan="2">Local Students
▪ HFF225 (Philosophy and Current Issues) (2 credits)
▪ HFE224 (Appreciation of Ethics and Civilisations) (2 credits)
▪ LKM400 (Malay Language IV) (2 credits)
International Students of Science and Technology
▪ HFF225 (Philosophy and Current Issues) (2 credits)
▪ Malay Language course (2 credits)</td><td rowspan="2">6</td><td rowspan="2">4</td></tr>
<tr><td colspan="2"><table><tr><td>International Students of Arts
(program with Malay Language as the medium of instruction)
▪ HFF225 (Philosophy and Current Issues) (2 credits)
▪ LKM100 (Malay Language I) (Z)
▪ LKM200 (Malay Language II) (U) (2 credits)</td><td>International Students of Arts
(program with English Language as the medium of instruction)
▪ HFF225 (Philosophy and Current Issues) (2 credits)
▪ LKM100 (Malay Language I) (U) (2 credits)</td></tr></table></td></tr>
<tr><td>U2 (Local students)
AND
U3 (International students)</td><td colspan="2">Local Students
▪ WUS101 (Core Entrepreneurship) (2 credits)
▪ English Language Courses (4 credits)
International Students
▪ SEA205E (Malaysian Studies) (4 credits)
▪ English Language Courses (4 credits)</td><td>6</td><td>8</td></tr>
<tr><td>U4</td><td>Local Students
WAR122 (Integrity and Anti-Corruption Course) / Co-Curricular Courses*</td><td>International Students
Co-Curricular Courses*</td><td>2</td><td>2</td></tr>
<tr><td>Options</td><td colspan="2">Students can/have to choose any of the following:
▪ Co-curricular courses
▪ Skill courses/Foreign Language Courses/ Other courses offered by other schools</td><td>1-8</td><td>1-8</td></tr>
<tr><td></td><td colspan="2">CREDIT TOTAL</td><td>15-22</td><td>15-22</td></tr>
</table>

* Students from the School of Educational Studies are required to register for one (1) of the Co-Curricular Packaged Course (Uniformed Body) throughout their period of study to fulfill the programme requirements.

* Students from the School of Dental Sciences are required to register for three (3) credits of courses in the U4 group. Further information can be obtained from the Academic Office, School of Dental Sciences.

3.2 General Studies Components (MPU) (14 credits)

General studies is one of the strategies and initiatives planned for the purpose of Shift 1, which is Holistic, Entrepreneurial and Balanced Graduates. Malaysia Education Blueprint 2015-2025 (Higher Education) or PPPM (PT) outlines 10 shifts to achieve the aspirations of the nation's higher education system and student aspirations.

General studies are divided into four groups as follows:

1. U1: appreciation of philosophy, values and history;
2. U2: the mastery of soft skills;
3. U3: expansion of the knowledge of Malaysia and its history; and
4. U4: practical community management skills such as community service and co-curriculum.

A. U1 Group

Local Students

All Malaysian students are required to take and pass the following courses. In order to graduate, the minimum passing grade required is Grade C.

(i) HFF225 (Philosophy and Current Issues) (2 credits)

The course synopsis is as follows:

This course covers the relation between philosophy and the National Education Philosophy and Rukun Negara. Philosophy is used as a tool to refine the culture of thought in life through the art and methods of thinking as well as through our understanding of the concept of the human person. Key topics in philosophy, namely epistemology, metaphysics, and ethics, are discussed in the context of current issues. Emphasis is given to philosophy as the basis for intercultural dialogue and fostering common values. At the end of this course, students will be able to see the disciplines of knowledge as a comprehensive and integrated body of knowledge.

(ii) HFE224 (Appreciation of Ethics and Civilisations) (2 credits)

The course synopsis is as follows:

This course prepares students to appreciate the ethics and civilisation that existed in the multiple ethnic society in Malaysia to strengthen their critical and analytical thinking in handling a more challenging life. The content of this course focuses on appreciating ethics and civilisation according to the Malaysian mould. Students will be exposed to the dynamics of the concept of ethics and

civilisation that gave strength to the formation of a Malaysian nation based on the timeline of its historical evolution from the precolonial to the postcolonial era. Understanding the formation of the ethical and civilisation is discussed to increase their civil ethical appreciation towards strengthening the concept of national and Malaysian nation. Civilisation in the Malaysian mould needs to be analysed and debated in academic activity with reference to the Federal Constitution as the base for integration and a vehicle for ethics and civilisation. The development of national unity is too much influenced by globalisation and the development of information technology and complex communication. Therefore, the appreciation of ethics and civilisation has given rise to socially responsible behaviour and moved at the level of individual, community, society and nation. Therefore, the change that is happening in the society and direct economic development has brought new challenges to the strengthening of ethics and civilisation in Malaysia. Finally, High Impact Educational Practices is carried out during teaching and learning to learn the course in-depth.

(iii) LKM400/2 (Malay Language IV)

In order to graduate, the minimum passing grade required is Grade C. Entry requirements for Malay Language are as follows:

No	Qualification	Grade	Entry Level	Type	Credit	Status
1	(a) SPM/MCE/SC (or equivalent qualification) (b) STPM/HSC (or equivalent qualification)	1 - 6 P/S	LKM400	U	2	Graduation Requirement

Note:

To obtain credits for **Malay Language** courses, a minimum of grade C is required. Students may seek advice from the School of Languages, Literacies and Translation if they have a different Bahasa Malaysia qualification from the above.

International Students

All international students are required to take and pass the following courses. In order to graduate, the minimum passing grade required is Grade C.

(i) HFF225 (Philosophy and Current Issues) (2 credits)

The course synopsis is as follows:

This course covers the relation between philosophy and the National Education Philosophy and Rukun Negara. Philosophy is used as a tool to refine the culture of thought in life through the art and methods of thinking as well as through our understanding of the concept of the human person. Key topics in philosophy, namely epistemology, metaphysics, and ethics, are discussed in the context of current issues. Emphasis is given to philosophy as the basis for intercultural dialogue and fostering common values. At the end of this course, students will be able to see the disciplines of knowledge as a comprehensive and integrated body of knowledge.

(ii) Malay Language Course (2 credits)

All international students are required to take and pass the Malay Language course. In order to graduate, the minimum passing grade required is Grade C. Malay Language course requirements by academic programme are as follows:

a) International students pursuing a Bachelor's Degree in Arts (*program with Malay Language as the medium of instruction)* are required to take the following courses:

Code	Type	Credit
LKM100	Z	2
LKM200	U	2

b) International students pursuing a Bachelor's Degree in Arts (*program with English Language as the medium of instruction*) are required to take the following course:

Code	Type	Credit
LKM100	U	2

c) International students pursuing Bachelor's Degrees in Science and Technology are required to take the following course:

Code	Type	Credit
LKM100	U	2

B. U2 or U3 Group

Local Students

WUS101 (Core Entrepreneurship) (2 credits)

All students are required to take and pass the WUS101/2 (Core Entrepreneurship) course. In order to graduate, the minimum passing grade required is Grade C. The following is the synopsis of the course:

This course provides basic exposure to students on entrepreneurship and business fields, with emphasis on the implementation of the learning aspects while experiencing the process of executing business projects on campus. The main learning outcome is the assimilation of culture and entrepreneurship work ethics in their everyday life. This initiative is made to open the minds and arouse the spirit of entrepreneurship among target groups that possess the potential to become successful entrepreneurs.

For more information, please refer to the Centre for Co-Curricular Programme website.

International Students

SEA205E (Malaysian Studies) (4 credits)

All international students are required to take and pass the SEA205E/4 (Malaysian Studies) course. In order to graduate, the minimum passing grade required is Grade C. The following is the synopsis of the course:

This course discusses Malaysia from the perspectives of history, politics, social, culture and economics. It looks at the relations between the country's history and its politics, the formation of a plural society that has since become its important characteristics, as well as issues related to development in Malaysia. Students will also be exposed to contemporary issues in Malaysia such as the marginalized groups, popular culture, issues related to health and wellbeing, as well as looking at Malaysia from the global context.

Local and International Students

All Bachelor's degree students must take four (4) units from the English Language courses to fulfil the University requirement for graduation.

(i) Entry Requirements for English Language Courses (for students with MUET)

The following table shows the entry requirements for the English language courses offered by the School of Languages, Literacies and Translation.

No.	MUET qualification / Pre-requisite course	Band / Grade	English Language Course	Course Type
1.	MUET **or**;	2.0 / 2.5	LSP101 (2 credits)	Pre-requisite/ Type Z
	Discretion of the Dean of SoLLaT			
2.	MUET **or**;	3 .0 / 3.5	LSP201 (2 credits)	Compulsory/ Type U
	LSP101 **or**;	A – C		
	Discretion of the Dean of SoLLaT			
3.	MUET **or**;	4.0 / 4.5	LSP301 (2 credits)	Compulsory/ Type U
	LSP201 **or**;	A – C		
	Discretion of the Dean of SoLLaT			
4.	MUET **or**;	5.0 & above	LHP410/411/412/458/459 (2 credits)	Compulsory/Option/ Type U
	LSP301 **or**;	A - C		
	Discretion of the Dean of SoLLaT			

(ii) Entry Requirements for English Language Courses (for students with IELTS, TOEFL, PTE or Linguaskill)

The following table shows the entry requirements for the English language courses offered by the School of Languages, Literacies and Translation.

No.	IELTS	TOEFL iBT (Internet Based Test)	PTE (Pearson Test of English)	Linguaskill	English Language Course	Course Type
1.	5.0 & below	45 & below	50 & below	159 & below	LSP101 (2 credits)	Pre-requisite / Type Z
2.	5.5 & 6.0	46 – 78	51 – 59	160 – 175	LSP201 (2 credits)	Compulsory/ Type U
3.	6.5 & 7.0	79 – 109	60 – 79	176 – 179	LSP301 (2 credits)	Compulsory/ Type U
4.	7.5 & above	110 & above	80 & above	180 & above	LHP Series	Compulsory/ Option/ Type U

Note:

- Students are required to refer to the list of English language courses required by their respective schools.
- Students may seek advice from the School of Languages, Literacies and Translation if they have a different English language qualification from the above.

- In order to obtain units in English Language courses, students have to pass with a minimum grade 'C'.

- Students with Bands 5 & above in MUET must accumulate the 4 credits of English from the courses in the advanced level (LHP410/411/412/458/459).

- Students with Bands 2.0/2.5 in MUET may re-sit MUET to improve their score to Band 3.0 OR take the LSP101 course and pass with a minimum grade C before they can register for the LSP201 course.

(iii) English Language Course

English courses offered as university courses are as follows:

No.	Code/Unit	Course Title
1.	LSP101/2	Progressive English
2.	LSP201/2	General English I
3.	LSP301/2	General English II
4.	LHP410/2	Effective Reading
5.	LHP411/2	Effective Writing
6.	LHP412/2	Effective Oral Presentation
7.	LHP458/2	English for Translation (offered in Semester 2 only)
8.	LHP459/2	English for Interpretation (offered in Semester 1 only)

C. U4 Group

i. Integrity and Anti-Corruption Course (WAR122)

Local students are required to register the Integrity and Anti-Corruption Course during their studies to complete the minimum requirement of two (2) credits in the MPU4 structure as a graduation requirement. The minimum passing grade required is Grade C.

ii. Co-Curricular Packaged Course (Uniformed Body)

Students from the School of Educational Studies are required to register for one (1) of the Co-Curricular Packaged Course (Uniformed Body) throughout their period of study to fulfill the programme requirements. Students who register for the Co-curricular Courses (Uniformed Body)

under PALAPES, SUKSIS, or SISPA must complete the entire course package. The minimum passing grade required is Grade C.

3.3 Options (1 – 8 credits)

A. Co-curricular course

Students can choose Co-Curricular Courses as an Option to complete the total number of University Course credits according to the requirements of their respective schools.

Co-curriculum courses are grouped by Core and are available in packages and without packages. Students are required to complete all phases of the course package if they register for the Co-Curricular Packaged Course. The minimum passing grade required is Grade C.

The details of the list of Co-Curricular Courses offered are as follows:

(i) Core of Volunteerism (6 - 10 credits)

All courses offered under this core are the uniformed courses offered in the following packages:

PALAPES Army	PALAPES Navy	PALAPES Air Force	SUKSIS (Students' Police Volunteers)
WTD103/3	WTL103/3	WTU103/3	WPD101/2
WTD203/3	WTL203/3	WTU203/3	WPD201/2
WTD304/4	WTL304/4	WTU304/4	WPD301/2

SISPA (Siswa Siswi Pertahanan Awam Malaysia)	St John Ambulance	Red Crescent Emergency Aid Team
WPA103/2	WJA102/2	WBM102/2
WPA203/2	WJA202/2	WBM202/2
WPA303/2	WJA302/2	WBM302/2

For more information, please refer to the Centre for Co-Curricular Programme website.

(ii) Core of Sports (1 - 3 credits)

The courses offered are as follows:

Packaged Courses (3 Credits, 3 Semesters) (Students are required to complete all levels)	
Karate	**Taekwondo**
WSC108/1	WSC115/1
WSC208/1	WSC215/1

WSC308/1	WSC315/1
Non Packaged Courses (1 Credit)	
WSC105/1 –Volley Ball	WSC124/1 - Sepak Takraw
WSC110/1 - Archery	WSC 125/1- Futsal
WSC111/1 - Table Tennis	WSC 126/1 - Netball
WSC112/1 - Swimming	WSC127/1 - Event Management 1
WSC113/1 - Aerobics	WSC227/1 - Event Management 2
WSC114/1 - Squash	WSC128/1 - Petanque
WSC116/1 - Tennis	WSC130/1 - Orienteering
WSC119/1 - Badminton	WSC131/1 - Woodball

For more information, please refer to the Centre for Co-Curricular Programme website.

(iii) Core of Culture (1 – 6 credits)

The courses offered are as follows:

Packaged Courses (6 Credits, 3 Academic Sessions) (Students are required to complete all levels)	
Jazz Band	**Seni Silat Cekak Malaysia**
WCC108/2	WCC123/2
WCC208/2	WCC223/2
WCC308/2	WCC323/2
Non-Packaged Courses (1 Credit)	
WCC105/1 - Gamelan	WCC116/1 - Traditional Dance
WCC107/1 - Guitar	WCC117/1 - Modern Theatre
WCC109/1 - Choir	WCC118/1 - Malay Shadow Play
WCC115/1 - Modern Dance	WCC124/1 - Musical Kompang

For more information, please refer to the Centre for Co-Curricular Programme website.

(iv) Core of Innovation and Initiative (1 - 2 credits)

The courses offered are as follows:

Non-Packaged Courses (1 Credit)	
WCC103/1 - Painting	WCC128/1 - Embroidery and Beads Sequin Art
WCC110/1 - Handcrafting	WCC130/1 - Digital SLR Photography Art
WCC120/1 - Canting Batik	WCC 131/1 - Editing Digital Photography Art

WCC121/1 - Calligraphic Art	WCC132/1 - The Art of Ceramic
WCC122/1 - Culinary Arts	WCC133/1 - Decoupage Arts
WCC125/1 - Traditional of Kite Art	
Non-Packaged Courses (2 Credits)	
WLF103 - Climate Change Resilience	WMU102/2 - Makers@USM Level 1
WLF104 - Digital Financial Literacy	WMU112/2 – Artificial Intelligence Literacy
WLF105 - Grit in You	WMU122/2 - Data Science Literacy

For more information, please refer to the Centre for Co-Curricular Programme website.

(v) Core of Community Service (4 credits)

The courses offered are as follows:

Packaged Courses (4 Credits) (Students are required to complete all levels)	
WKM102/2 - Community Service 1	WKM202/2 - Community Service 2
Non-Packaged Courses (2 Credits)	
WSK102/2 - Volunteerism Science	

For more information, please refer to the Centre for Co-Curricular Programme website.

(vi) Core of Public Speaking (2 credits)

The courses offered are as follows:

Non-Packaged Courses (2 Credits)
WEC102/2 - Public Speaking in Malay Language
WEC103E/2 - Public Speaking in English Language

For more information, please refer to the Centre for Co-Curricular Programme website.

(vii) Core of Sustainability (2 credits)

The courses offered are as follows:

Non-Packaged Courses (2 Credits)
WSU101/2 - Sustainability of Issues, Challenges and Prospects

For more information, please refer to the Centre for Co-Curricular Programme website.

B. Skill / Foreign Language Courses / Courses offered by other schools

Students can choose the following courses as an option:

(i) WSU 101 (Sustainability: Issues, Challenges & Prospects) (2 credits)

The following is the synopsis of the course:

This course introduces and exposes the concept of sustainable development to students. The course aims to ensure future generation capabilities to meet their needs in the future are not affected, especially in the era of challenging globalization and the rapid development of information technology at present. Sustainable development models and case studies are also discussed.

The minimum passing grade required is Grade C. For more information, please refer to the Centre for Co-Curricular Programme website.

(ii) HTV201 (Thinking Techniques) (2 credits)

The following is the synopsis of the course:

This course introduces students to various creative thinking such as styles and thinking tools that can broaden their understanding of creativity and improve problem-solving skills. Students are trained to select and apply the best techniques to solve specific problems. So this course helps students to learn to think effectively in order to make the most effective decisions in both their studies and daily life.

(iii) SHE101 (Ethnic Relations) (2 credits)

The following is the synopsis of the course:

This course is an introduction to ethnic relations in Malaysia. This course is designed with 3 main objectives: (1) to introduce students to the basic concepts and the practices of social accord in Malaysia, (2) to reinforce basic understanding of challenges and problems in a multi-ethnic society, and (3) to provide an understanding and awareness in managing the complexity of ethnic relations in Malaysia. At the end of this course, it is hoped that students will be able to identify and apply the skills to issues associated with ethnic relations in Malaysia.

(iv) Other options/skill courses as recommended or required by the respective schools (if any)

(v) English language course

The following courses may be taken as a university course to fulfil the compulsory English language requirements (or for students with MUET Band 5+) or as a skill/option course:

No	Code/Kredit	Course Title
1.	LHP410/2	Effective Reading
2.	LHP411/2	Effective Writing
3.	LHP412/2	Effective Oral Presentation
4.	LHP458/2	English for Translation (offered in Semester 2 only)
5.	LHP459/2	English for Interpretation (offered in Semester 1 only)

(vi) Foreign Language Courses

The foreign language courses offered by the School of Languages, Literacies and Translation can be taken by students as option or compulsory courses to fulfil the number of units required for graduation. Students are not allowed to register for more than one foreign language course per semester. They must complete at least two levels of a foreign language course before they are allowed to register for another foreign language course. However, students are not required to complete all four levels of one particular foreign language course. The foreign language courses offered are as follows:

Arabic	Chinese	Japanese	German	Spanish
LAA100/2	LAC100/2	LAJ100/2	LAG100/2	LAE100/2
LAA200/2	LAC200/2	LAJ200/2	LAG200/2	LAE200/2
LAA300/2	LAC300/2	LAJ300/2	LAG300/2	LAE300/2
LAA400/2	LAC400/2	LAJ400/2	LAG400/2	LAE400/2

French	Thai	Tamil	Korean
LAP100/2	LAS100/2	LAT100/2	LAK100/2
LAP200/2	LAS200/2	LAT200/2	LAK200/2
LAP300/2	LAS300/2	LAT300/2	LAK300/2
LAP400/2	LAS400/2		

4.0 SCHOOL OF AEROSPACE ENGINEERING

4.1 Introduction

The School of Aerospace Engineering was known as The Aerospace Engineering Unit that was established and operated between 13 May 1998 until 28 February 1999. Within the same year, the unit was upgraded to School of Aerospace Engineering on the 1st of March 1999 with the establishment of USM, Engineering Campus. The school was established in realizing the needs to produce aerospace engineering graduates with high expertise, creativity with societal values, and competent in following the rapid technology development in aerospace industry. This program not only focuses on aerospace courses, but also emphasizes the multidisciplinary engineering concept that combines Mechanical, Electrical and Electronic Engineering. Non-technical subjects that are of equal importance to an engineer, such as Management, Language, Computer, Accounting and Engineer in Society are also included as part of the overall educational program.

To produce engineers who are competent to face the challenges in the workplace, students will be thought not only with theoretical knowledge but also exposed in practical and hands-on activities in the labs. In addition, they are required to undergo ten (10) weeks practical training during long semester break preferably in aerospace industries to obtain real-working experience.

After graduation, the graduates shall be eligible to work in engineering sector within the government institution, half-government bodies, or private institutions which are actively involved in aerospace industry and related engineering industries.

4.2 Mission and Vision of the School of Aerospace Engineering

To fulfil and complement the university mission, the school operates under its own vision and missions.

Vision:

The School of Aerospace Engineering strives to be the best and leading provider of aerospace engineering education and research in Malaysia.

Mission:

1. To provide quality and innovative teaching and maintain accreditations for all its degree programme.
2. To achieve research excellence.
3. To establish and enhance the collaboration with industries for education and research.
4. To serve society and country by providing the latest knowledge and technology.

4.2.1 Program Educational Objectives

Consistent with vision and mission of the university and school, the Program Educational Objectives (PEOs) of the Aerospace Programme are:

1. PEO1: Excel in engineering practices in aerospace or other engineering industries.
2. PEO2: Establish themselves as leaders in their professional careers.
3. PEO3: Improve themselves continually through advanced degree programme or professional certification.

4.2.2 Program Outcomes

Our graduates are expected to attain the following attributes upon their graduation:

1. **Engineering Knowledge** - Apply knowledge of mathematics, natural science, **computing and** engineering fundamentals, and an engineering specialization as specified in WK1 to WK4 respectively to **develop** solutions to complex engineering problems particularly in Aerospace engineering.
2. **Problem Analysis** - Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with **holistic considerations for sustainable development** (WK1 to WK4).
3. **Design/Development of Solutions -** Design **creative** solutions for complex engineering problems and design systems, components or processes to meet **identified** needs relevant to Aerospace engineering with appropriate consideration for public health and safety, **whole-life cost, net zero carbon as well as resource**, cultural, societal, and environmental considerations **as required** (WK5).
4. **Investigation -** Conduct investigation of **related** complex Aerospace engineering problems using **research methods** including research-based knowledge, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid **conclusions** (WK8).
5. **Tool Usage -** Create, select and apply, **and recognize limitation of** appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems (WK2 and WK6).
6. **The Engineer and the world** - Analyze and evaluate sustainable development impacts to society, the economy, sustainability, health and safety, legal frameworks, and the environment, in solving

complex engineering problems (WK1, WK5, and WK7).

7. **Ethics** - Apply ethical principles and commit to professional ethics and norms of engineering practice **and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion** (**WK9**).
8. **Individual and Collaborative Team Work -** Function effectively as an individual, and as a member or leader in diverse and **inclusive teams** and in multidisciplinary, **face-to-face, remote** and distributed settings (**WK9**).
9. **Communication** - Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, taking into account cultural, language, and learning differences.
10. **Project Management and Finance - Apply** knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, **and** to manage projects in multidisciplinary environments.
11. **Life-Long Learning -** Recognise the need for, and have the preparation and ability **for i)** independent and life-long learning **ii) adaptability to new and emerging technologies and iii) critical thinking** in the broadest context of technological change (**WK8**).

4.3 Administrative Staff

Refer to school website or click here ☞ Faculty & Staff (usm.my)

4.4 Academic Staff List

Refer to school website or click here ☞ (Faculty & Staff (usm.my)

4.5 Industry/Community Advisory Panel (ICAP)

No.	Name	Position	Address
1.	Ir. Ts. Dr Mohd Yusri @ Zulfiki Mohd Yusuf	Director of Quality	Boeing Composites Malaysia, Lot 224, Kawasan Perindustrian Bukit Kayu Hitam, 06050 Bukit Kayu Hitam, Kedah
2.	Ts. Jamari A Ghafar	Associate Consultant, Global Aerospace Sdn Bhd.	Global Aerospace Sdn Bhd. 37B, Jalan TS 6/10A, Taman Industri Subang, 47510, Subang Jaya, Selangor Tel: +603-5631 0019 Mobile: +6012 636 5860 Email:jamari.ghafar@yahoo.com/jamarighafar@gmail.com

3.	Ir. Ts. Syed Muhammmad Afdal Sayed Ghazali	Head Engineering Petronas, ISRO Sarawak	No. 5, SS2/128, Jalan Kadam Kai, MNLG Housing Estate, Tanjung Kidurong, 97000 Bintulu, Sarawak

4.6 External Examiner

Professor Ir. Dr. Faizal Mustapha
Department of Aerospace Engineering
Faculty of Engineering
Universiti Putra Malaysia
43400 UPM Serdang, Selangor

4.7 Laboratories Facilities

The School of Aerospace Engineering has excellent facilities for research and teaching. Multiple laboratories (Table 4.7.1) are available for student access focusing on research areas such as structures, aerodynamics, control systems, instrumentation, applied mechanics and propulsion. Experimental research is well supported by well-equipped workshops and computer modeling resources. The workshops are utilized for engineering practice modules such as welding, threading, milling, and sheet metal works. Workshops are also used for research activities for fabricating and modifying research models. Enquiries about the use of facilities may be directed to the school dean or by contacting the relevant Lab Manager.

Table 4.7.1: Laboratories at the School of Aerospace Engineering.

Laboratory	**Experiment**
Aerodynamics 1	Boundary Layer Lift and Drag Measurement on Aerofoil
Aerodynamics 2	Wind Tunnel/ Water Table Losses in Piping System Concept of Bernoulli Properties of Fluids Reynolds Apparatus Series and Parallel Pumps Pelton Turbine/ Francis Turbine
Propellant and propulsion	Micro Jet Turbine Rocket Thrust Measurement
Computer Numerical Control (CNC) Machine	CNC Milling Programming
Light Structure Lab	Shear Test In A Beam Deflection Moment Test In A Beam Beam Deflection Test Unsymmetrical Load Beam Test

	Parallel Beam Test Curved Beam Test
Composite Lab	Wet/Hand Lay-Up Vacuum Assisted Curing Oven Resin Infusion
Flight Mechanic Lab	Unmanned Aerial Vehicle (UAV) Flight Simulator/ Drone System
Space System Lab	Clean room 100K/ISO Class 8 CubeSAT system Education Satellite – Caked CanSat System Control Moment Gyroscope Satellite Tool Kits Software HAB system
UAV lab	Indoor UAV development
Electronics, Instrumentation and Avionics Lab	Signal and System Analog Digital/ Internet of Things (IoT) Micro Processor
Wind Tunnel Testing Room	Closed-Circuit Wind Tunnel

The laboratories are adequately supported by multiple engineering workshops as listed in Table 4.7.2 covering a multitude of area of engineering practices.

Table 4.7.2: Workshop at the School of Aerospace Engineering.

Workshop	**Experiment**
Workshop 2	Arc/TIG/MIG Welding
Workshop 3	Sheet Metal/ Riveting/Aeromodelling
Aircraft Hangar	Maintenance, Repair & Overhaul (MRO)

Apart from the laboratories located at the school, student will also aptly support by facilities provided by the School of Mechanical Engineering as listed in Table 4.7.3.

Table 4.7.3: Workshop and laboratories at the School of Mechanical Engineering.

Workshop/Laboratory	**Experiment**
Workshop 1	Lathe/Feed Rate Milling/Milling Shearing/Sand Casting/Gas Welding
Heat transfer	Thermal Conductivity Forced Convection

	Air Conditioning System
Energy conversion	Bomb Calorimeter/ Boiler Performance
Thermodynamics	Diesel /Petrol Engine Performance Two-Stroke Engine Study
Tribology and failure analysis	Hardness Test Metallurgy
Dynamics and instrumentations lab	Balancing of Pendulum
Applied Mechanics	Beam Bending/ Torsion/Tensile Test Impact Test
Automatics and Control	Hydraulic/ Pneumatic System
Flexible manufacturing	Industrial Robot/ Automation
Metrology Lab	Roughness/ Roundness Measurement Profile/ Dimensional Measurement

The School of Aerospace Engineering provides sufficient computer and software facilities for teaching and learning purposes. There is a dedicated computer laboratory opened to all School members. Furthermore, students are also provided with an additional access to the computer laboratories in the School of Mechanical Engineering and Centre of Knowledge, Communication & Technology (PPKT). The summary of facilities in the laboratories are listed in Table 4.7.4

Technical software is available in the computer laboratories such as CATIA for Computer Assisted Design (CAD), ANSYS and Nastran/Patran for Finite Element Analysis (FEA) and, Fluent and ANSYS CFX for Computer Fluid Dynamics (CFD) analysis.

Table 4.7.4: Computer Laboratories

Laboratory	**Equipment**
CAD, Mechanical Building	**Hardware:** 1. Workstation – 48 units 2. Cluster PCs – 50 units **Software:** CATIA, SolidWorks, ANSYS Witness 2000, Master CAM, Matlab Automation Studio, Maple, Mimics Microsoft Office, SPSS22 etc.
CAE (Catia lab), Aero Building	**Hardware:** 1. Workstation – 4 units 2. Cluster PCs – 26 units 3. Printer – 2 units **Software:** CATIA, SolidWorks, ANSYS, Matlab, Fluent, Nastran & Patran etc.

CFD Lab, Aero Building	**Hardware:** 1. Workstation-7 units 2. Printer-1 unit **Software** ANSYS,Mathematica, Paraview MS Visual Studio, Matlab, CATIA etc.
Computer Lab, PPKT	**Hardware:** 1. Cluster PCs – 60 units **Software:** Matlab, C++ Compiler, Ms Office etc

4.8 Job Opportunities

The School of Aerospace Engineering has excellent facilities for research and teaching. Multiple laboratories (Table 4.7.1) are available for student access focusing on research areas such as structures, aerodynamics, control systems, instrumentation, applied mechanics and propulsion. Experimental research is

The courses followed shall enable graduates to venture into a variety of related fields in private or government agencies.

The related fields are as follows: -

Aeronautic: Aerospace Manufacturing, aerospace composite, control system, aircraft propulsion, thermo-fluids, aircraft systems, aircraft system design, aircraft maintenance, flight engineer, aerodynamics, aircraft design, and aircraft licensed engineer.

Astronautic: Satellite design, orbital mechanics, spacecraft attitude and determination control system, space environment, rocket propulsion system, testing and integration, launcher, and spacecraft communication system.

Aerospace Management: Aerospace Project Management.

Satellite Application: Communication and Remote Sensing.

4.9 Postgraduate Studies and Research Program

The School of Aerospace Engineering is offering Master of Science and Doctor of Philosophy degree by research in the field of aeronautics and astronautics.

An applicant for Master of Science degree should achieve a CGPA of at least 2.75 in Bachelor of Engineering degree obtained in USM or other universities, which is recognized by the Senate of USM. However, applicant

who has relevant experiences and who is found to be capable in following the higher degree shall also be considered.

An applicant who wishes to pursue a Doctoral of Philosophy degree should have already obtained a master's degree or equivalent from the USM or university which is recognized by the Senate of USM. In special cases, the senate shall also consider applications from those who possessed a bachelor's degree with CGPA over 3.67.

An applicant should provide some form of evidence that he or she has sufficient practice and is capable in pursuing the higher degree program proposed and shall be required to fulfil the Malay Language requirement as put forward by the University as well as other additional requirements from the school if necessary.

For further information about the higher degree program, applicants can contact the Dean of Institute of Graduate Studies, USM, or the Programme Chairman of Higher Degree, School of Aerospace Engineering, USM.

At present, the postgraduate education offers only MSc and PhD programs via research mode. Usually, the duration study for MSc program is 2 years while the PhD program takes 3 years to be completed. The main areas of research include Algorithm Development and Engineering Application in CFD, Vibration, Aerospace Structures, Aeroelasticity, Experimental Fluid Dynamics, Control Systems, Spacecraft Subsystem Elements, Aircraft Design and Composite Materials and Design or any engineering related field that is agreed by the supervisor. Students can choose any of abovementioned areas but with a specific topic and will be supervised and guided by qualified faculty members of the school. Financial assistance is also available to the students in the form of either fellowships, teaching assistantships, or through research grants.

4.10 Curriculum Structure

Our curriculum is comprehensive and tailored to be in line with the school's programme educational objectives and programme outcomes. The curriculum is deemed to provide students with a broad and modern aerospace engineering education.

The academic curriculum and curricular design for bachelor's degree of Aerospace Engineering strongly reflect the philosophy and approach adopted in the programme structure shown in table 4.10.1 (The course-PO Mapping is shown in Table 4.10.3). A total of 135 cumulative credit units must be completed and passed prior graduation of which 108 units are core courses, 15 units are university courses, and 12 units are elective courses.

The distribution of the core and elective courses according to areas is as shown below:

1. Engineering Mathematics (Basic)
2. Materials
3. Static and Dynamics
4. Engineering Design & Computer Aided Engineering
5. Engineering Labs
6. Fluids Mechanics & Thermodynamics
7. Aerodynamics & Propulsion
8. Aerospace Structure
9. Aircraft/Spacecraft sub-system and Design
10. Engineering Management
11. Electrical Engineering Technology
12. Flight and Orbital Mechanics
13. Flight Stability and control
14. Mechatronics, IoT and Automation Control

The programme structure includes all engineering and non-engineering courses. The curriculum integrates theory and practical and provides an extensive exposure involving laboratory works and professional engineering practices. The engineering courses consist of 94 units and the remaining units are the non-engineering courses such as mathematics, Computer Programming, languages, ethnic relations, Islamic and Asian Civilization, thinking skills, and co-curriculum.

The design courses can be divided into two parts, namely the general design courses and aerospace design-oriented courses. Those design courses comprise of 14 units. In the first and second year the student will be exposed with design methods such as engineering drawing, conceptual design and CAD, and machine component design using CATIA and SOLIDWORKS. The design courses then engage with aerospace design oriented with aerospace structural design, aircraft design 1, and spacecraft subsystem design. The aerospace-oriented design and final year project challenge the students with open-ended problems that include various aspects not only for Aerospace Engineering but also covers analysis of environmental, social, safety, and economic impacts.

The laboratory related courses include engineering practice, engineering laboratory 1 & 2, and aerospace laboratory which accumulate 8 credit units. Engineering practice exposes the students about basic skills in engineering such as welding, sheet metal, threading, and others. The two laboratories support the general theoretical courses such as static, electrical technology and fluid mechanics. The aerospace lab supports the aerospace theoretical courses such as aerodynamics, flight mechanics, propulsion, and aerospace structures. In each laboratory course, 10 experiments are carried out with group of 4-5 students.

The industrial training exposes the students to the actual working environment. This exposure is a key element in differentiating an engineering degree from an applied science degree. During the training, the students may gain broad experience, knowledge, and skills in addition to what they learnt in the class. The main objective of the industrial training is to ensure that the students adopt work

ethical, disciplines, and appreciate the practical aspects of engineering. The industrial training requires students to be in the selected industries for the duration of 10 weeks. Among the objectives of this internship program are:

(i) To provide early exposure to the students the real job environment.
(ii) To link the theoretical knowledge learned at university with the practical training at industries.
(iii) To provide opportunities for students to practice theoretical knowledge.
(iv) To improve competency skills as well as communication with the employers and work colleagues.
(v) To enhance self-confidence about the expectation of professional engineer in the true environment.
(vi) To provide an opportunity of better engagement between USM and industries.

Every year, at the end of second semester (during semester break), the 3rd year students will undergo an industrial training with a selected agency e.g., SMEs & MNCs industries, government sectors, private entities. During this period, the students are expected to gain some experiences in technical or communication within the real-world working environment. At the end of the training, the students are required to submit:

- A complete and comprehensive report on their experiences, assignments and works obtained during the training.
- A brief report on the suitability of the training and companies.
- Logbooks.

In addition, the respective industries are also requested to provide confidential report about the training program and attributes of the students. Among the aspects that are assessed are:

- Knowledge on the subject matters
- Quantity and quality of the work
- Initiative and interest in work
- Relationship with others and work colleagues
- Discipline & punctuality.
- Initiative of the students in work

4.10.1 List and Description of Courses

Table 4.10.1: List of courses for bachelor's in aerospace engineering

Level	Semester 1			Semester 2		
	Code	Course	Type/ Unit	Code	Course	Type/ Unit
100	EUM 113	Engineering Calculus	C3	EUM 114	Advanced Engineering Calculus	C3
	EBB 113	Engineering Materials	C3	EEU 104	Electrical Technology	C3
	EMD 111	Engineering Drawing & CAD	C2	ESA 122	Fluid Mechanics	C3
	EML 101	Engineering Practice	C2	EMM 102	Static	C3
	EMT 101	Numerical Computing	C2	ESA 112	Computer-Aided Engineering Design	C2
	LSP 300	Academic English (L&I)	U2	ESA 124	Aerospace Laboratory I	C2
	LKM 400	Bahasa Malaysia IV (L)	U2	WUS 101	Entrepreneurship (L)	U2
	LKM 100	Bahasa Malaysia I (I)	U2			
	WAR 122	Integrity and Anti-Corruption	U2			
		Co-Curriculum/Option/Skills	U1			
	Total unit/semester (Local / Int.)		**17/17**	**Total unit/semester (Local / Int.)**		**18/16**
200	EPP 201	Manufacturing Technology I	C3	ESA 226	Dynamics & Mechanism	C3
	ESA 225	Strength of Materials	C3	EMT 212	Computational Engineering	C3
	ESA 213	Thermodynamics & Heat Transfer	C3	ESA 272	Aircraft Subsystem Elements	C2
	EUP 222	Engineers in Society	C3	ESA 256	Control System Theory	C3
	ESA 227	Introduction to Aerospace Engineering	C2	ESA 244	Aerodynamics	C3
	LSP 404	Tech.& Engr. English (L&I)	U2	ESA 228	Machine Component Design	C2
	HFF 225	Philosophy and Current Issues (L&I)	U2	HFE 224	Appreciation of Ethics and Civilisations (L)	U2
				SEA 205E	Malaysian Studies (I)	U4
	Total unit/semester (Local / Int.)		**18/18**	**Total unit/semester (Local / Int.)**		**18/20**
300	ESA 321	Aerospace Structure	C3	ESA 374	Flight Stability & Control	C3
	ESA 313	Mechatronics	C3	ESA 382	Spacecraft Subsystem Design	C3
	ESA 355	Flight Performance	C3	ESA 322	Structural Dynamics	C3
	ESA 389	Orbital Mechanics	C3	ESA 312	Aerospace Laboratory III	C2
	ESA 317	Aerospace Laboratory II	C2	ESA 344	Propulsion System	C2
	ESA 319	Aerospace Policy & Management	C2	ESA 326	Aerospace Structural Design	C2
		Elective 1	E3		Elective 2	E3
	Total unit/semester (Local / Int.)		**19/19**	**Total unit/semester (Local / Int.)**		**18/18**
400	ESA 412	Final Year Project I	C2~	ESA 412	Final Year Project II	C4
	ESA 471	Aircraft Design I	C3	ESA 490	Aerospace Manufacturing Tech.	C2
	ESA 481	Spacecraft Design	C3		Elective 4	E3
	ESA 493	Industrial Training [1]	C5		Co-Curriculum/Option/Skills	U1
		Elective 3	E3			
		Co-Curriculum/Option/Skills	U1			
	Total unit/semester (Local / Int.)		**17/17**	**Total unit/semester (Local / Int.)**		**10/10**

- C= Core, E =Elective, U= University, Total Graduation Unit = 135

Table 4.10.2: Elective courses

Group	*Code*	*Course*	*Unit*
Elective 1	ESA 303	High Speed Aerodynamics	3
	ESA 305	Modern Control for Autopilot	3
Elective 2	ESA 302	Avionic Systems	3
	ESA 304	Aero-composite Engineering	3
Elective 3	EME 451	Computational Fluid Dynamics	3
	ESA 401	Satellite Communication System	3
Elective 4	ESA 402	Aircraft Design II	3
	ESA 404	Space Environment	3
	EME 412	Applied Finite Element Analysis	3

*Note: [1] The Industrial Training is conducted for 10 weeks during the long holiday between Year 3 (Semester 2) and Year 4 (Semester 1)
* (L) for Local student and (I) for International student.
*For University courses (U) please refer to section 3.0, page 34.

YEAR 1 (SEMESTER 1)

EUM 113/3 ENGINEERING CALCULUS

(Offered by the School of Electrical & Electronic Engineering)

Objectives:

This course reviews the concept of one and multivariable calculus and covers the concept of ordinary differential equation. This course will provide students with a variety of engineering examples and applications based on the above topics.

Synopsis:

Calculus of one variable: Functions, techniques for solving differentiation and integration, sequence and series, numerical solutions for solving differentiation and integration.

Calculus of multivariable: Scalar and vector fields, partial differentiation, chain rule, gradient, directional derivative, Lagrange multiplier.

Multiple integral: Double and triple integrals and their applications.

First order ordinary differential equation: Solving differential equations: separable equations, homogenous and non-homogenous equations, linear and non-linear equations, exact and non-exact equations, Bernoulli equation and Ricatti equation.

Second and higher order ordinary differential equation: Linear and homogeneous equations, non-homogeneous equations with method of undetermined coefficients, variation of parameters, reduction of order, D-operator, power series and Euler's equation.

Laplace transform: Definition and basic properties, step function, Direct Delta, Heaviside function, Laplace transform method for solving ODE.

Numerical solutions: Taylor, Euler and Runge Kutta methods for solving ODE.

Course Outcomes:

1. Able to define the concept of single and multivariable calculus and to solve the related problems.
2. Able to use the analytical and numerical methods to the solution of first order differential equation.
3. Able to use the analytical method to the solution of second order differential equation.
4. Able to apply the above concepts to the solution of related engineering problems.

EBB 113/3 ENGINEERING MATERIALS

(Offered by the School of Materials and Mineral Engineering)

Objective:

To be exposed to various engineering materials

Synopsis:

This course introduces behaviour, classifications and processing technique of engineering materials.

Course Outcomes:

1. Able to list the primary classifications of solid materials and to cite the distinctive chemical features of each class.
2. Able to outline the criteria that are important in the materials selection process.
3. Able to correlate the structures of a material with its behavior and performance.
4. Able to evaluate mechanical characteristics of materials.
5. Able to describe processing techniques of a material for typical applications.

EMD 111/2 ENGINEERING DRAWING & COMPUTER AIDED DESIGN

(Offered by the School of Mechanical Engineering)

Objective:

To introduce the technique of engineering graphics as a basis of engineering communication and expression of idea and thought. It consists of the principles and perspectives of geometric drawing that includes the standardization, drafting, dimensions etc.

Synopsis:

An introductory course in the engineering graphics comprises of the application of the principles of geometric drawing and perspective as a preparation for engineering drawings course. Topics include standards in engineering drawings, freehand sketching, dimensioning and tolerance, engineering drawing practice including the use of standards and conventional representation of machine elements and assembly drawings, and introduction to computer aided drafting.

Course Outcomes:

1. Able to use proper and standard technique in lettering, basic geometric constructions, sketching, dimensioning methods to describe size, shape, and position accurately on an engineering drawing.
2. Able to create orthographic projection auxiliary, sectional views, and apply 3D pictorials to choose the best view to present the drawings.
3. Able to produce final drawings during the design process including assembly, machine and working drawings.
4. Able to create 3D part and assembly drawings using CAD software.

EML 101/2 ENGINEERING PRACTICE

(Offered by the School of Mechanical Engineering)

Objective:

To provide the exposure and basic knowledge of hands-on engineering practices that includes the academic aspects as well as practical trainings in learning and teaching of common engineering workshop works and to optimize the use of available resources in the laboratory.

Synopsis:

Trainings are based on theoretical and practical concepts which consists of manufacturing.

process; computer numerical control (CNC), lathe, mill and thread machining, joint process, arc welding, gas welding and MIG welding, metrology measurement, electric and electronic circuits, and safety practice in laboratory and workshop.

EMT 101/2 NUMERICAL COMPUTING

(Offered by the School of Mechanical Engineering)

Objective:
An introduction to engineering programming, problem solving and algorithm developing using programming language.

Synopsis:
This course covers the fundamental concepts of programming, introduction to programming language, control structures and operators, arrays and plots and data file processing. Mathematical problem applications will be demonstrated.

Course Outcomes:
1. Able to declare and manipulate data types and use a simple C++ program (PO1)
2. Able to write, debug and execute a simple computer code using C++ (PO3)
3. Able to develop and execute a C++ code to solve and analyze simplified engineering problems (PO2)
4. Able to use Matlab to solve matrix problems in engineering (PO5)

LSP 300/2 ACADEMIC ENGLISH
Refer to Section 3.0.

LKM 400/2 BAHASA MALAYSIA
Refer to Section 3.0.

YEAR 1 (SEMESTER 2)

EUM 114/3 ADVANCED ENGINEERING CALCULUS

(Offered by the School of Electrical & Electronic Engineering)

Objective:

This course covers the concepts of linear algebra, Fourier series, partial differential equation and vector calculus. This course will provide students with a variety of engineering examples and applications based on the above topics.

Synopsis:

Linear algebra:

Determinants, inverse matrix, Cramer's rule, Gauss elimination, LU (Doolittle and Crout), eigen value and vector eigen, system of linear equation, numerical method for solving linear equation: Gause Seidel and Jacobian.

Fourier series: Dirichlet condition, Fourier series expansion, function defined over a finite interval, half- range cosine and sine series.

Vector Calculus: Introduction to vectors, vector differentiation, vector integration: line, surface and volume, Green's, Stoke's and Gauss Div theorems.

Partial differential equation: Method for solving the first and second order PDE, linear and non-linear PDE, wave, heat, and Laplace equations.

Course Outcomes:

1. Able to define the concept of Fourier Series and to solve Fourier Series problems.
2. Able to recognize the type of partial differential equation and to solve the equation
3. (analytically and numerically).
4. Able to use the vector fundamental operation to solve the problems in vector calculus.
5. Able to solve the problem in linear algebra analytically and numerically.

EEU 104/3 ELECTRICAL TECHNOLOGY

(Offered by the School of Electrical & Electronic Engineering)

Objective:

To learn and familiarize the basics of electrical circuit components as well as the analysis of AC circuit and magnetic component.

Synopsis:

Unit, definitions, experiments on plain circuit, circuit analysis method, load and current, circuit without RL and RC sources, the use of bit forced step unit, bit forced sinus, phasor concept, average power and RMS value, power circuit system, and magnetic circuit and components.

Course Outcomes:

1. Able to define, elaborate, and analyse the basic law, method, and circuit theories in direct current circuit.

2. Able to understand, evaluate and solve the problems related to direct current circuit.
3. Able to define, elaborate, and analyse the basic law, method, and circuit theories in alternate current circuit.
4. Able to understand, evaluate and solve the problems related to alternate current circuits.

ESA 122/3 FLUID MECHANICS

Objective:
To introduce the concept of fluid mechanics and provide knowledge on the fundamentals of static and dynamic flows.

Synopsis:
Introduction to the properties of fluid mechanics, hydrostatic pressure, fluid static forces (including buoyancy), flow measurements, introduction to laminar and turbulence flows, the Bernoulli equation and its applications, dimensional analysis, and losses in pipe flow.

Course Outcomes:
1. Apply knowledge of mathematics, science, and engineering fundamentals to solve complex engineering problems particularly in fluid mechanics.
2. Identify, formulate, and analyse fluid mechanics complex engineering problems to an extent of obtaining meaningful conclusions using principles of mathematics, science, and engineering.

EMM 102/3 STATIC
(Offered by the School of Mechanical Engineering)

Objective:
To provide the students with the basic knowledge in the mechanics of rigid body, especially in the concept of statics and strength of materials. Considerations are given in order the students to effectively implement the basic of mechanics such a free-body diagram and force vector to analyze the static force system in 2D and 3D equilibriums.

Synopsis:
This course is an introductory to engineering mechanics where 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, centre of gravity, centroid, second moment of area, stress and strain, axial loading and mechanical properties of materials.

Course Outcomes:
1. Able to express and resolve the position and force into vector unit components.
2. Able to define the system of forces and moments and calculate the resultants of force using the concept of equilibrium system.

3. Able to draw and describe the free-body diagram and to solve the problems using the equations of equilibrium.
4. Able to determine the forces in the members of trusses and frames using the method of joints and sections.
5. Able to determine the location of center of gravity and centric for a system and to determine the moment of inertia for an area.
6. Able to define normal, shear, bearing and thermal stresses and deformation of axially loaded members, and able to express the stress-strain diagram.

ESA 112/2 COMPUTER-AIDED ENGINEERING DESIGN

Objective:
To introduce and hence, to provide knowledge of the basic concepts of design and introduction to computer aided design (CAD) as well as SOLIDWORKS software.
Considerations are given on the production of 3-dimensional design from engineering drawings as well as to enhance the communication skills, team participation and writing technique of technical report.

Synopsis:
This course introduces basic concept in design process, techniques and tools used. It exposes the student to design new products or/and improve the existing products through conceptual design. This course will expand the application of computer aided design (CAD) software such as CATIA in the design processes starts with sketching the design idea towards producing a final model. This will provide the student with a better understanding of CAD software applications, able to create 3 dimensional products, assemble the models and be able to produce mechanical drawing of high enough quality to be used in a design portfolio.

Course Outcomes:
1. Identify the elements of the design process.
2. Apply concepts for solving design problems in group projects.
3. Design engineering products using CAD software with sketching, parts, and surface modeling, create assembly models, and engineering drawing.
4. Develop proper project budgeting to design cost-effective products.

ESA 124/2 AEROSPACE LABORATORY I

Objective:
To provide skill and practical experiences through relevant laboratory experiments so that the students can relate the theoretical concept they learnt in the class.

Synopsis:
Experiments in related topics of thermodynamics, fluid mechanics, solid mechanics, dynamics, manufacturing, electrical and electronics.

Course Outcomes:

1. Apply the knowledge of solid mechanics, fluid mechanics, thermodynamics, and electrical technology in solving mechanical engineering fundamental problems.
2. Create, select, and apply appropriate techniques, resources, and modern engineering and computational tools to complex engineering activities with an understanding of the limitations.
3. Investigate mechanical engineering fundamental problems through research methods.
4. Communicate effectively through writing technical reports.
5. Function as individual and team by participating actively in laboratory activities.
6. Apply ethical principles and commit to professional ethics, responsibilities, and norms of engineering practice.
7. Describe the purpose and outcomes of the experiment that may contribute to lifelong learning.

WUS 101/2 ENTREPRENEURSHIP

This course aims to provide basic exposure to students in the field of entrepreneurship and business, with emphasis on the implementation of the learning aspects while experiencing the process of executing business projects in campus. The mode of teaching is through interactive lectures, practical, business plan proposal, execution of entrepreneurial projects and report presentations. Practical experiences through hands-on participation of students in business projects management will generate interest and provide a clearer picture of entrepreneurship world. The main learning outcome is the assimilation of culture and entrepreneurship work ethics in their everyday life. This initiative is made to open the minds and arouse the spirit of entrepreneurship among target groups that possess the potentials to become successful entrepreneurs. Therefore, it is hoped that it will accelerate the effort to increase the number of middle-class entrepreneurs in the country.

For more information, please refer to the Co-curriculum Program Reference Book.

YEAR 2 (SEMESTER I)

EPP 201/3 MANUFACTURING TECHNOLOGY I

(Offered by the School of Mechanical Engineering)

Objective:
To introduce to the students the fundamental concepts and implementation of basic manufacturing processes.

Synopsis:
Introduction to the manufacturing processes and techniques that are used in the industries for turning raw materials into final products. Basic principles of forming, casting and joining processes, machining process, measurement principles, measurement apparatus, limit and tolerance, early exposure to the latest technology in manufacturing systems.

Course Outcomes:
1. Able to recognize the attributes of manufactured products such as mechanical and physical properties, geometrics, and shapes.
2. Able to differentiate ferrous and non-ferrous alloys, their properties and processing.
3. Able to distinguish the various kinds of fundamental casting processes and the defects from casting.
4. Able to formulate and calculate basic mechanisms of bulk deformation processes such as forging, extrusion, rolling and drawing.
5. Able to formulate and calculate various techniques of sheet metal working processes such as cutting, bending, and drawing.
6. Able to analyze metal removal processes such as machining and evaluate tool life.
7. Able to describe and categorize various joining processes such as welding, brazing, soldering and mechanical joining processes.

ESA 225/3 STRENGTH OF MATERIALS

Objective:
To enhance student knowledge on the basic principles of solid mechanics and design problem solution.

Synopsis:
The course covers the following topics: stress and strain concepts, statically indeterminate axially loaded members, thermal stress, torsion, angle of twist, statically indeterminate torque-loaded members, bending, transverse shear, shear flow in build-up members, combined loadings, stress and strain transformation and deflection of beams and shaft.

Course Outcomes:
1. To understand the basic concepts and principles of strength of materials.

2. To be able to calculate stresses and deformations of objects under external loadings.
3. To give an ability to analyse combined loadings and stress transformation as well as principal stresses.

ESA 213/3 THERMODYNAMICS AND HEAT TRANSFER

Objective:
To introduce the fundamental concepts of energy, work and heat, as well as to provide understanding on the thermodynamic concepts including first and second thermodynamic laws.

Synopsis:
To introduce types of energy, basic concepts of thermodynamics, first law of thermodynamics, fluid properties, thermodynamics process, second law of thermodynamics and thermodynamics cycles. Furthermore, this course will introduce the basic concept of heat transfer, one-dimensional steady-state conduction, convection and radiation and heat exchanger system.

Course Outcomes:
1. Able to apply knowledge of mathematics, science, and engineering fundamentals to solve problems on the basic principle and concept of thermodynamics, first law of thermodynamics, properties of ideal gas, second law of thermodynamics and thermodynamics cycles.
2. Able to solve complex engineering problem in computing and analysing thermodynamics process based on the first law of thermodynamics, properties of ideal gas, second law of thermodynamics and thermodynamics cycles.
3. Able to apply knowledge of mathematics, science, and engineering fundamentals to solve problems on the basic principle and concept of conduction, convection and radiation heat transfer and heat exchangers system.
4. Able to solve complex engineering problem in computing and analysing problems on the basic principle and concept of conduction, convection and radiation heat transfer and heat exchangers system.

EUP 222/3 ENGINEERS IN SOCIETY

(Offered by the School of Civil Engineering)

Objective:
To provide knowledge on ethics, management, law, and financial accounting related to engineering industry and the related framework necessary for the effective conduct to the society and industry.

Synopsis:
This course provides exposure to students the fundamentals principles of engineering ethics such as code of engineering ethics and the responsibility of a professional engineer, basic

law covering introduction to Malaysian Laws, engineering accounts and basic introduction to management theory.

Course Outcomes:

1. Introduce the fundamental theoretical principles related to engineering ethics, basic law, for engineering accounting and basic management.
2. Practice the real understanding of the fundamental theoretical principles related to engineering ethics, basic law for engineers, engineering accounting and basic management.
3. Appreciate the importance of the fundamental theoretical principles in the actual construction industry.

ESA 227/2 INTRODUCTION TO AEROSPACE ENGINEERING

Objective:

This course provides students with basic understanding and general working principles about aerospace engineering and technology.

Synopsis:

This course introduces the basic elements of aeronautics and astronautics in Aerospace Engineering. In Aeronautics, students will be introduced to the history of flight, standard atmosphere, flow regimes, air foils, wings, propulsion, aircraft structures, systems, stability and control. In Astronautics, students will be introduced to the basic principle of space engineering, the overview of the space mission, and the working principle of spacecraft main component.

Course Outcomes:

1. Able to apply knowledge of aeronautics' basic elements that cover the history of flight, standard atmosphere, flow regimes, air foils, wings, and propulsion to solve problems related to aircraft.
2. Able to apply understanding of the basic elements of aeronautics in aircraft structures, systems, stability, and control to solve problems related to aircraft.
3. Able to apply fundamental concepts of engineering to describe the working principle of the main components that form spacecraft subsystem.
4. Able to apply understanding of the spacecraft subsystem elements for a specified mission.

LSP 404/2 TECHNICAL AND ENGINEERING ENGLISH

Please refer to section 3.0

HFF 225/2 PHILOSOPHY AND CURRENT ISSUES

Objective:
This course aims to program the mindset of the graduate students in the mission to develop generation to have civilized mindset of critical thinking, creative, innovative, healthy, and mature.

Synopsis:
The course discusses the fundamentals of philosophy. The main topics in this course are epistemology, metaphysics, ethics, methods of thinking, and the concept of the human person, and these are discussed in the context of current issues. Emphasis is given to philosophy as a basis for inter-cultural dialogue, to foster common values, and its relation to the National Education Philosophy and Rukun Negara. At the end of this course, students will be able to understand the importance of philosophy in culture and life.

Course Outcomes:
1. Enlightening current issues based on philosophical knowledge, National education philosophy and National principles (Rukun Negara).
2. Enlightening current issues based on mainstream thinking in different philosophical branches.
3. Elaborating current issues through comparative perspective value philosophy as a basis to establish an inter-cultural dialog.

YEAR 2 (SEMESTER 2)

ESA 226/3 DYNAMICS AND MECHANISM

Objective:
This course will provide the student with fundamental concepts and principles of particle and planar rigid-body dynamics of a mechanism. In addition to that, the students will be introduced about the mechanism kinematic analysis the applications of mechanisms in mechanical engineering environment.

Synopsis:
Introduction to dynamics, particle kinematics, particle kinetics, rigid body kinematics, plane rigid body movement - forces 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 analysis, velocity, and acceleration analysis.

Course Outcomes:
1. Able to explain the kinematic movement of a rigid body particle by using motion equations for the solution of dynamic problems.
2. Able to apply equation of motion and the principles of work, energy, impulse and momentum in solving dynamic problems.
3. Able to determine graphically and analytically the position, displacement, velocity and acceleration and also force analysis of a four-bar mechanism using CAD software.
4. Able to apply and analyze, different types of cams, gear train mechanisms in the design mechanism design.

EMT 212/3 COMPUTATIONAL ENGINEERING
(Offered by the School of Mechanical Engineering)

Objective:
To bridge students' theoretical and analytical skills gained from basic calculus, linear algebra, differential equations, and discrete techniques into physical and engineering exposures.

Synopsis:
This course exposes the students to the collective applications of calculus, differential equations, linear algebra, and discrete methods in engineering problem solving techniques. It presents the relationship of problems in continuum physics described in differential equations with problems in discrete domains and its solutions using the linear algebra concepts.

Course Outcomes:
1. Able to identify four special matrices and their relations to physical problems.
2. Able to characterize the properties of these matrices and their relations to the solution methods.

3. Able to identify nonlinear problems and their relations with algebraic solutions.
4. Able to mathematically describe a boundary value problem in various physical interpretations and setup the solution steps for the corresponding algebraic problems.
5. Able to mathematically describe an initial value problem in various physical interpretations and setup the solutions for the corresponding algebraic problems.
6. Able to solve large systems of linear equations using matrices.

ESA 272/2 AIRCRAFT SUBSYSTEM ELEMENTS

Objective:
The main course's objective is to teach students the relationships between the various sub-systems of aircraft and concentrate on those sub-systems that are fundamental to the best performance of the primary aircraft tasks.

Synopsis:
This course provides students with comprehensive knowledge to familiarize students with all systems involved in aircraft. In this course students will be exposed about aircraft systems such as hydraulic system, pneumatic system, engine control system, fuel system, landing system, flight control system, avionic technology etc.

Course Outcomes:
1. Students will be able to apply engineering knowledge to identify components and determine requirement of each system in aircraft systems.
2. Students will be able to demonstrate the knowledge and need for sustainable development in providing professional engineering solutions related to aircraft systems.
3. Students will be able to communicate effectively to show their understanding on principle operation and functions of aircraft systems.
4. Students will be able to function successfully and efficiently as an individual, and as a member or leader in multi-disciplinary teams to deliver tasks given.

ESA 256/3 CONTROL SYSTEM THEORY

Objective:
To provide the knowledge and analytical foundation to the students of aerospace in control system theory for engineering applications.

Synopsis:
This course equips the students of Aerospace, Aeronautical and related engineering disciplines with fundamental knowledge in control systems. It covers from the theoretical perspective which requires the student to understand modelling process using both analytically and numerically using modern tools such as Matlab and Simulink. In addition, the students will be exposed to a simple hands-on project where they can apply the control theory into a micro-controller.

Course Outcomes:

1. Students should be able to obtain and grasp the fundamental knowledge in control system theory.
2. Students should be able to analyze and solve control-related engineering problems using mathematical model such as differential equation, Laplace transform and state space.
3. Students should be able to design/optimize the parameters of the control system based on the specific requirement using root locus, Routh-Hurwitz criterion and the Bode plot.
4. Students should be able to demonstrate their capability and competency using modern tools to solve control-related engineering problem e.g., Matlab, Arduino IDE.

ESA 244/3 AERODYNAMICS

Objective:

The main objective of this course is to expose students the fundamental understanding of aerodynamics from first principle.

Synopsis:

Aerodynamic is the study of the airflow around a body. In this case, the study will focus on the inviscid, incompressible flow at subsonic speed. The aerodynamic topics in this course are relevant to a wide variety of applications from automobiles to sports balls and birds.

Course Outcomes:

1. Able to apply knowledge of mathematics, science, and engineering fundamentals to solve aerodynamics problems for inviscid and incompressible flow.
2. Able to apply theoretical aerodynamics knowledge into real life application through glider project assignment.
3. Able to analyse the aerodynamic characteristics of an aircraft and investigate the effect of aircraft geometric parameters on aerodynamic performance.
4. Able to discuss and work in teams to solve problems related to the aircraft aerodynamics.

ESA 228/2 MACHINE COMPONENT DESIGN

Objective:

To familiarize students with the commonly used machine elements in mechanical design and to learn specific design procedures with particular attention paid to material structure and properties, loading modes and stress states.

Synopsis:

By the end of this course, students will be able to: Identify critical static and dynamic stresses in a mechanical component, determine suitable dimensions and materials to ensure

that a mechanical component meets its design requirements and will be able to design mechanical systems.

Course Outcomes:

1. Students should be able to Understand component behavior subjected to loads and identify the failure criteria, understand concepts of principal stresses, theories of failure, stress concentration, fatigue loading and analyze various types of stresses induced in machine elements to failure prevention for static and fatigue loading.
2. Students should be able to consider the design of common machine elements such as shafts, fasteners, springs, and welding.
3. Students should be able to select and apply appropriate techniques, resources, handbooks, and modern engineering tools to complex engineering activities to design mechanical elements.
4. Students should be able to communicate and function effectively in written to explain engineering activities associated with the machine element design project.

HFE 224/2 APPRECIATION OF ETHICS AND CIVILISATIONS

Objective:

Explain the concept of ethics from different civilizations through comparison of systems, levels of development, social and cultural progress across nations. Finally, students are able to discuss contemporary issues related to economic, political, social, cultural and environmental from an ethical and civilization perspective.

Synopsis:

This course discusses ethical concepts from different civilizational perspectives. It aims to identify the systems, stages of development, and rational cultures. Contemporary economic, political social, cultural and environmental issues will be discussed from the ethical and civilizational perspectives. At the end of this course, students will be able to appreciate the values of ethics and civilization.

Course Outcomes:

1. Explain the concept of ethics from different angles of civilization.
2. Compare the systems, stages of development, social and cultural progress that cross the nation.
3. Discuss contemporary issues related to economic, political, social, cultural and environmental from an ethical and civilization perspective.

SEA 205E/4 MALAYSIAN STUDIES

Please refer to section 3.0 (For international students only).

YEAR 3 (SEMESTER 1)

ESA 321/3 AEROSPACE STRUCTURE

Objective:
To understand the different structural elements, loads and analysis techniques that are associated with light-weight aerospace vehicles (aircrafts, launch vehicles, spacecraft, etc.).

Synopsis:
This course is structured to provide a thorough understanding of the different structural elements, loads and design analysis techniques that are associated with light-weight aerospace vehicles (aircrafts, launch vehicles, spacecraft, etc.). Applications to other structural systems (civil, mechanical, etc.) can be drawn. The course develops a student's ability to apply principles of mathematics, strength of materials, engineering mechanics and theory of elasticity to design and analyze aerospace structural components, assemblies, and systems.

Course Outcomes:
1. Able to understand basic aspects of loads and structural elements in aerospace vehicle, able to recognize structural features pertaining to load carrying capacity and able to understand of the causes and types of different loads acting on aerospace structures.
2. Able to understand the basic theory of elasticity and able to apply it for developing engineering formulations. Able to idealize and analyse thin-walled aerospace structural elements using formulations from theory of elasticity.
3. Able to design solutions for complex engineering problems and design systems, components, or processes to within the prescribed specifications relevant to aerospace structure.
4. Able to analyse aerospace structural elements using Finite Element Method.

ESA 313/3 MECHATRONICS

Objective:
Giving exposure to students about the integration system between electronic systems, sensors, mechanical systems, and the use of software that can produce a mechatronic system that performs a process and application automatically. In addition, with this exposure, students can understand the importance of mechatronic systems in industry, especially in the aerospace sector.

Synopsis:
To offer students with the knowledge of basic instrumentations, working principles, suitable signal in measurement system, design, plan drawing and installation of hydraulics and pneumatics circuits including mechanical movement. Ability to produce mathematical modelling for engineering system and to determine the model response on experiments. To

use the latest machine controllers such as programmable logic circuits (PLC). Also, to introduce maintenance techniques of pneumatic and hydraulic systems and failure detection techniques to the programmable logic circuits.

Course Outcomes:

1. Able to understand the terms mechatronics and the systems related to mechatronic.
2. Able to understand and design pneumatic and hydraulic circuits that make up mechatronic systems using different actuators and control elements.
3. Ability to operate a Programmable Logic Controller (PLC) practically using a ladder diagram.
4. Able to operate microcontrollers and develop digital logic functions software code such as Arduino and raspberry Pi.

ESA 355/3 FLIGHT PERFORMANCE

Objectives:

The purpose of the course is to introduce and build students' skills/competencies in understanding, analysing, and solving problems related to point-mass aircraft flight performance. Team projects are provided to build students' competence in applying knowledge and theory learned practically and numerically to solve real cases and to strengthen teamwork skills.

Synopsis:

The course covers the study of the theory of flight performance including the development of equations of motions (EOM) for key aircraft manoeuvres (e.g., cruising, climbing, gliding, turning, pulling up/down, accelerating, etc), and the theory, analysis, problem solving, and related topics on steady and unsteady flight manoeuvres. This course involves practical learning activities through the hands-on projects, numerical computation, and team-based projects.

Course Outcomes:

1. Able to analyze problems related to the performance of propeller and jet aircraft in their steady and accelerated flights.
2. Able to apply the theories learnt to assess and suggest methods to improve flight performance on case studies and develop computer programs using MATLAB to analyze flight performance.
3. Able to demonstrate the outcomes of their projects accurately and effectively through presentations and reports, as well as articulate the individual progress of their learning process in reflective journals.
4. Able to develop teamwork to complete programming projects, presentations, and reports.

ESA 389/3 ORBITAL MECHANICS

Objective:
To provide knowledge about mechanical orbitals to students and solve mechanical orbital problems using the basic principles of mathematics and physics.

Synopsis:
This course provides students with detailed knowledge concerning the trajectory motions of the spacecraft moving under the influence of gravity and the concept of the impulsive thrusting used in orbital and interplanetary transfers.

Course Outcomes:
1. Students are able to apply knowledge of fundamental mathematics and physics to solve problems in orbital mechanics.
2. Students are able to formulate and analyze orbital mechanics problems to obtain concrete and conclusion using principles of mathematics and physics.
3. Students are able to select and apply appropriate computational tools to demonstrate orbital analysis problems.

ESA 317/2 AEROSPACE LABORATORY II

Objective:
This course gives students the opportunity to apply basic knowledge in the field of mechanical engineering such as solid mechanics, material properties, fluid mechanics, thermodynamics, and electrical circuits. Students are also exposed to academic writing techniques for laboratory reports.

Synopsis:
This is a practical subject designed to let the students apply fundamental understanding in the areas of solid mechanics, fluid mechanics, thermodynamics, and electrical circuits. The students will learn on a 'hands-on' basis the actual application and observe the differences between theoretical and practical knowledge in mechanical engineering. They are expected to find references that will enable further understanding of the topic as well as an explanation of the differences between theoretical and experimental results. The results and discussions on the experiments are reported in a laboratory report based on academic writing format. An objective test is conducted at the end of the course to ensure that the students grasp the major lessons learned in the labs.

Course Outcomes:
1. Able to apply the knowledge of solid mechanics, fluid mechanics, thermodynamics, and electrical technology in solving mechanical engineering fundamental problems.
2. Able to apply appropriate techniques, resources, and modern engineering and computational tools to complex engineering activities with an understanding of the limitations.
3. Able to investigate to mechanical engineering fundamental problems through research methods.

4. Able to communicate effectively through writing technical report.
5. Able to function as individual and team by participate actively in laboratory activities.
6. Able to apply ethical principles and commit to professional ethics, responsibilities, and norms of engineering practice.
7. Able to describe the purpose and outcomes of the experiment that may contribute to lifelong learning.

ESA 319/2 AEROSPACE POLICY AND MANAGEMENT

Objective:
Give students exposure to economics, management, and national and international aerospace policy.

Synopsis:
The main course objective is to provide knowledge, logical and analytical foundation to the students of Aerospace Engineering. The materials covered are technology of aerospace engineering disciplines on economics, legal aspects, management and policy as related to aviation, aircraft operation, air-transportation system and space science, application and technology.

Course Outcomes:
1. Students will be able to investigate complex aerospace problems based on aerospace legal aspect and policy.
2. Students will be able to respond to the current critical issues in the aerospace society regarding policy and management.
3. Students will be able to discuss code of ethics and ethical standards regarding aerospace policy and management problems.
4. Students will be able to apply their knowledge and understanding on aerospace related cost analysis and project managements.

YEAR 3 (SEMESTER 2)

ESA 374/3 FLIGHT STABILITY & CONTROL

Objective:
To give exposure to students in topics related to flight stability and control.

Synopsis:
This course provides students with comprehensive knowledge of longitudinal and lateral-directional static stability and dynamic stability of an aircraft as well as their control characteristics.

Course Outcomes:
1. Able to apply knowledge of aerodynamic forces and moments to define the static stability and control of an aircraft.
2. Able to analyze a given aircraft configuration to determine its static stability and control characteristics.
3. Able to formulate the nonlinear 6-DOF kinematics and dynamics equations for fixed wing aircraft and use perturbation methods to reduce nonlinear dynamics equations to linearized equations of motion.
4. Able to solve the aircraft equations of motion and analyze its dynamics responses.
5. Able to utilize computational tools to effectively solve flight stability and control problems.

ESA 382/3 SPACECRAFT SUB-SYSTEM DESIGN

Objective:
To introduce and strengthen students' understanding of spacecraft design including its subsystems. This course will enhance the knowledge of students in terms of the design process of a spacecraft system.

Synopsis:
This course teaches the design process of each spacecraft's subsystem. Students will be exposed to the technical principles of bus subsystems, trade-off analysis, and analysis of physical and technical limitations of subsystem components. They will be introduced also to the key performance parameters of each subsystem.

Course Outcomes:
1. Able to perform conceptual and preliminary spacecraft design to meet a set of mission requirements within realistic constraints as well as design analysis of one or more spacecraft subsystem.
2. Able to analyse important social, health safety and legal issues related to space engineering and determine ways that engineers might contributes to a solution as well as demonstrate environmental awareness and the need for sustainable solutions in designing spacecraft systems.

3. Able to work effectively in teams by holding efficient meetings, distributing work effectively, setting realistic goals and deadlines, and managing conflicts smoothly.
4. Able to develop a milestone schedule (timeline) for a space mission and perform cost analysis of aerospace systems at the component/subsystem level.
5. Able to apply appropriate techniques, resources, and modern engineering tools to well-defined space engineering problems, with an awareness of the limitations.

ESA 322/3 STRUCTURAL DYNAMICS

Objective:
This course provides a background and understand the concept and theory of dynamic and aeroelastic structures.

Synopsis:
This course is divided into two parts. The first part will cover the theory of structural dynamics. The second part of the course covers the basic of aeroelasticity. Students will learn the basic concept of aeroelasticity and phenomena which occur on aircraft structures such as divergence and flutter.

Course Outcomes:
1. Identify vibration response for a single degree-of-freedom (DOF) system in terms of displacement, velocity, and acceleration and frequency.
2. Calculate the natural frequency and mode shape for a 2-degree of freedom system and design a vibration absorber system.
3. Able to describe aeroelastic phenomena such as divergence and aileron reversal.
4. Adopt a rational and ethical attitude with sensitivity to problems to meet the requirements of a specific task in a structural design project.
5. Apply flutter phenomenon mechanism, testing and techniques used to prevent flutter in the design of aircraft wings.

ESA 312/2 AEROSPACE LABORATORY III

Objective:
To provide advanced skill and practical experiences through relevant open-ended laboratory experiments so that the students can relate the theoretical concept they learnt in the class and provide solutions based on their own understanding.

Synopsis:
The students will learn on a 'hands-on' basis the actual application and observe the differences between theoretical and practical knowledge in solving aerospace engineering problems. This laboratory consisted of open-ended and traditional laboratories. An open-ended lab is where students are given the freedom to develop their own experiments, instead of merely following the already set guidelines from a lab manual or elsewhere. Students are expected to find references that will enable further understanding of the topic as well as explanation of the differences between theoretical and experimental results.

Course Outcomes:

1. able to apply engineering mathematics and sciences to solve complex engineering problems.
2. able to investigate and evaluate complex engineering problems using combination of research methods and scientific skills.
3. able to utilize appropriate techniques, resources, and modern engineering tools to solve complex engineering problems.
4. Able to communicate effectively through engineering reports.
5. Able to discuss efficiently with respect, self-confidence, and attitude within the team.
6. Able to recognize the need to autonomously learn with an inquisitive mind to solve complex engineering problems.
7. Able to comply with ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

ESA 344/2 PROPULSION SYSTEM

Objective:

This course gives students exposure to the basic theory in aerospace propulsion systems.

Synopsis:

This course will teach students on the fundamentals of aerospace propulsion. Topics will be covered: Engine cycles, air breathing propulsions such as turbofan and turbojet engines and piston engines. Students will be taught on estimating the performance and emissions generated from the engine. Moreover, student will be introduced to rocket propulsion elements and estimation of performance and preliminary design parameters of rocket propulsion including sizing.

Course Outcomes:

1. Able to apply understanding of jet engine operating principles to analyze and assess the performance of jet engines and characteristics of their components (which includes fan, inlet, compressor, combustor, turbine, and nozzle).
2. Able to solve problems related to performance of rocket engines and propeller-piston engine.
3. Able to discuss environmental issues involved in aerospace propulsion system and incorporates that into design process.
4. Able to utilize modern tools to simulate, analyze and estimate the performance of aerospace propulsion system.

ESA 326/2 AEROSPACE STRUCTURAL DESIGN

Objective:
The main objective of this course is to expose students the philosophy and processes of structural design, either for aircraft or spacecraft, as part of the curriculum requirement and as a fundamental background to aerospace vehicle design.

Synopsis:
This course teaches students to design aerospace structure with appropriate strength through modelling and investigative analysis by applying principles of mathematics, strength of materials, and engineering mechanics and utilizing computational tools.

Course Outcomes:
1. Able to develop computer code/procedure for analyzing aerospace structure by doing information review.
2. Able to analyze aerospace structural stress.
3. Able to evaluate the strength of aerospace structure.
4. Able to validate aerospace structural design using safety factors (within the airworthiness specifications) for the benefit of society.
5. Able to create/design and analyze aerospace structure using computational tool/software.

YEAR 4 (SEMESTER 1)

ESA 412/6 FINAL YEAR PROJECT

Objective:
The main objective of this course is to expose the students on how to conduct a research project including the literature review, experiment setup, analysis, engineering tools, thesis writing, presentation so that the student will learn how to organize a project in the aerospace and engineering related fields.

Synopsis:
The final year projects provide a student the opportunities to apply knowledge acquired in their undergraduate study. It aims at developing and measuring the capabilities of the students in aerospace engineering research projects. The individual project will involve searching for relevance literature, identifying, and defining problems, designing and developing solutions with appropriate planning and project's management skills.

Course Outcomes:
1. Able to identify, formulate and analyse the problems of the project to an extent of obtaining meaningful conclusions using principles of mathematics, science, and engineering.
2. Able to design solutions for problems of the project and design systems, components, or processes to within the prescribed specifications with appropriate considerations for public health and safety, society, and environmental impact.
3. Able to investigate the project using research-based knowledge and research methods to provide justified conclusions.
4. Able to discuss the project effectively in both orally and in writing that can be understood by the engineering community and society.
5. Able to recognize the need for autonomous learning to solve the final year project through literature reviews.
6. Able to practice the aspect of project management via documenting the research activities/progress through the project logbook.

ESA 471/3 AIRCRAFT DESIGN I

Objective:
The main objective of this course is to teach students the methodology and decision making involved in the process of designing conceptual aircraft.

Synopsis:
The main aim of this course is to offer students a learning environment to learn how to design a conceptual aircraft Theories on conceptual aircraft design will be covered in the early part of the semester. The major focus of this course will involve students working in multidisciplinary teams to design unmanned aircrafts (UAV) with real and practical purposes. Student assessments are based on constructively align activities to achieve those outcomes stated below.

Course Outcomes:

1. Able to design solutions for complex engineering problems and design systems, components, processes to within the prescribed specifications relevant to UAV design project.
2. Able to investigate complex aerospace engineering problems using research-based knowledge and research methods to provide justified conclusions to meet the needs of specific tasks in the UAV design project.
3. Able to recognize and adopt a rational attitude with sensitivity to the problems to meet the needs of specific tasks in the UAV design project via initiative to be engaged and able to act as an agent of change in the team.
4. Able to demonstrate the knowledge of and need for sustainable development in providing professional engineering solutions to meet the needs of specific tasks in the UAV design project.
5. Able to communicate effectively both orally and in writing on UAV design project activities.
6. Able to function effectively as an individual, and as a member or leader in multi-disciplinary settings of the UAV design project.
7. Able to recognize the need for and is capable to undertake life-long learning in the broadest context of knowledge and technological change by articulate the personal progress of their learning process in quiz and reflective journals.

ESA 481/3 SPACECRAFT DESIGN

Objective:

This course aims to introduce students to the actual design process in a practical way in producing spaceships.

Synopsis:

This course teaches students the key topics related to spacecraft and mission design, including requirements development, trade studies, the project life cycle, system hierarchy, risk analysis, and cost analysis. The course has been designed to expose the students to complex problems and complex engineering activities through a capstone design project.
Synopsis:

Course Outcomes:

1. Able to apply and integrate the knowledge of Orbital Mechanics, Spacecraft Subsystem Element, and Spacecraft Subsystem Design in designing and developing a spacecraft.
2. Able to establish a working knowledge of the methods and tools systems engineers in evaluating and validating the design.
3. Able to identify the spacecraft engineer's responsibility for the safety of the public.
4. Able to demonstrate the knowledge of and need for sustainable development and the protection of the environment in designing and building a mission and spacecraft.
5. Able to communicate effectively through reports, presentations, and viva.
6. Able to function in teams to solve engineering problems.

7. Able to exhibit project management skills and develop the ability to contribute to the development of complex space missions.

ESA 493/5 INDUSTRIAL TRAINING

Objective:
To provide the students with real-working experience in the industrial environment and organization as well as the functionality of the engineers in industries.

Synopsis:
The objective of this course is to expose students to real life experience working in a local industry. It is compulsory for all students in which they must complete a minimum of 10 weeks during their long semester breaks at related industries approved by the school.

Course Outcomes:
1. Able to able to be responsible and take the initiative/volunteer to be engaged and able to act as a trainee in the company.
2. Able to be ethical in carrying out their responsibilities, carry out duties as prescribed, have a good relationship with superiors and other associates and follow rules practiced in the company.
3. Able to communicate in writing and verbally with superiors and other associates.
4. Able to build good relationship, interact with superiors and other associates and work effectively with them.
5. Able to show their attention, curiosity, interest, optimism, and passion towards the learning process in the industry.

YEAR 4 (SEMESTER 2)

ESA 490/2 AEROSPACE MANUFACTURING TECHNOLOGY

Objective:
To introduce the students with the knowledge, concept and application of aerospace manufacturing technology and processes.

Synopsis:
This course will provide an outline of the manufacturing technologies utilized in the aerospace industries. Emphasis will be given on the overview of the Aerospace Manufacturing Technology, Aerospace Manufacturing System, Standard Materials in Aerospace Manufacturing, Aerospace Precision Engineering, Aerospace Manufacturing Standard and Requirement, and Aerospace Assembly and Testing.

Course Outcomes:
1. Able to create, select and demonstrate their understanding on Aerospace Manufacturing Technology through analyzing complex engineering problems.
2. Able to undertake lifelong learning in Aerospace Manufacturing Technology in developing sustainable engineering solutions.
3. Able to demonstrate their work in front of the classroom, discussion in group, oral presentation and technical reports related to perspective of Aerospace Manufacturing Technology.
4. Able to recognize the lifelong learning related to perspective of Aerospace Manufacturing Technology.

ELECTIVE 1

ESA 303/3 HIGH SPEED AERODYNAMICS

Objective:
The purpose of the course is to introduce and build students' skills/competencies in understanding, analysing and solving problems related to compressible flows, i.e. high-speed flows above Mach 0.3 and supersonic flows. High-speed aerodynamic phenomena are important for high-speed aircraft such as jet and supersonic aircraft, and also for air flow in aerospace propulsion systems. Team projects are provided in the course to build students' competence in applying knowledge/theory learned practically and numerically to solve real cases and also to strengthen teamwork skills. This course is important to prepare students for related courses, especially the Motivation System course.

Synopsis:
The course covers the study of the theory of high-speed aerodynamics based on three main parts: (1) sound wave propagation and isentropic flows, (2) shock and expansion waves, and (3) variable-area flows (e.g., in jet engines). This course involves practical learning activities through the numerical computation and team-based projects.

Course Outcomes:

1. Able to analyze and solve challenging problems related to high-speed aerodynamics such as shock and expansion waves in tubes and on supersonic lifting surfaces.
2. Able to develop computer programs using Matlab to analyze high speed flows and solve engineering problems numerically and effectively through Team Projects.
3. Communicate the process and outcomes of Team Projects accurately and effectively through oral presentations and technical reports and communicate their learning progress through reflective essays.
4. Work as part of their teams and as professional individuals by fully participating in Team Projects and in class discussions.

ESA 305/3 MODERN CONTROL FOR AUTOPILOT

Objective:
To improve students' knowledge and ability to design and analyse control systems using modern control methods.

Synopsis:
This course provides students with basic principles of state-space control design, analysis of feedback control systems, and solving control problems using Proportional-Integral-Derivative and nonlinear approaches. At the completion of this course, the student should be able to use Matlab and other tools to analyze systems and design autopilot systems.

Course Outcomes:

1. Able to formulate the state-space representations for linear control problems and linearization from non-linear control problems.
2. Able to analyze the stability, controllability, observability of open loop systems, and determine time responses.
3. Able to solve state-space feedback control problems.
4. Able to solve control problems using Proportional-Integral-Derivative (PID) and nonlinear approach.
5. Able to utilize computational tools to effectively solve practical control problems.

ELECTIVE 2

ESA 302/3 AVIONIC SYSTEMS

Objective:
This course aims to introduce students the theory and practical in avionics system which is electronic and communication system in the aircraft.

Synopsis:

This course is designed to expose students to the key topics related to the avionics system, namely the electronic system fitted in an aircraft to enable aircraft to function. Students are able to understand the role and operation of each aircraft instruments, navigation, cockpit display, control, flight management and communication systems in the aircraft, theoretically and practically. Visits to the agencies involved will bridge the gap between the classroom and industry.

Course outcomes:

1. Able to apply and improve the knowledge on the fundamental concepts relating to avionic systems which consist of radio communication, radio navigation system, radar and management of various systems in the aircraft
2. Able to identify the role and operation of each electronic system in the aircraft to enable the aircraft to function.
3. Able to communicate effectively through reports and presentations.
4. Able to function in teams to solve engineering problems.

ESA 304/3 AERO-COMPOSITE ENGINEERING

Objective:

The main course's objective is to expose to the students on the fundamentals, design, manufacturing and testing of composite materials.

Synopsis:

This course provides an overview of composites, design applications, fabrication, structural characteristics, testing and damage assessment of the structural composite used in an aerospace engineering industry. The students will also learn a brief overview of non-polymer composites and their application in the aerospace industry. Hands-on experience on composite materials manufacturing and testing will complement student's learning to enhance their understanding on the subject matter.

Course Outcomes:

1. Able to analyze problems related to the design, performance and manufacturing of composite materials and structure.
2. Able to investigate composite materials problems using research-based knowledge and research methods to provide justified conclusions.
3. Able to demonstrate experimental techniques to solve problems related to design and performance of composite materials.
4. Able to recognize the need to engage in independent and lifelong learning in the context of composite materials design, fabrication, and testing.

ELECTIVE 3

EME 451/3 COMPUTATIONAL FLUID DYNAMICS

(Offered by the School of Mechanical Engineering)

Objective:

To introduce the mathematical theories and application of Computational Fluid Dynamics solving engineering problems.

Synopsis:
The goal of this course is to lay the foundations for the numerical solution of partial differential equations (PDE) and be able to perform computational simulation of PDE in fluid dynamics. By the end of this course, students will be able to classify a given set of PDE's and anticipate the sort of numerical difficulties that are associated with them and apply numerical techniques to overcome the difficulties. Once the foundations have been given to the students, they will use a commercial CFD software (Fluent) to simulate real fluid dynamics problems.

Course Outcomes:
1. Able to classify types of PDE and various fluid dynamics models.
2. Able to analyze fluid dynamics models and discretization methods, and limitations with the models and discretization methods.
3. Able to design a computational fluid dynamic experiment via writing a computer code and using commercial CFD software.
4. Able to do future research and solve real engineering fluid dynamics problems.

ESA 401/3 SATELLITE COMMUNICATION SYSTEM

Objective:
This course aims to provide exposure to the working principle of satellites as a communication system including the design of satellite communication systems.

Synopsis:
This course teaches advanced knowledge of satellite communications systems and satellite payload for communications systems. This course discusses satellite link design, digital transmission, modulation and multiple access techniques. The VSAT systems, mobile communication satellite systems, DBS systems, NGSO satellite systems, and Satellite Internet will be introduced in this course.

Course Outcomes:
1. Able to analyse the problem related to satellite communication systems.
2. Able to apply the concept in satellite link design to optimise the system operation through calculation.
3. Able to communicate effectively through reports and presentations.
4. Able to function in teams to solve engineering problems.

ELECTIVE 4

ESA 402/3 AIRCRAFT DESIGN II

Objective:
To enhance the student knowledge about aircraft design they learn in aircraft design 1 so that the students can further understand the aspects of aircraft design by focusing on preliminary design, detailed design, fabrication, and flight tests.

Synopsis:
Aircraft Design II course will focus on detailed design, fabrication, and flight tests of a UAV. This is a continuation design work from Aircraft Design I Course. The best model from Aircraft Design I will be chosen as a baseline for Aircraft Design II. The student will improve the design to meet the design requirement. Several engineering tools such CATIA, FEA, AAA, and CFD will be used to perform the detail drawing, aerodynamics analysis, structural analysis, and flight stability analysis. Students also must fabricate a scale down model of their aircraft and install the brushless motor as their propulsion system. Students would then give an oral presentation on their UAV design project.

Course Outcomes:

1. Able to analyse complex engineering problems of 1) design the final drawing of aircraft for their UAV model fabrication 2) fabricate a UAV model of their aircraft by using combination of composite, balsa and metal materials, and 3) analyses on their UAV design.
2. Able to investigate electric propulsion sizing problems related to the conceptual design of aircraft using research-based knowledge and research methods to provide justified conclusions to specific tasks of the UAV design project.
3. Able to apply appropriate techniques, resources, and modern engineering and computational tools to complex engineering activities with an understanding of the limitations for 1) to generate the final drawing of their aircraft for RC model fabrication using CAD, 2) to use CFD, FEA, MotoCalc, etc. to perform the design work to analyze their RC aircraft design and 3) to integrate their aircraft airframe with the control and brushless motor-propeller systems
4. Able to apply appropriate reasoning to assess contemporary societal, health, safety, and legal issues to establish responsibilities relevant to UAV design project.
5. Able to demonstrate the knowledge of and need for sustainable development in UAV design project.
6. Able to communicate effectively verbally and in written to explain complex engineering activities associated with the UAV design project.
7. Able to function effectively as an individual, and as a member or leader in multi-disciplinary settings of the UAV design project.
8. Able to recognize the need for and is capable to undertake life-long learning in the broadest context of knowledge and technological change by articulate the personal progress of their learning process in reflective journal.

9. Able to apply knowledge and understanding of project management and finance in the UAV design project.

ESA 404/3 SPACE ENVIRONMENT

Objective:
To strengthen knowledge of the characteristics of outer space and its relevance to spacecraft design and satellite technology.

Synopsis:
This course explains the basic knowledge in space environment and its effect to the spacecraft and orbit design. By taking into consideration the elements in space such as galaxy, natural activity and artificial activity and the effect to satellite design.

Course Outcomes:
1. Able to identify and solve problems related to the space environment and its effect on the spacecraft.
2. Able to understand and evaluate the sustainability and impact of space environment on human daily activity.
3. Able to recognize the need for and is capable of undertake lifelong learning in the context of knowledge related to space environment effect to human and technology.

EME 412/3 APPLIED FINITE ELEMENT ANALYSIS
(Offered by the School of Mechanical Engineering)

Objective:
To systematically highlight and strengthen students' understanding of the methods and applications of software design elements and engineering problem analysis.

Synopsis:
The course covers intermediate level knowledge of the finite element method (FEM). It equips students with the formulations of the FEM including discretization of a physical problem in a unified manner while emphasizing examples in solid mechanics and heat conduction. Analysis in discretization error with energy norm is discussed. The applications of the finite element analysis (FEA) in more complex engineering problems are taught by way of the commercial FEM package, ANSYS. Several case studies are introduced to the students.

Course Outcomes:

1. To understand the finite element method (FEM) using the elements "truss" and "beam" through the direct equilibrium method (Direct Equilibrium Method) on structural engineering problems and heat transfer.
2. To understand the method of finite element (FEM) through energy method (Energy Method) on structural engineering problems and heat transfer.
3. To understand software through script code (Ansys Parametric Design Language) finite element Analysis (FEA), Ansys code for structural problems, heat transfer, thermal stress, dynamics, non-linear problems.

4. Able to use finite element applications (FEA) to solve complex engineering problems using ANSYS software.
5. To be able to work in teams as leaders and members.

5.0 STUDENTS' FEEDBACK

The aim of this feedback form is to obtain students' response regarding the contents of this Guidebook.

Please respond to items 1 – 5 below based on the following 4-point scale:

1 = Strongly disagree	2 = Disagree	3 = Agree	4 = Strongly agree

1. This Guidebook is very useful.

1	2	3	4

2. The information provided in this Guidebook is accurate.

1	2	3	4

3. The information provided in this Guidebook is clear and easy to understand.

1	2	3	4

4. Overall quality of this Guidebook is good.

1	2	3	4

5. Please write your comments to improve this guidebook (if any).
