Transforming Higher Education
for a Sustainable Tomorrow

MATERIALS AND MINERAL RESOURCES ENGINEERING

2022/2023

SCHOOL OF MATERIALS AND MINERAL RESOURCES ENGINEERING

BACHELOR OF MINERAL RESOURCES ENGINEERING WITH HONOURS

BACHELOR OF MATERIAL ENGINEERING WITH HONOURS

BACHELOR OF POLYMER ENGINEERING WITH HONOURS

2022/2023

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USM Vision

Transforming Higher Education for a Sustainable Tomorrow

USM Mission

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

STUDENT'S PERSONAL INFORMATION

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

CONTENT **PAGE**

UNIVERSITI SAINS MALAYSIA

ACADEMIC CALENDAR - ACADEMIC SESSION 2022/2023
FOR ALL SCHOOLS (EXCEPT THE SCHOOL OF MEDICAL SCIENCES AND SCHOOL OF DENTAL SCIENCES)

SEM	WEEK	ACTIVITY	DATE	REMARKS
ONE	1	Teaching & Learning (T&L 7 Weeks)	Monday, 17.10.2022 - Sunday, 23.10.2022	
	2		Monday, 24.10.2022 - Sunday, 30.10.2022	24.10.2022, Monday - Deepavali**
	3		Monday, 31.10.2022 - Sunday, 06.11.2022	
	4		Monday, 07.11.2022 - Sunday, 13.11.2022	11, 12 & 13.11.2022, Friday, Saturday & Sunday - Sultan of Kelantan's Birthday (Kelantan)
	5		Monday, 14.11.2022 - Sunday, 20.11.2022	
	6		Monday, 21.11.2022 - Sunday, 27.11.2022	
	7		Monday, 28.11.2022 - Sunday, 04.12.2022	
	8	Mid Semester Break (1 Week)	Monday, 05.12.2022 - Sunday, 11.12.2022	
	9	Teaching & Learning (T&L 7 Weeks)	Monday, 12.11.2022 - Sunday, 18.12.2022	
	10		Monday, 19.12.2022 - Sunday, 25.12.2022	25.12.2022, Sunday - Christmas
	11		Monday, 26.12.2022 - Sunday, 01.01.2023	26.12.2022, Monday - Christmas 01 & 02.01.2023, Sunday & Monday - New Year of 2023
	12		Monday, 02.01.2023 - Sunday, 08.01.2023	
	13		Monday, 09.01.2023 - Sunday, 15.01.2023	
	14		Monday, 16.01.2023 - Sunday, 22.01.2023	22.01.2023, Sunday - Chinese New Year
	15		Monday, 23.01.2023 - Sunday, 29.01.2023	23 & 24.01.2023, Monday & Tuesday - Chinese New Year
	16	Revision Week (1 Week)	Monday, 30.01.2023 - Sunday, 05.02.2023	04.02.2023, Saturday - Thaipusam**
	17	Examination (3 Weeks)	Monday, 06.02.2023 - Sunday, 12.02.2023	
	18		Monday, 13.02.2023 - Sunday, 19.02.2023	
	19		Monday, 20.02.2023 - Sunday, 26.02.2023	
	20	Mid Semester Break / Industrial Training (4 Weeks)	Monday, 27.02.2023 - Sunday, 05.03.2023	
	21		Monday, 06.03.2023 - Sunday, 12.03.2023	
	22		Monday, 13.03.2023 - Sunday, 19.03.2023	
	23		Monday, 20.03.2023 - Sunday, 26.03.2023	23.03.2023, Thursday - Ramadhan
TWO	24/1	Teaching & Learning (T&L 7 Weeks)	Monday, 27.03.2023 - Sunday, 02.04.2023	
	25/2		Monday, 03.04.2023 - Sunday, 09.04.2023	08.04.2023, Saturday - Nuzul Al-Quran
	26/3		Monday, 10.04.2023 - Sunday, 16.04.2023	
	27/4		Monday, 17.04.2023 - Sunday, 23.04.2023	22 & 23.04.2023, Saturday & Sunday - Eid-ul fitr**
	28/5		Monday, 24.04.2023 - Sunday, 30.04.2023	24.04.2023, Monday - Eid-ul fitr**
	29/6		Monday, 01.05.2023 - Sunday, 07.05.2023	01.05.2023, Monday - Labour Day 04.05.2023, Thursday - Wesak Day
	30/7		Monday, 08.05.2023 - Sunday, 14.05.2023	
	31/8	Mid Semester Break (1 Week)	Monday, 15.05.2023 - Sunday, 21.05.2023	
	32/9	Teaching & Learning (T&L 7 Weeks)	Monday, 22.05.2023 - Sunday, 28.05.2023	
	33/10		Monday, 29.05.2023 - Sunday, 04.06.2023	30 & 31.05.2023, Tuesday & Wednesday - Pesta Kaamatan (Sabah) 01 & 02.06.2023, Wednesday & Thursday - Hari Gawai (Sarawak)
	34/11		Monday, 05.06.2023 - Sunday, 11.06.2023	05.06.2023, Monday - Agong's Birthday
	35/12		Monday, 12.06.2023 - Sunday, 18.06.2023	
	36/13		Monday, 19.06.2023 - Sunday, 25.06.2023	
	37/14		Monday, 26.06.2023 - Sunday, 02.07.2023	28 & 29.06.2023, Wednesday & Thursday - Eid-ul adha**
	38/15		Monday, 03.07.2023 - Sunday, 09.07.2023	07.07.2023, Friday - Penang Heritage 08.07.2023, Saturday - Penang Governer's Birthday
	39/16	Revision Week (1 Week)	Monday, 10.07.2023 - Sunday, 16.07.2023	
	40/17	***Examination (2 Weeks) / Examination (3 Weeks)	Monday, 17.07.2023 - Sunday, 23.07.2023	19.07.2023, Wednesday - Awal Muharram
	41/18		Monday, 24.07.2023 - Sunday, 30.07.2023	
	42/19		Monday, 31.07.2023 - Sunday, 06.08.2023	
*KSCP / LONG SEMESTER BREAK	43/20	Long Semester Break / Industrial Training (10/11 Weeks)	Monday, 07.08.2023 - Sunday, 13.08.2023	
	44/21		Monday, 14.08.2023 - Sunday, 20.08.2023	
	45/22		Monday, 21.08.2023 - Sunday, 27.08.2023	
	46/23		Monday, 28.08.2023 - Sunday, 03.09.2023	31.08.2023, Wednesday - National Day
	47/24	*T&L	Monday, 04.09.2023 - Sunday, 10.09.2023	
	48/25		Monday, 11.09.2023 - Sunday, 17.09.2023	16.09.2023, Friday - Malaysia Day
	49/26	Examination	Monday, 18.09.2023 - Sunday, 24.09.2023	
	50/27		Monday, 25.09.2023 - Sunday, 01.10.2023	27.09.2023, Wednesday - Prophet Muhammad's Birthday
	51/28		Monday, 02.10.2023 - Sunday, 08.10.2023	
	52/29		Monday, 09.10.2023 - Sunday, 15.10.2023	

**This Academic Calendar is subject to changes

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 2022/2023**.** This handbook contains concise information that will prove 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 for them to plan their academic studies, understand the field of studies that they are following 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.

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 2007, 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 Objectives

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 equipments 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 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:

- *Engineering Knowledge* - Apply knowledge of mathematics, science,engineering fundamentals and an engineering specialisation to the solution of complex engineering problems
- *Problem Analysis* - Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;
- *Design/Development of Solutions* - Design solutions for complex engineering problems and design systems, components or processes that meet specified needs

with appropriate consideration for public health and safety, cultural, societal, and environmental considerations;

- *Investigation* - Conduct investigation into complex problems using researchbased knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
- *Modern Tool Usage* - Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations;
- *The Engineer and Society* - Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice;
- *Environment and Sustainability* - Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development;
- *Ethics* - Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice;
- *Communication* - Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;
- *Individual and Team Work* - Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings;
- *Life Long Learning* - Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- *Project Management and Finance* - Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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 least five 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. Feedbacks from the alumni are obtained from the USM Alumni Relations Unit and the School's alumni communities such as email, webpage and Facebook. 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.

1.5 External Examiners

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.

- Scrutinise 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/Centre, 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/centre during the first academic session of his appointment.

- Scrutinise 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 staffs/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:

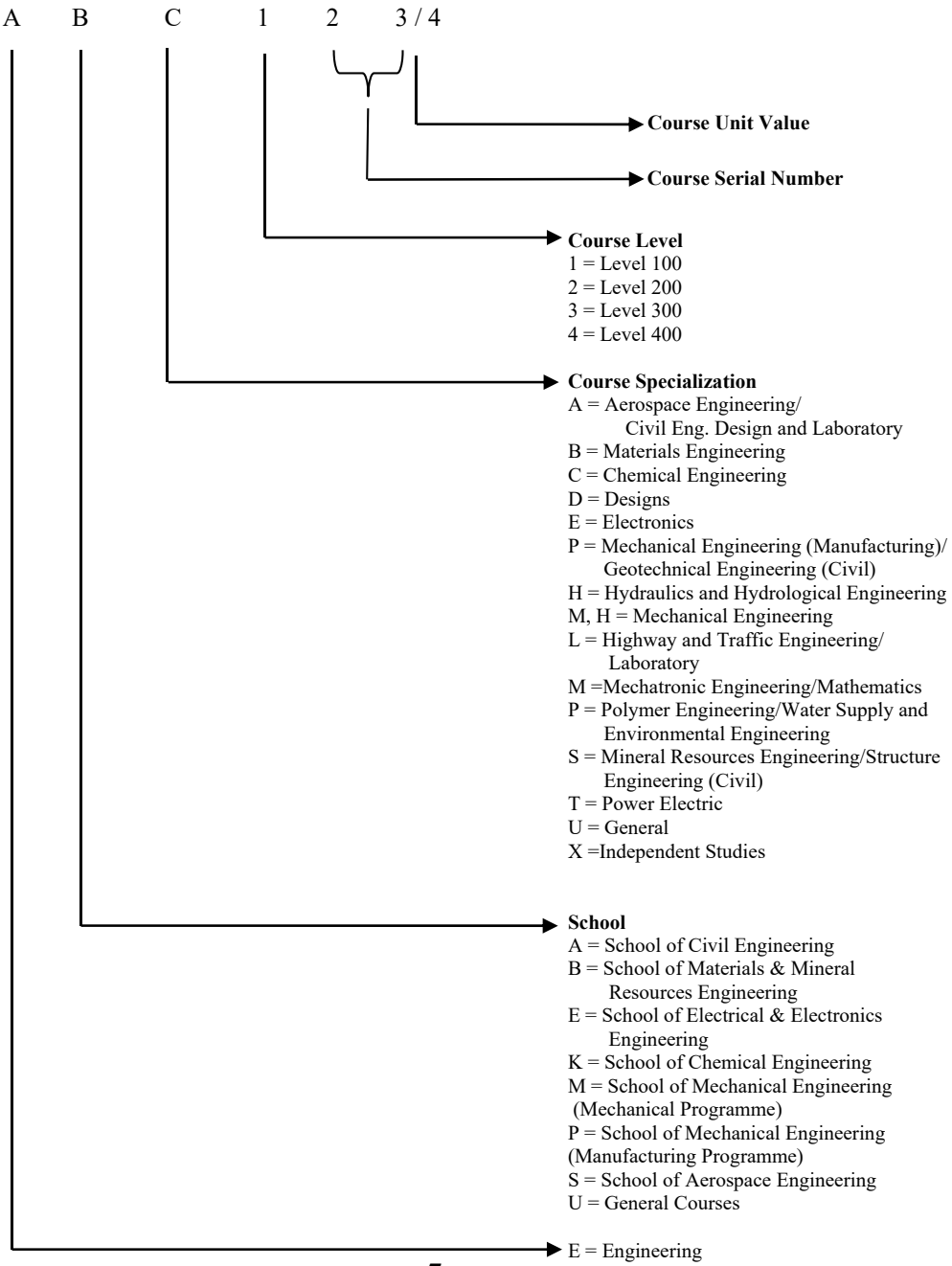
- Academic Staffs (University)
- Employers (industry and government)
- Alumni
- Students
- Parents

1.9 Teaching Delivery Method

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

1.10 Course Code

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



1.11 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 REQUIREMENT	15	
<u>Compulsory (14 units)</u>		
(a) Bahasa Malaysia	2	For international students, courses Appreciation of Ethics and Civilisations and Core Entrepreneurship are to be replaced by Malaysian Studies (4 units)
(b) English Language	4	
(c) Philosophy and Current Issues	2	
(d) Appreciation of Ethics and Civil Civilisations	2	
(e) Core Entrepreneurship	2	
(f) Co-curriculum	2	
<u>Optional Course (1 Units)</u>		
(a) Optional	1	

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

Starting from academic year 2014/2015, students that obtain grade of C- and below for a particular course offered by the School of Materials and Mineral Resources Engineering are required to improve their grades by repeating the course during the long vacation (Kursus Semasa Cuti Panjang) (KSCP) or normal semester. Students will not be allowed to graduate until they repeat the course and obtain a minimum grade of C. Students that obtain grade 'C' and above for a particular course will not be allowed to repeat the course whether during KSCP or normal semester.

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

Elective Courses

Students who do not choose a Minor area are required to take Elective courses. Students need to accumulate no less than 12 units from the list of courses suggested and acknowledged by the school.

Optional Courses

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

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

Audit Courses

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

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

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

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

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

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

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

Laboratory Work/Practical, Engineering Practice and Industrial Training

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

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

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

General Objectives of Engineering Practice

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

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

The Engineering Practice will be conducted in the following manner:

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

(i) <u>Engineering Practice Course</u>

The Engineering Practice Course is a basic training course on mechanical, manufacturing and electrical engineering. The training includes engineering workshops, introduction to manufacturing processes and electrical circuit. Engineering students will also be exposed to methods of engineering planning and project implementation. The duration of the

training is 14 weeks and during this period, students will be supervised by the academic staff on duty.

(ii) Industrial Training

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

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

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 2925/2924/2923
Fax No.	:	04-657 4641
E-Mail	:	sdrp@usm.my
Website	:	http://bpa.usm.my/index.php/ms/

2.1.2 Course Registration Platform

1. E-Registration

E-Registration is a platform for online course registration. The registration is done directly through the Campus Online portal**.** Course registration exercise for both semesters begins after the release of Official examination results of every 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 email 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 E-mail ID and password to access their profile page, which includes the *E-Daftar* menu.

c. Students need to 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 begins on the first day of the new semester until 3rd week. Registration during 4th - 6th week of the official academic calendar is considered as late registration. Hence, a penalty of RM50.00 per registration will be imposed unless justifications for the late registration are provided by the students. The Examination and Graduation Unit, Academic Management Section (Registrar Department) will manage students' late registration.

2.1.3 Course Registration General Information

1. Several information that can be referred by the students pertaining to the registration activity:

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

- List 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	25
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 courses
M= Minor 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 resit 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)

(i) The information of the Academic Advisor.

(ii) Academic information such as academic status, GPA value, CGPA value and year of study.

(iii) Cangred and Course Registration Form.

(iv) List of courses offered by all Schools/Centres.

(v) Teaching and Learning Timetable for all Schools/Centres/Units from the three campuses.

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

(vii) Reminders about the University course registration policies/general requisites.

2.1.5 Registration of Language and Co-Curricular Courses

(a) Registration of Language courses through E-Daftar is allowed.

- ❖ 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.

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

- ❖ 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 3974	
English Language Programme Chairperson	: 04-653 3406	
Foreign Language Programme Chairperson	: 04-653 3396	
Engineering Campus Programme Chairperson	: 04-599 5400/5430	
	: 04-599 5402/5407	
Health Campus Programme Chairperson	: 09-767 1262	

(b) Registration of co-curricular courses through E-Daftar is not allowed.

- ❖ 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.

- ❖ 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 5097/6308)

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

(c) **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:

(i) 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.

(ii) 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.

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

(iv) The option for dropping courses cannot 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 that has been printed/obtained after registering the course 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. Student may update their correspondence address, telephone number and personal email through the Campus Online portal.

2. The office of the Student Data and Records Unit must be notified of any application for updating the 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.

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

The achievement of students in any semester is based on Grade Point Average (GPA) achieved from all the registered courses in a particular semester. GPA is the indicator to determine the academic performance of students in any semester.

CGPA is the Cumulative Grade Point Average accumulated by a student from one semester to another during the years of study.

The formula to compute GPA and CGPA is as follows:

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

where:

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

Example of calculation for GPA and CGPA:

	Course	Unit	Grade Point (GP)	Grade (G)	Total GP
Semester I	ABC XX1	4	3.00	B	12.00
	ABC XX2	4	2.33	C+	9.32

	BCD XX3	3	1.67	C-	5.01
	CDE XX4	4	2.00	C	8.00
	EFG XX5	3	1.33	D+	3.99
	EFG XX6	2	2.67	B-	5.34
		20			43.66

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

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

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

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

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

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

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

The purpose of KSCP is to:

(i) Give an opportunity to students who are facing time constraints for graduation.

(ii) Assist students who need to accumulate a few more credits for graduation.

(iii) Assist probationary students to enhance their academic status.

(iv) 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.

The Implementation of KSCP

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

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

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

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

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

2.3.5 Academic Status

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

Probation Status: A probation status is given to any student who achieves a GPA of 1.99 and below. A student who is under probation status for three consecutive semesters (P1, P2, FO) will not be allowed

to pursue his/her studies at the university. On the other hand, if the CGPA is 2.00 and above, the student concerned will be allowed to pursue his/her studies and will remain at P2 status.

2.3.6 Penalty for not attending the examination

Students who do not attend the examination for any of the courses they have registered for must provide their reasons in writing to the Principal Assistant Registrar, Examination and Graduation Unit, Academic Management Division within 48 hours (for full-time students) and 48 hours (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. For reasons accepted by the University Examination Board, students will be granted a DK grade (with permission). DK grade will be granted to the students if they 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.

2.3.7 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.

2.3.8 Examination Results

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

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

2.3.9 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 USM official website or at the Academic Management Division, Registry Department of each campus. 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 or marks, 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:

   (i) 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).

(ii) 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.

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

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

(v) The total number of semesters exempted should not exceed two semesters.

(vi) **In order to obtain unit exemption 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. <u>USM Supervised IPTS (Private Institutions of Higher Learning) /External Diploma Graduates</u>:

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:

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

(ii) 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.

(iii) 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.

(a) Category of Students Who Can Be Considered for Credit Transfer

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.

(b) Specific Conditions

(i) 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.

(ii) 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.

(iii) 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.

(c) General Conditions

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

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

3) 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.

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

5) 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.

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

7) 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.

8) 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 in academic 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 context of academic include 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. Rule 48 of Universiti Sains Malaysia (Discipline of Students) 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

(a) 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.

(b) 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.

(c) To produce more volunteers to assist those who need help.

(d) 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 2430.

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

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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"><u>Local Students</u>
▪ HFF225 (Philosophy and Current Issues) (2 credits)
▪ HFE224 (Appreciation of Ethics and Civilisations) (2 credits)
▪ LKM400 (Bahasa Malaysia IV) (2 credits)
<u>International Students of Science and Technology</u>
▪ HFF225 (Philosophy and Current Issues) (2 credits)
▪ LKM100 (Bahasa Malaysia I) (2 credits)</td><td rowspan="2">6</td><td rowspan="2">4</td></tr>
<tr><td><u>International Students of Arts</u>
(program with Malay Language as the medium of instruction)
▪ HFF225 (Philosophy and Current Issues) (2 credits)
▪ LKM100 (Bahasa Malaysia I) (Z)
▪ LKM200 (Bahasa Malaysia 2) (U) (2 credits)</td><td><u>International Students of Arts</u>
(program with English Language as the medium of instruction)
▪ HFF225 (Philosophy and Current Issues) (2 credits)
▪ LKM100 (Bahasa Malaysia I) (U) (2 credits)</td></tr>
<tr><td>U2 (Local students)
AND
U3 (International students)</td><td colspan="2"><u>Local Students</u>
▪ WUS101 (Core Entrepreneurship) (2 credits)
▪ English Language Courses (4 credits)
<u>International Students</u>
▪ SEA205E (Malaysian Studies) (4 credits)
▪ English Language Courses (4 credits)</td><td>6</td><td>8</td></tr>
<tr><td>U4</td><td colspan="2">Co-curricular courses*</td><td>2</td><td>2</td></tr>
<tr><td>Options</td><td colspan="2">Skill courses/Foreign Language Courses/ Other courses offered by other schools. Students 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 choose a uniform body co-curricular package.

* Students from the School of Dental Sciences are required to take co-curricular courses that consist of three (3) credits. 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 (Bahasa Malaysia IV)

In order to graduate, the minimum passing grade required is Grade C. Entry requirements for Bahasa Malaysia 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 Bahasa Malaysia 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:

(i) 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

(ii) 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

(iii) 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.

(a) 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	Grade	English Language Course	Course Type
1.	MUET or;	Bands 2, 2.5, 3 / 3.5	LMT100 (2 credits)	Pre-requisite/ Type Z
	Discretion of the Dean of PPBLT			
2.	MUET or;	Bands 4 / 4.5	LSP300 (2 credits)	Compulsory/ Type U
	LMT100 or;	A - C		
	Discretion of the Dean of PPBLT			
3.	MUET or;	Band 5	LSP 401/402/403/404 (2 credits)	Compulsory/ Type U
	LSP300 or;	A - C		
	Discretion of the Dean of PPBLT			
4.	MUET or;	Bands 5+ / 6	LHP 451/452/453/454/455/ 456/457/458/459 * all LHP courses are 2 credits except for LHP457 which is 4 credits	Compulsory/Option / Type U
	LSP401/402/403/404 or;	A - C		
	Discretion of the Dean of PPBLT			

(b) Entry Requirements for English Language Courses (for students with TOEFL or IELTS)

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

No.	TOEFL (Internet Based Test)	IELTS	English Language Course	Course Type
1.	35 - 59	5.0 – 5.5	LMT100 (2 credits)	Pre-requisite / Type Z
2.	60 – 93	6.0 – 6.5	LSP 300 (2 credits)	Compulsory/ Type U
3.	94 - 109	7.0 – 7.5	LSP 401/402/403/404 (2 credits)	Compulsory/ Type U
4.	110 - 120	8.0 – 9.0	LHP Series * all LHP courses are 2 credits except for LHP457 which is 4 credits	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+ / 6 in MUET must accumulate the 4 credits of English from the courses in the advanced level (LHP451/452/453/454/455/456/457/458/459). They can also take foreign language courses to replace their English language credits but students must first obtain written consent from the Dean of the School of Languages, Literacies and Translation. (Please use the form that can be obtained from the School of Languages, Literacies and Translation).

- Students with Bands 2/2.5/3/3.5 in MUET MAY re-sit MUET to improve their score to Band 4 OR take the LMT100 course and pass with a minimum grade C before they can register for the LSP300 course.

(c) English Language Course

English courses offered as university courses are as follows:

No	Code/Unit	Course Title	School (If Applicable)
1	LMT100/2	Preparatory English	Students from all schools
2	LSP300/2	Academic English	Students from all schools
3	LSP401/2	General English	School of Language, Literacies and Translation School of Educational Studies (Arts) School of the Arts School of Humanities School of Social Sciences
4	LSP402/2	Scientific and Medical English	School of Biological Sciences School of Physics School of Chemical Science School of Mathematical Sciences School of Industrial Technology School of Educational Studies (Science) School of Medical Sciences School of Health Science and Dentistry School of Pharmaceutical Sciences
5	LSP403/2	Business and Communication English	School of Management School of Communication
6	LSP404/2	Technical and Engineering English	School of Computer Sciences School of Housing, Building and Planning School of Engineering

C. U4 Group

All students are required to register for a co-curricular course in order to complete the minimum requirement of two (2) credit hours in the MPU structure. Students who choose to take packaged co-curricular courses are required to complete all levels of the package. Students can choose the courses offered by the Core group 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
WSC106/1 - Golf	WSC 125/1- Futsal

WSC110/1 - Archery	WSC 126/1 - Netball
WSC111/1 - Table Tennis	WSC127/1 - Event Management 1
WSC112/1 - Swimming	WSC227/1 - Event Management 2
WSC113/1 - Aerobics	WSC128/1 - Petanque
WSC114/1 - Squash	WSC130/1 - Orienteering
WSC116/1 - Tennis	WSC131/1 - Woodball
WSC119/1 - Badminton	

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	WCC117/1 - Modern Theatre
WCC107/1 - Guitar	WCC118/1 - Malay Shadow Play
WCC109/1 - Choir	WCC119/1 - Qigong Exercises
WCC115/1 - Modern Dance	WCC124/1 - Musical Kompang
WCC116/1 - Traditional Dance	WCC129/1 - Latin Dance

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 - Cullinary Arts	WCC133/1 - Decoupage Arts

WCC125/1 - Traditional of Kite Art	
Non-Packaged Courses (2 Credits)	
WMU102/2 - Makers@USM Level 1	WMU112/2 – Artificial Intelligence Literacy
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.

3.3 Options (1 – 8 credits)

A. Co-curricular course

Students who have enrolled in co-curricular courses in excess of two (2) credits under the U4 General Subjects requirement are not required to attend the co-curriculum course under the Option courses. Students only need to register for skill courses or Foreign Language courses subject to the graduation requirements of their respective program of study.

The details of the list of co-curricular courses offered are in the U4 General Subjects section as stated above.

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.

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 (for students with Band 6 in MUET) or as a skill/option course:

No	Code/Kredit	Course Title
1.	LHP451/2	Effective Reading
2.	LHP452/2	Business Writing
3.	LHP453/2	Creative Writing
4.	LHP454/2	Academic Writing
5.	LHP455/2	English Pronunciation Skills
6.	LHP456/2	Spoken English
7.	LHP457/4	Public Speaking and Speech Writing
8.	LHP458/2	English for Translation *(Offered during Semester II only)*
9.	LHP459/2	English for Interpretation *(Offered during Semester I 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 MATERIALS AND MINERAL RESOURCES ENGINEERING (http://material.eng.usm.my/)

4.1 INTRODUCTION

The School of Materials and Mineral Resources Engineering (SMMRE) started its program since 1984 in Universiti Sains Malaysia (USM), Penang under the School of Industrial Technology and Engineering Sciences. With the advancement of technology and market demand for skilled engineers in the country, USM took the initiative to fulfill the requirement by having its own engineering school separated from other disciplines of applied sciences.

In March 1986, the engineering disciplines under the School of Industrial Technology were separated to form their own schools, which include the formation of the School of Materials and Mineral Resources Engineering. USM had then housed the new campus at Ipoh before moving to Seri Iskandar, Perak. However, after a lapsed of 15 years, in May 2001, the campus was moved to the new site situated at Nibong Tebal, Seberang Perai Selatan, Penang.

Compared to other schools or faculty in other Institutes of Higher Learning in Malaysia, the School of Materials and Mineral Resources Engineering is unique because it offers three programs, these are Materials Engineering, Mineral Resources Engineering and Polymer Engineering at bachelor degree (honours) level for each programme.

Polymer Engineering program is the latest addition to the school that commenced in April 2002. The program is an upgrading of Polymer Technology program that was originally under the School of Industrial Technology in USM Penang.

In general, the three programs include specialization as follows:

(i) The Material Engineering emphasizes on materials such as metal, ceramic, composite, polymer and semiconductor and electronic materials. These involve design and production of materials, quality control and the materials properties.

(ii) Mineral Resources Engineering focuses on areas of mining, processing and management of mineral resources and the environment.

(iii) Polymer Engineering focuses on polymeric materials such as plastics, rubber, latex and composites. These involve synthesis, processing, design and production of polymer products, quality control and the properties of polymers.

A minimum of four years or 8 semesters are required to complete for each of the program. Graduates who have completed the program of study successfully will be awarded B. of Materials Engineering with Honours, B. of Mineral Resources Engineering with Honours or B. of Polymer Engineering with Honours accordingly, which is recognized locally and internationally.

4.2 OBJECTIVE AND PHILOSOPHY

In principal, Universiti Sains Malaysia, upholds the mission among which to build a greater understanding and strive to provide quality education as well as efficient and professional services through vast knowledge, innovation and latest expertise while upholding common ethical values.

With that, SMMRE through its three programmes have one similar objective that is to produce materials, mineral resources and polymer engineers that are professionally qualified, knowledgeable and matured, highly skilled and capable to perform in relevant engineering activities including giving ideas and solution towards complex engineering problem through analytical, innovative and proactive thinking. With these philosophies, the curriculum has been design to fulfill the aspiration and goals of Industrial Revolution 4.0, sustainable development goals (SDGs), industrial needs and in line with the growth of world globalization technology. Therefore, the existing curriculum is moulded with the following quality:

- Recognized by professional bodies including Board of Engineers Malaysia (BEM) and Institution of Engineers Malaysia (IEM).
- Balanced integration of teaching based on theory with practical skills.
- Continuously up-dated with various specializations in tandem with the needs and development of local and international market.
- Develop and generate graduates with knowledge, ethics, quality, skill, innovative and strong commitment towards excellent performance.

Vision of SMMRE

To be an established and respectable world class academic and research school of excellence based on current technology.

Mission of SMMRE

To be globally recognized as a dynamic engineering school that produces creative, innovative and resourceful intellectuals with an ethos towards life-long learning that will contribute towards the creation of knowledge based society.

4.3 MAIN ADMINISTRATIVE STAFFS

DEAN

Professor Ir. Dr. Mariatti Jaafar @ Mustapha

DEPUTY DEAN

Academic, Career & International
Assoc. Prof. Dr. Nurulakmal Mohd Sharif

Research, Innovation &
Industrial-Community Engagement
Assoc. Prof. Dr. Raa Khimi Shuib

PROGRAM CHAIRMAN

Assoc. Prof. Ts. Ir. Dr. Hasmaliza Mohamad
Materials Engineering

Assoc. Prof. Dr. Hareyani Zabidi
Mineral Resources Engineering

Assoc. Prof. Ir. Ts. Dr. Zuratul Ain Abdul Hamid
Polymer Engineering

Dr. Khairul Anuar Shariff
Corporate Affairs and Positioning

MANAGEMENT / TECHNICAL

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Principal Assistant Registrar

Mrs. Normala Omar
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4.5 EXTERNAL EXAMINERS

Materials Engineering

Professor Dr. Andanastuti Muchtar
Department of Mechanical and Materials Engineering
Faculty of Engineering & Built Environment
Universiti Kebangsaan Malaysia
43600, Bangi, Selangor, Malaysia

Mineral Resources Engineering

Professor Ir. Dr. Ridho Kresna Wattimena
Faculty of Mining and Petroleum Engineering
Institut Teknologi Bandung
Jln. Ganesha 10, Bandung 40132, Indonesia

Polymer Engineering

Professor Dr. Sadhan C. Jana
College of Engineering and Polymer Science
University of Akron
Ohio 44325-0301, United States

4.6 INDUSTRY/ COMMUNITY ADVISORY PANEL (ICAP)

Materials Engineering

Ir. Mohamad Zamri Md Zain
Project Leader
Perusahaan Otomobil Nasional Sdn. Bhd

Datin Lynette Chan Wei Ling
Managing Director
Axislyn Consultancy

Mdm. Feroza Shariff
Lead Assurance Engineer
SAPURA-OMV Supstream (Sarawak) Inc

Dr. Lee Ting
Development Engineer
Infeneon Kulim Sdn. Bhd.

Dr. Rafiza Ramli
Senior Manager
Lumileds Malaysia Sdn. Bhd.

Mineral Resources Engineering

Mr. Kamaruddan Abdullah
Pengarah
Jabatan Mineral dan Geologi Johor

Mr. Zaidi Harun
Director
Selinsing Mining Sdn Bhd

Mr. Foo Kheng Sin
Chairman
FYS Marketing Sdn Bhd

Mr. Ir. Shukeri Ismail
Chief Executive Officer
Malaysian Metal Resources Sdn. Bhd.

Polymer Engineering

Mr. Mohamad Firdaus Abu Bakar
Senior Exec
Petronas Chemicals Group Berhad (Pcg)

Ir. Lim Joo Chai (JC),
Engineering Manager
Entegris (Malaysia) Sdn Bhd.

Mr. Mohd Nazri Othman
OEM Consultant
Everthrough Rubber Products Sdn. Bhd.

Mrs. Nadia Wan Azman
Senior R&D Engineer
Midori Wakatouch (M) Sdn. Bhd.

4.7 LABORATORY FACILITIES

The School is equipped with modern equipments for its undergraduate and postgraduate programmes and for research purposes. To date, there are 36 laboratories equipped with, among others, included:

[1] Scanning Electron Microscope (SEM) & Energy Dispersive X-Ray (EDX)
[2] Field Emission Electron Microscope (VPFESEM) & Energy Dispersive X-Ray (EDX)
[3] X-Ray Diffractometer (XRD)
[4] X-Ray Fluorescence Spectrometer (XRF)

[5] Servohydraulic Testing Machine
[6] Spray Forming Machine
[7] Particle Size Analyser
[8] Microhardness Tester
[9] Magnetic Separator
[10] Ultrafine Grinding Machine
[11] Furnaces
[12] Hot Press
[13] Plastic Injection Molding Machine
[14] Rubber Injection Molding Machine
[15] Hot & Cold Isostatic Press
[16] Twin Screw Extruder
[17] Internal Mixer
[18] Crusher & Grinder
[19] Autoclave Reactor
[20] Potentiostat
[21] Semiconductor Parametric Analyser
[22] Scanning Probe Microscope
[23] Corrosion Tester
[24] Optical Microscopes
[25] Dynamic Mechanical Analyser (DMA)
[26] Differential Thermal Analysis (DTA) & Thermogravity Analyser (TGA)
[27] UV-VIS Spectrometer
[28] Atomic Absorbtion Spectrometer (AAS)
[29] Fourier Transform Infrared Analyser (FTIR)
[30] Surface Area Analyser
[31] Density Meter
[32] Rheometer
[33] Single Screw Extruder
[34] Energy Dispersive X-Ray Fluorescence (EDXRF)
[35] Semiconductor Parametric Analyser (SPM, AFM, STM)
[36] Differential Scanning Calorimeter (DSC)
[37] 500kN Dymanic Universal Testing Machine (UTM)
[38] Nano Particle Size Analyser
[39] Zeta Potential Analyser
[40] Benchtop X-Ray Diffraction (XRD)
[41] Atomic Absorption Spectrometer (AAS + Graphite Furnace)
[42] Inductively Coupled Plasma Optical / Atomic Emmision Spectroscopy (ICP-OES)
[43] Pultrusion
[44] Twin Screw Extruder
[45] Auto Dilute Viscometer
[46] Differential Thermal Analyser (DTA)

Apart from the above, the school has a range of support equipments including well equipped workshop. These equipments are operated by trained and knowledgeable technical staff.

4.8 JOB OPPORTUNITIES

Graduates of B. of Materials, Mineral Resources and Polymer Engineering have good job prospect especially with the growth of IT and that the curriculum has been geared to the industrial needs and organizations such as manufacturing and process industry, design industry, quarry, mining, research, consultancy, institute of higher learning, training centers and government agencies.

Career opportunities for Materials and Polymer Engineering include process engineer, maintenance engineer, site engineer, site manager, design engineer, plant engineer, control engineer, researcher and others. As for Mineral Resources Engineering the graduate may be employed as mining engineer, mineral processing engineer, quarry engineer, blasting engineer, plant engineer, mine or quarry manager, drilling engineer and production engineer in oil companies, research engineer and others.

4.9 POSTGRADUATE STUDIES AND RESEARCH

SMMRE also offers opportunities for postgraduate study for locals and foreign graduates who wish to further their studies at higher level. Therefore, SMMRE offers M. Sc and Ph. D programmes through research mode for all the three programmes and M. Sc programmes through mix-mode (for Materials Engineering).

Areas of research offered through research mode are (amongst others):

[1] Traditional Ceramic and Advanced Ceramics
[2] Physical Mechanical and Applied Metallurgy
[3] Extractive Metallurgy
[4] Glass and Glass Ceramic
[5] Composite (ceramic, metal and polymer)
[6] Semiconductor Material and Electronic Material
[7] Metal Coatings
[8] Mining
[9] Blasting
[10] Geochemistry
[11] Exploration
[12] Environment and Pollution Control
[13] Material Processing
[14] Plastic
[15] Rubber and Latex
[16] Polymer Alloy and Mixture
[17] Polymer Composite
[18] Biomaterials

The Institute of Postgraduate studies of USM has the following entry requirements in considering application by candidates:

(1) Candidates for master's programme must attain at least CGPA of 2.75 or related qualification, which are recognized by the University's Senate and Ministry of Higher Learning or Public Services Department.

(2) For candidates having lower qualification, the application may also be considered through working experiences or vast research background in related area and endorsed by the School Board of SMMRE.

4.10 PROGRAMME FOR BACHELOR OF MATERIALS ENGINEERING WITH HONOURS

PROGRAMME OBJECTIVES

1) PEO1- Employable graduates with the knowledge and competency in Materials Engineering related fields
2) PEO2 - Graduates having good leadership and soft skills with the right attitudes and ethics
3) PEO3 - Graduates who possess interest in research and/or lifelong learning

PROGRAMME OUTCOMES

PO No	Programme Outcomes
PO1	Graduates able to apply the knowledge of mathematics, natural science, engineering fundamentals and engineering specialization related to the practice of **Materials Engineering** and solve complex Engineering problems
PO2	Graduates have the ability to identify, formulate, conduct research literature and analyze complex engineering problems using first principles of mathematics, natural sciences and engineering sciences
PO3	Graduates have the ability to design solution for complex engineering problems and design systems, components or processes that meet specified needs for public health and safety, cultural, societal, and environmental considerations
PO4	Graduates have the ability to conduct an investigation of complex problems related to **Materials Engineering** using research based knowledge and research methods to provide valid conclusions
PO5	Graduates have the ability to select and apply appropriate techniques, resources and modern engineering and IT tools, to complex engineering problems with an understanding of the limitations
PO6	Graduates have the ability to reason using contextual knowledge in assessing societal, health, safety, legal and cultural issues, relevant to professional **Materials Engineering** practice and solutions to complex engineering problems
PO7	Graduates have the ability to understand and evaluate the sustainability, and impact of professional engineering work in the solution of complex engineering problems in society and the environment context

PO8	Graduates have the ability to apply ethical principles and commit to professional ethics and responsibilities, and norms of **Materials Engineering** practice
PO9	Graduates have the ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
PO10	Graduates have the ability to communicate effectively on complex engineering activities with the engineering community and with society at large
PO11	Graduates can demonstrate knowledge and understanding of engineering management principles and economic decision- making, and apply them to manage projects in multidisciplinary environments
PO12	Graduates recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

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4.10.1 CURRICULUM STRUCTURE FOR BACHELOR OF MATERIALS ENGINEERING WITH HONOURS

COURSE TYPE	LEVEL 100				LEVEL 200				LEVEL 300				EBB 350 10 Week	LEVEL 400				Total Unit
	SEMESTER 1		SEMESTER BREAK	SEMESTER 2		SESSION BREAK	SEMESTER 1		SEMESTER BREAK	SEMESTER 2		SESSION BREAK	SEMESTER 1		SEMESTER BREAK	SEMESTER 2		INDUSTRIAL TRAINING	SEMESTER 1		SEMESTER BREAK	SEMESTER 2		
	Code & Course	Unit		Code & Course	Unit		Code & Course	Unit		Code & Course	Unit		Code & Course	Unit		Code & Course	Unit		Code & Course	Unit		Code & Course	Unit	
CORE	EUM 113 Engineering Calculus	3		EUM 114 Advanced Engineering Calculus	3		EUP 222 Engineers In Society	3		EBB 204 Materials Characterizations Laboratory	2		EBB 325 Microscopy Laboratory	2		EBB 326 Corrosion Engineering	3		EBB 410 Materials Product Design	4		EBB 442 Quality Control & Management	3	108
	EBP 105 Introduction to Statics and Dynamics	3		EEU 104 Electrical Technology	3		EBB 202 Crystallography & Bonding In Solids	3		EBB 215 Semiconductor Materials	3		EBB 345 Mechanical Behavior of Materials	3		EBB 307 Failure Analysis & Non-Destructive Testing	3		EBB 440 Metal Processing and Surface Engineering	3		EBB 407 Research Project	5	
	EBB 113 Engineering Materials	3		EBB 160 Physical Chemistry of Engineering Materials	3		EBB 251 Basic Programming and Engineering Design	2		EBB 220 Engineering Polymers	3		EBU 301 Acquisition and Measurement of Digital Data	2		EBB 328 Occupational Safety & Health	3		EBB 444 Industrial Ceramics	3				
	EBS 110 Engineering Drawing	2		EBB 123 Basics Mechanical Behavior of Materials	3		EBB 236 Materials Termodynamics	3		EBB 226 Physical Metallurgy and Heat Treatment	3		EBB 323 Semiconductor Fabrication Technology	3		EBB 317 Materials Processing Laboratory	2		EBB 407 Research Project	1				
	EBB 155 Engineering Materials Introduction Laboratory	2		EML 101 Engineering Practice	2		EBB 201 Engineering Economy and Management	3		EBB 222 Ceramic Materials and Processing	3		EBB 300 Engineering Statistic	2		EBB 337 Advanced Materials & Composites	3							
													EBB 343 Engineering Materials Characterizations	3										
	13			14			14			14			15			14		5	11			8		
UNIV REQ	Bahasa Malaysia/Option 2 English/Option 4 Co-curriculum/Option 3 Ethics and Civilizations 2 Philosophy and Current Issues 2 Entrepreneurship 2																							15
ELECTIVE													EBB 324 Electronic Packaging	3		EBB 339 Nanomaterials	3		EBB 424 Semiconductor Devices & Opto Electronics	3		EBB 438 Process Control	3	12
													EBB 334 Biomaterials	3		EBB 327 Technology & Application of Engineering Polymer	3		EBB 433 Transport Processes	3				
													EBS 238 Fluid Mechanic	3		EBB 308 Materials Selection and Design Analysis	3							
																EBS 323 Pyrometallurgy	3							
	TOTAL UNIT FOR GRADUATION																							135

4.10.2 CURRICULUM

LEVEL 100

Semester I			Unit		
			Total	**Lecture**	**Lab**
EUM	113/3	Engineering Calculus	3	3	0
EBP	105/3	Introduction to Statics and Dynamics	3	3	0
EBS	110/2	Engineering Drawing	2	0	2
EBB	113/3	Engineering Materials	3	3	0
EBB	155/2	Engineering Materials Introduction Laboratory	2	0	2
			13	9	4
University Requirement					
LMT	100/2	English Language	2	2	0
SEMESTER BREAK					
Semester II			**Unit**		
			Total	**Lecture**	**Lab**
EBB	160/3	Physical Chemistry of Eng. Materials	3	3	0
EBB	123/3	Basics Mechanical Behavior of Materials	3	3	0
EUM	114/3	Advanced Engineering Calculus	3	3	0
EEU	104/3	Electrical Technology	3	3	0
EML	101/2	Engineering Practice	2	0	2
			14	12	2
University Requirement					
LKM	400/2	Bahasa Malaysia	2	2	0
WUS	101/2	Entrepreneurship	2	2	0
SESSION BREAK					

LEVEL 200

Semester I			Unit		
			Total	**Lecture**	**Lab**
EBB	202/3	Crystallography & Bonding In Solids	3	3	0
EBB	251/2	Basic Programming and Engineering Design	2	0	2
EBB	236/3	Materials Thermodynamics	3	3	0
EUP	222/3	Engineers In Society	3	3	0
EBB	201/3	Engineering Economy and Management	3	3	0
			14	12	2
University Requirement					
LSP	300/2	English Language	2	2	0
HFF	225/2	Philosophy and Current Issues	2	2	0
SEMESTER BREAK					
Semester II			**Unit**		
			Total	**Lecture**	**Lab**
EBB	204/2	Materials Characterization Lab.	2	0	2
EBB	222/3	Ceramic Materials and Processing	3	3	0
EBB	215/3	Semiconductor Materials	3	3	0
EBB	220/3	Engineering Polymers	3	3	0
EBB	226/3	Physical Metallurgy and Heat Treatment	3	3	0
			14	12	2
University Requirement					
LSP	404	Technical and Engineering English	2	2	0
HFE	224/2	Appreciation of Ethics and Civilisations	2	2	0
SESSION BREAK					

LEVEL 300

Semester I			Unit		
			Total	**Lecture**	**Lab**
EBB	325/2	Microscopy Laboratory	2	0	2
EBB	323/3	Semiconductor Fabrication Technology	3	3	0
EBU	301/2	Acquisition and Measurement of Digital Data	2	2	0
EBB	343/3	Eng. Materials Characterization	3	3	0
EBB	345/3	Mechanical Behavior of Materials	3	3	0
EBB	300/2	Engineering Statistic	2	2	0
			15	13	2
Electives					
EBB	324/3	Electronic Packaging	3	3	0
EBB	334/3	Biomaterials	3	3	0
EBS	238/3	Fluid Mechanics	3	3	0
SEMESTER BREAK					
Semester II			**Unit**		
			Total	**Lecture**	**Lab**
EBB	326/3	Corrosion Engineering	3	3	0
EBB	317/2	Materials Processing Laboratory	2	0	2
EBB	337/3	Advanced Materials & Composites	3	3	0
EBB	307/3	Failure Analysis & Non Destructive Testing	3	3	0
EBB	328/3	Occupational Safety & Health	3	3	0
			14	12	2
Electives					
EBB	308/3	Materials Selection and Design Analysis	3	3	0
EBB	339/3	Nanomaterials	3	3	0
EBB	327/3	Technology & Application of Engineering Polymer	3	3	0
EBS	323/3	Pyrometallurgy	3	3	0
SESSION BREAK - EBB 350/5 Industrial Training					

LEVEL 400

Semester I			Unit		
			Total	**Lecture**	**Lab**
EBB	410/4	Materials Product Design	4	4	0
EBB	440/3	Metal Processing and Surface Engineering	3	3	0
EBB	444/3	Industrial Ceramics	3	3	0
EBB	407/1	Final Year Research Project	1	0	1
			11	11	1
Electives					
EBB	424/3	Semiconductor Devices & Opto Electronics	3	3	0
EBB	433/3	Transport Processes	3	3	0
SEMESTER BREAK					
Semester II			**Unit**		
			Total	**Lecture**	**Lab**
EBB	407/5	Final Year Research Project	5	0	5
EBB	442/3	Quality Control and Management	3	3	0
			8	3	5
Electives					
EBB	438/3	Process Control	3	3	0
SESSION BREAK					

4.10.3 COURSE PROGRAMME OUTCOME MATRIX (MATERIALS ENGINEERING)

Level	No.	Code		Course	Programme Outcomes Attainment											
		Sem I	Sem II		1	2	3	4	5	6	7	8	9	10	11	12
CORE																
100	1.	EBB 113/3		Engineering Materials	/	/										
	2.	EBP 105/3		Introduction to Statics and Dynamics	/	/										
	3.	EUM 113/3		Engineering Calculus	/	/										
	4.	EBS 110/2		Engineering Drawing	/	/			/							
	5.	EBB 155/2		Engineering Materials Introduction Laboratory	/			/	/				/	/		
	6.		EUM 114/3	Advanced Engineering Calculus	/	/										
	7.		EEU 104/3	Electrical Technology	/											
	8.		EBB 123/3	Basics Mechanical Behavior of Materials	/	/										
	9.		EML 101/2	Engineering Practice	/		/		/	/		/		/		
	10.		EBB 160/3	Physical Chemistry of Engineering Materials	/	/										
200	11.	EBB 202/3		Crystallography and Bonding in Solids	/	/										
	12.	EBB 236/3		Materials Thermodynamics	/	/										
	13.	EUP 222/3		Engineers In Society	/					/		/				/
	14.	EBB 201/3		Engineering Economy and Management	/					/						/
	15.	EBB 251/2		Basic Programming and Engineering Design	/	/			/					/		
	16.		EBB 204/2	Materials Characterisation Laboratory	/			/	/				/	/		
	17.		EBB 222/3	Ceramic Materials and Processing	/	/										
	18.		EBB 215/3	Semiconductor Materials	/	/										
	19.		EBB 220/3	Engineering Polymers	/	/					/					
	20.		EBB 226/3	Physical Metallurgy and Heat Treatment	/	/										
300	21.	EBB 325/2		Microscopy Laboratory	/	/		/	/				/	/		
	22.	EBB 323/3		Semiconductor Fabrication Technology	/	/										
	23.	EBB 343/3		Engineering Materials Characterization	/	/	/									
	24.	EBB 345/3		Mechanical Behavior of Materials	/	/										
	25.	EBB 300/2		Engineering Statistic	/	/			/							
	26.	EBU 301/2		Acquisition and Measurement of Digital Data	/				/							
	27.		EBB 307/3	Failure Analysis and Non-Destructive Testing	/	/		/	/				/	/		
	28.		EBB 326/3	Corrosion Engineering	/	/										
	29.		EBB 317/2	Materials Processing Laboratory	/	/	/	/	/				/	/	/	
	30.		EBB 337/3	Advanced Materials and Composites	/	/										
	31.	EBB 350/5	EBB 350/5	Industrial Training (Materials Engineering)	/	/				/		/	/	/	/	
	32.		EBB 328/3	Occupational Safety & Health	/			/		/						
400	33.	EBB 410/4		Materials Product Design	/	/	/		/		/		/	/	/	/
	34.	EBB 440/3		Metal Processing and Surface Engineering	/	/	/						/	/		
	35.	EBB 444/3		Industrial Ceramics	/	/										
	36.	EBB 407/6	EBB 407/6	Research Project (Materials)	/	/	/	/	/			/	/		/	/
	37.		EBB 442/3	Quality Control and Management	/	/										
Percentage of Core Courses on PO (%)					100	78.4	16.2	18.9	32.4	13.5	5.4	10.8	24.3	27.0	10.8	10.8
ELECTIVE																
300	38.	EBB324/3		Electronic Packaging	/	/							/			

	39.	EBB 334/3		Biomaterials	/	/										
	40.	EBS 238/3		Fluid Mechanics	/	/										
	41.		EBB 339/3	Nanomaterials	/	/					/					
	42.		EBB 308/3	Materials Selection and Design Analysis	/	/			/				/	/		
	43.		EBB 327/3	Technology and Application of Engineering Polymers	/	/					/					
	44.		EBS 323/3	Pyrometallurgy	/	/										
400	45.	EBB 433/3		Transport Processes	/	/										
	46.	EBB 424/3		Semiconductor Devices and Optoelectronics	/	/										
	47.		EBB 438/3	Process Control	/	/										

Legend:

1	**Engineering Knowledge** : Graduates able to apply the knowledge of mathematics, natural science, engineering fundamentals and engineering specialization related to the practice of Materials engineering and solve complex engineering problems
2	**Problem Analysis** : Graduates have the ability to identify, formulate, conduct research literature and analyze complex engineering problems using first principles of mathematics, natural sciences and engineering sciences
3	**Design / Development of Solutions** : Graduates have the ability to design solution for complex engineering problems and design systems, components or processes that meet specified needs for public health and safety, cultural, societal, and environmental considerations
4	**Investigation and Made Conclusion** : Graduates have the ability to conduct investigation of complex problems related to Materials/Mineral Resources/Polymer engineering using research based knowledge and research methods to provide valid conclusions
5	**Modern Tool Usage** : Graduates have the ability to select and apply appropriate techniques, resources and modern engineering and IT tools, to complex engineering problems with an understanding of the limitations
6	**The Engineer and Society** : Graduates have the ability to reason using contextual knowledge in assessing societal, health, safety, legal and cultural issues, relevant to professional Materials/Mineral Resources/Polymer engineering practice and solutions to complex engineering problems
7	**Environment and Sustainability** : Graduates have the ability to understand and evaluate the sustainability, and impact of professional engineering work in the solution of complex engineering problems in society and the environment context
8	**Ethics** : Graduates have the ability to apply ethical principles and commit to professional ethics and responsibilities, and norms of Materials/Mineral Resources/Polymer engineering practice
9	**Individual and Team Work** : Graduates have the ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
10	**Communication** : Graduates have the ability to communicate effectively on complex engineering activities with the engineering community and with society at large
11	**Project Management and Finance** : Graduate can demonstrate knowledge and understanding of engineering management principles and economic decision-making, and apply them to manage projects in multidisciplinary environments
12	**Lifelong Learning** : Graduates recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

4.10.4 COURSE DESCRIPTION

EUM 113 Engineering Calculus

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.

EBP 105/3 Introduction to Statics and Dynamics

Objective: To provide students with the fundamental concepts and principles of rigid bodies in statics and dynamics equilibrium.

Synopsis: This course is an introduction to the mechanics of rigid bodies. It is divided into two areas: Statics and Dynamics. In Statics, the student will learn the fundamental concepts and principles of rigid bodies in static equilibrium. In Dynamics, the student will learn the fundamental

concepts and principles of the accelerated motion of a body (a particle). Consideration is given on the fundamental of mechanics and structure analysis, including concepts of free body diagram as well as force, moment, couples, kinematic of motion, momentum, impulse, conservation of energy and equilibrium analyses in two and three dimensions.

EBB 113/3 - Engineering Materials

Objective: Students are expected to acquire the fundamental knowledge on engineering materials especially on the classification of materials, properties and applications.

Synopsis: The course is an introductory course on engineering materials which is divided into two main parts. The first part includes the classifications of engineering materials that determine their applicability, the structure of the materials explained by bonding scheme of different materials, the structure of crystalline solids and introduction to imperfection in solids and diffusion mechanism. The first part also includes the introduction of phase diagram. The second part covers the behaviors and characteristics of engineering materials including mechanical and electrical properties. In general, this introductory materials science and engineering course deals with the different material types (i.e., metals, ceramics, polymers, composites), as well as the various kinds of properties exhibited by these materials (i.e., mechanical, electrical, magnetic, etc.) which intended to equip the students with necessary knowledge on material science and engineering.

EBB 155/2 - Engineering Materials Introduction Laboratory

Objective: To give exposure of practical works that related to the basic principles of material science.

Synopsis: The course is an introductory course on experimental method related to the basic principles of materials. It consists of ten set of different experiments which the student has to carry out with the assistance of lecturer and technical staff. Students are divided into small group and hands-on experiments are performed. Students are required to record, measure, calculate the result and finally write and submit a report at the end of each session. Each experiment covers various aspects of materials (i.e. metal, ceramics polymers and composites). Safety aspects and regulations on conducting scientific experiments are also briefed and taught.

EBS 110/2 - Engineering Drawing

Objective: To give basic knowledge in drawing concept applicable to engineering.

Synopsis: This course emphasizes on basic engineering design and drawings through manual method and by using CAD software. It covers basic methodology for traditional and concurrent design as well as basic engineering graphic principles such as drawing size, line styles, texts, conventional symbols, orthographic and isometric projection, multi-view drawings, dimensioning, section, part list and assembly and production drawings as well as standards in engineering drawing.

EBB 160/3 - Physical Chemistry of Engineering Materials

Objective: Students are expected to be able to understand the basic concept of thermodynamics, kinetics and electrochemistry.

Synopsis: This course covers topics on introduction to thermodynamics, kinetics and electrochemistry. The concepts of mass and energy conservation (1^{st} law) and reversibility (2^{nd} law) applied to closed and open (control volume) systems. Thermochemistry, stoichiometry, chemical equilibrium, reaction kinetics. Relations between state functions and their derivatives. Total differentials, partial differentials and their meaning. Introductory description of thermodynamic energy functions (U, H, A and G), departure functions and thermodynamic reference states. Kinetics of reaction-effects of reactant and product concentration, determination order of reaction, effect of temperature on reaction kinetics, activation energy, catalysis. Electrolytes, conductance, electrode potentials, Galvanic cell, determination of emf electrode potential, thermodynamics of electrochemical cell, Nersnt equation , Electrolysis, Faraday's Law.

EBB 123/3 - Basic Mechanical Behaviour of Materials

Objective: Provide basic knowledge of applied mechanics related to the behavior of solid bodies of materials when subjected to loads.

Synopsis: This course provide the basic fundamental on relationships between external loads (forces and moment) and internal forces to deformation induced in the body of engineering materials

EUM 114 Advanced Engineering Calculus

Objectives: 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.

EEU104/3 – Electrical Technology

Objective: To study characteristics of various elements of electrical engineering and analyze the electrical circuits and magnetic devices.

Synopsis: **Units, Definitions, Experimental Laws and Simple Circuits**
System of units, charge, current, voltage, and power types of circuits and elements. Ohm's law, Kirchhoff's laws, analysis of a single-loop current, single node-pair circuit, resistance and source combination, voltage and current division.

Circuit Analysis Techniques
Nodal and mesh analyses, linearity and superposition, source transformations, Thevenin's and Norton's theorems.

Inductance and Capacitance
The V-I relations for inductor and capacitor, inductor and capacitor combinations, duality, linearity and its consequences.

Source-free Transient Response of R-L and R-C Circuits

Simple R-L and R-C circuits, exponential response of source free R-L, R-C circuits.

Response to Unit Step Forcing Function
Response of R-L and R_C circuits to unit step forcing functions.

Response to Sinusoidal Forcing Function
Characteristic of sinusoidal forcing functions, response of R-L and R-C circuits to sinusoidal forcing functions.

Phasor Concept
The complex forcing function, the phasor, phasor relationships for R, L and C, impedance and admittance

Average Power and RMS Values
Instantaneous power, average power, effective values of current and voltage, apparent power and power factor, complex power.

Power System Circuits
An overview of single and three phase systems, wye and delta configurations of three circuits, wye and delta transformations, and power calculations in three phase systems.

Magnetic Circuits and Devices
Concept and laws of magnetism and analysis of transformers. Introduction to electromechanical energy conversion, operation of machines as generators and motors, power loss, efficiency and operations at maximum efficiency.

EML 101/2 – Engineering Practice

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 also 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.

EBB 202/3 - Crystallography and Bonding in Solids

Objective: To learn the basic symmetry in crystals and the development of space groups - characterization of crystal symmetry. Bonds in solids, atom and molecule structure and the application of X-ray diffraction are also touched.

Synopsis: The subject discuss about crystal symmetry including point and space group symmetry presented and explained through stereographic projection and crystal models. Bonding in Solids covers atomic models and the general wave equation, Schrödinger equation for quantum number (electronic level of electrons), and types of bonding in solids and its contribution / correlation with materials properties. The principle and application of X-Ray diffraction techniques for the characterization of crystal materials.

EBB 251/2 - Basic Programming and Engineering Design.

Objective: To introduce programming methods and develop structured engineering programming programs. Introduces Solidworks software as a 3-D design tool that covers the creation, retrieval and modification of 3-D and drawing layouts using basic Solid Works instructions.

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Synopsis: This course focuses on hands-on practical training that ensure students are familiar with the "Visual Basic" and "Solidworks" softwares for engineering applications.

EBB 236/3 - Materials Thermodynamic

Objective: To learn thermodynamics concept and its application to material systems.

Synopsis: This course will cover the basic knowledge, comprehension and application of law of thermodynamic to understand the relationship between the properties that matter exhibits as it changes its condition. The first part includes review of thermodynamic concept, statistic thermodynamic and solution. The second part covers the phase equilibrium, thermodynamic of phase diagram, crystal defect, phase transformation unary and heterogeneous system, solution, phase equilibrium, surface and interface, defects in crystal, phase transformation and energy of interfaces.

EUP 222/3 - Engineers in Society

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.

EBB 201/3 – Engineering Economy and Management

Objective: To introduce students to the engineering management technology and principle, and how to apply the knowledge in engineering project management. The focus is on developing students' ability to make critical decision related to the assigned job and other engineering project management activities based on the engineering management technology and principle. Students will also be trained to apply the knowledge of engineering economy into the planning, execution and evaluation of any engineering projects.

Synopsis: The course is on management and engineering economy focusing on their relevance in Materials Engineering. The course is divided into two parts: (i) engineering management and (ii) engineering economy management in general. Topic on the engineering management is divided into several subtopics including the Function of Management Technology (leadership, planning, making decision and organization) and Management Technology whereby the most important aspect in a working structure and project management will be discussed. In the final topic of the course, knowledge on Career Management as an engineer will be thought whereby engineers from industries will be invited to share on experience with the students. In the second part of this course, fundamental concepts, models, and principles of economy related to engineering will be introduced. In addition, importance of cost, time value of money, and changes of value in a project will also be covered briefly; aiming to provide some basic knowledge and understanding of economy and management related to Materials Engineering.

EBB 204/2 - Materials Characterization Laboratory

Objective: To gain experience in materials characterization through the various tests and characterization of materials.

Synopsis: The course is an introductory course on experimental method related to the materials properties and materials testing methodology. It consists of ten set of different experiments which the student has to carry out with the assistance of lecturer and technical staff. Each experiment covers various aspects of materials properties testing such as mechanical, physical, corrosion and electrical conductivity. Students are divided into small group and hands-on experiments are performed. Students are required to record, analyze, discuss the result and finally submit a report at the end of each session.

EBB 222/3 - Ceramic Materials and Processing

Objective: To introduce ceramic materials as well as processing involved in ceramic, glass and glass ceramics related industries.

Synopsis: This is the first course on ceramic engineering which covers various aspect in fabrication of ceramic products including glass and glass-ceramic. Selection, type of raw materials and processes used by industry will be exposed to student.

EBB 215/3 - Semiconductor Materials

Objective: To introduce and expose the student to semiconductor materials including their physical and chemical properties, and their applications in semiconductor devices

Synopsis: The course is divided into two parts. The first part (part I) is an introduction of atomic model, bonding forces in solid, semiconductor materials and the concept of energy band model in solids. Having established the fundamental theory of crystals and some quantum mechanics in Part I, Part II takes a real semiconductor material as an example and expand the above mentioned topics to deal with semiconductor in equilibrium and non-equilibrium, transport phenomena in a semiconductor and junction formation (p-n and metal-semiconductor) which is the basic building block of semiconductor and optoelectronics devices.

EBB 220/3 - Engineering Polymers

Objective: To introduce basic engineering concepts for polymer chemistry, processing and production.

Synopsis: This course covers topics on introduction to various polymers such as thermoplastics, thermoset, elastomer, thermoplastic elastomer, and polymer composites. The course also covers relationship between

structures, properties and application as engineering materials with specific conditions. It also discusses the modifications of polymers, processing, rheological properties and viscoelastic concepts. It also covers the examples of commercially available polymeric materials for instance thermoplastic and thermoset for general and engineering applications.

EBB 226/3 - Physical Metallurgy and Heat Treatment

Objective: To provide exposure to aspects of physical metallurgy including the microstructure and physical properties of materials in ferrous and non - ferrous alloys as well as in heat treatment.

Synopsis: This course is a general introduction in physical metallurgy. It covered the basic principles of applied chemistry and physics for metals and alloys. The topics covered are: metal crystal structure, solidification process, plastic deformation behaviour, strengthening mechanisms-solid solution hardening, work hardening, dispersion hardening, order-disorder strengthening, recovery, recrystallization and grain growth, introduction to basic phase diagram, iron-carbon diagram, T-T-T diagram, hardenability, heat treatment for steel, ferrous metal, non-ferrous metal and alloy, heat treatment for non-ferrous metal.

EBB 325/2 - Microscopy Laboratory

Objective: To give exposure on the typical microstructures observed in many materials and aspects related to metallographic practices.

Synopsis: The course is a practical course on techniques and applications of microscopes in materials engineering study. It consists of ten set of different experiments which the student has to carry out with the assistance of lecturer and technical staff. Students are divided into small group and hands-on experiments are performed. Students are required to record, measure, calculate the result and finally write and submit a report at the end of each session. Each experiment covers various aspects of like samples preparation prior to analysis (etching), the use of optical microscope and the use of scanning electron microscope. The students are also invoked in the study of material properties with respect to the microstructure of the materials. Safety aspects and regulations on conducting scientific experiments are also briefed and taught.

EBB 323/3 - Semiconductor Fabrication Technology

Objective: To introduce about **s**ilicon wafer production technology and integrated circuits.

Synopsis: This course focuses on the major process technologies used in the fabrication of integrated circuits (ICs) and other semiconductor devices. Each lecture topic covers important scientific aspects of silicon wafer processing steps. Topics include: crystal growth and wafer preparation, crystal purification techniques, contamination control, oxidation, diffusion, ion implantation, lithography, thin film deposition technology, etching, metallization, process integration, electronic packaging and yield

EBU 301/2 : Acquisition and Measurement of Digital Data

Objective: To provide students with an understanding and basic skills of digital data acquisition and measurement as well as the importance of both aspects in the field of engineering. Such skills can help students perform important and often required digital data measurement and acquisition activities in the field of materials and mineral resources engineering.

Synopsis: This course will train students to develop a simple circuit suitable for the functions and requirements of digital data measurement and acquisition in the engineering field. Students will be exposed to basic concept of digital measurement involving conversion of basic physical quantities such as distance, temperature, pressure, current and light intensity into electrical signals. The use of sensors / transducers which are capable of detecting these physical changes will be interfaced with a basic data acquisition system for recording digital data often needed in real engineering applications. The basic skills of digital data acquisition will be applied in specialized projects relevant to the study of materials and mineral resources engineering.

EBB 343/3 : Engineering Materials Characterization

Objective: To give some introduction to materials characterization methods in theory and applications.

Synopsis: This course is on materials characterization techniques from the theoretical aspect, instrumentation and applications. It covers three topics: (a) Microstructural Analysis which includes electron microscopy, (b) Thermal Analysis and (c) Spectroscopy: phases and surface analysis for example x-ray techniques and electrons spectroscopy.

EBB 345/3 : Mechanical Behavior of Materials

Objective: To introduce all the aspects related to the mechanical behavior of materials.

Synopsis: Mechanical behaviour of materials concerned primarily with the response of various kinds of materials including metals, ceramics and polymers to forces or loads. It is a combination of many disciplines and many approaches to understand the response of materials to forces including strength of materials, theories of elasticity and plasticity, where a component is considered to be homogeneous materials. The determination of the relationship between the materials behaviour and engineering structure is the main interest of this course in order to minimize the possibility of failure. This course emphasizes on testing of materials based on acceptable standards, i.e. tensile, hardness, impact, fatigue, creep and wear, including data analysis and explaining the mechanics of the various failure modes.

EBB 300/3 : Engineering Statistics

Objective: Strengthening knowledge and skills in mathematical modeling to provide students in understanding engineering mathematics concepts then able to formulate and solve engineering problems.

Synopsis: This course is emphasizing the role of experimental design in engineering fundamentals and applications of experimental design such as sampling distributions, data analysis, factorial design, regression and correlation.

EBB324/3 : Electronic Packaging

Objective: This course aims to introduce the technologies and materials in advanced electronic packaging.

Synopsis: The course is intended to introduce the subject of integrated circuit (IC) packaging, IC package assembly and board assembly process, overview of materials in electronic packaging: interconnect materials (solder, flux, wire), encapsulant, thermal interface materials and substrate, quality and reliability in electronic packaging.

EBB334/3 : Biomaterials

Objective: To provide basic concepts and up-to-date knowledge on biomedical materials, processing techniques and characterization, properties and applications of biomedical materials in biomedicine.

Synopsis: This course provides a broad perspective about an overview for biomaterials engineering and processing, classes of biomaterials used

and application of biomaterials in medicine, biology, and artificial organs.

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EBS 238/3 : Fluid Mechanics

Objective: To introduce the concept, analysis and the fluid in static and dynamic condition.

Synopsis: Basic information on characteristics of floating bodies, forces when constant linear acceleration and constant rotational acceleration is applied. Fluid kinematics, momentum and Bernoulli equation and flow measurements. Boundary layers, control and separation, lift and drop forces.

Flow in pipes, pipe network analysis. Flow in open channel, critical flow and normal flow, hydraulic pump, fully developed flow that varies gradually. Hydraulic machines and pressure changes in pipes. Dimensional analysis, similarity models and hydraulic models.
Hydraulic machine, impulse turbines, reaction turbines and centrifugal pump. Pressure change in pipes, simple methods, surge tank.

EBB 326/3 : Corrosion Engineering

Objective: The purpose of this course is to understand the process of corrosion and degradation from a theoretical aspect as well as understand the types of corrosion and degradation. In addition, this course also aims to understand corrosion measurement and analysis techniques. The concept of corrosion and degradation prevention and its relevance in terms of material selection and design aspects are also covered in this course.

Synopsis: The course is intended to introduce the subject of corrosion of metals and degradation of other classes of materials at the undergraduate level. The bulk of course dwells into the aspects of corrosion of metals and their prevention. Only limited coverage given to the degradation of non-metallic materials.

EBB 317/2 : Materials Processing Laboratory

Objective: To give hands-on practice related to the processing of engineering materials.

Synopsis: This laboratory course which uses an open-ended laboratory (OEL) approach contains 4 set of experiments that cover different types of materials processing (ceramics, metals, polymers and polymer composites, electronic materials). Laboratory experiments are designed

for hands-on experience in a small group of students to understand the parameters involve in the processing and relate the structure with the properties of the materials. This course provides students with an opportunity to plan their experimental work, perform the experiment, characterize the materials and analyze the results. This course also emphasizes the technical writing aspect where all students' observation and arguments of each experiment must be reported in proper format. Safety aspects and regulations on conducting scientific experiments are also briefed and taught in this course.

EBB 337/3 : Advanced Material and Composites

Objective: To introduce the manufacturing process, nature and usage of advanced materials and composites.

Synopsis: This course offers further understanding on the fabrication, properties and applications of various advanced composite materials. Typical topics covered include ceramic engineering materials, advanced metal and alloys, speciality polymers, introduction to composite materials, composite materials based on matrix (MMC, PMC, CMC), failure mechanism and application and design of the composites.

EBB 307/3 : Failure Analysis and Non Destructive Testing

Objective: To introduce the failure analysis technique to solve industrial and industry product problems as well as NDT techniques.

Synopsis: An industry applies Non-Destructive Testing (NDT) as an economic tool to establish the integrity of the engineering components. The course covers the identification and analyzes the premature failure of an engineering component in carrying out its job. Origin of Failure; Location of contributing stress concentrators, presence of relevant contaminants on the fracture, direction of crack propagation and sequence of failure, Failure mode and mechanism, Orientation and magnitude of stresses, imperfections contribution to the failure and Sizes and other important physical data. Not only faulty manufacturing processes are the reasons for discontinuities in an industrial product but also due the environmental and loading condition during service, lab testing with FA is also introduced. Non destructive testing NDT methods can be used to detect discontinuities in industrial products without affecting the service performance of the product in any way. Therefore, The most important NDT techniques that discussed in detail are: Visual Inspection (VI), Liquid penetrant testing (PT), Magnetic particle testing (MT), Eddy Current testing (ET), Ultrasonic Testing (UT) and

Radiographic testing (RT). Writing a Failure Analysis Technical report is also introduced.

EBB 328/3 : Occupational Safety and Health

Objective: To give exposure to students about the health and safety requirement in industry.

Synopsis: Introduction to holistic and global occupational safety and health (OSH) engineering concepts towards efficient industrial development, significance of occupational safety and health in quality assurance, complemented by professional and ethical responsibilities towards safety in the industry. Major course components towards competence in occupational safety and health engineering include importance of OSH in national development, OSH legislation, benefits of OSH training and professionalism, OSH management policies and protocols, OSH performance monitoring, OSH assessment and audit techniques, hazard identification, risk assessment and implementation of safe worksite practices.

EBB 308/3 : Materials Selection and Design Analysis

Objective: Introduce material selection and process selection techniques for any engineering product or function, as well as design analysis using Solidwork software.

Synopsis: The focus of this course is engineering design where design analysis and the role of materials selection along manufacturing process in any design process will be explored. Various methods to do materials selection will be studied focusing on selection using Ashby charts of material properties and process. Then, the use of Solidworks software for design analysis in order to improve performance of component. Case studies and Problem Based Learning (PBL) will be used to enhance understanding and ability to carry out materials selection and design analysis in engineering design.
Case studies and project work will be used to reinforce the concepts and capabilities in applying selection of materials in engineering design.

EBB 339/3 : Nanomaterials

Objective: To give exposure on nanomaterials, fabrication method, properties and application of nanomaterials.

Synopsis: The main aim of this course is to equip students with knowledge on nanomaterials especially on the properties of materials in nanoscale, technique of fabrications, characterizations and applications of nanomaterials in various types of industries: electronics, optics, biotechnology, chemicals and other related engineering industries. Different types of nanomaterials will be introduced: metal, ceramics, semiconductors, carbon-based material, composite and polymer at different dimensions: 0, 1 and 2 dimensions. Societal impact of nanomaterials will also be discussed.

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EBB 327/3 : Technology and Application of Engineering Polymer

Objective: To give exposure on the technology and application of polymer in the engineering field.

Synopsis: This course covers topics on technology and applications of various polymers in engineering applications. It covers the properties and the processing techniques for three types of polymeric materials such as thermoset, thermoplastics and elastomer. Examples of new polymeric materials and commercially available polymeric materials, for instance thermoplastic and thermoset for general and engineering applications are covered in the course. Environmental issues in polymeric materials are also discussed.

EBS 323/3 : Pyrometallurgy

Objective: To know the general principles and different techniques of metals extraction and refining from ores at high temperatures for both ferrous and non-ferrous metals.

Synopsis: This course is a general introduction to pyrometallurgy. It covers the basic principles and actual industrial practice of extraction and refining of iron, steel, and other important non-ferrous metals. The topics covered are: thermodynamic principles, Ellingham diagram, blast furnace iron making including the physicochemical reactions, direct reduction processes, principles of steel making, major reactions and refining of steel, principles and practice of clean steel making, major process steps in non-ferrous metal extraction, roasting, matte smelting, vapour metallurgy, refining of non-ferrous metals, industrial practice for common non-ferrous metals.

EBB 350/5 : Industrial Training

Objective: Students are all required to undertake a compulsory ten weeks industrial training during long vacation i.e. after the second semester final

examination (third year level). Students will get their placement at various industrial sectors related to materials engineering program. They should experience the real exposure as an engineer in this field. Students will be given training on various aspects, such as analysis, design, management, quality control, and economy, which is related to their future career. The content of training is depending on the respective company and industry. It may vary from one and other. The students have the choice of applying any company or industry by themselves or from the list given by the Deputy Dean (Student Affairs and Industrial Linkages & Networking). If the former option is taken, offer from any company or industry must be approved by the Deputy Dean (Student Affairs and Industrial Linkages & Networking). During the training, a Log Book must be prepared by the students. To ensure the performance of the students, a visit by an academic staff to the company or industrial, where the students are trained, will be carried out during the mid term of the training program. After the training, a detail report must be submitted and a Poster presentation must be given by the students.

EBB 407 : Final Year Research Project

Objective: To give exposure in conducting scientific research projects.

Synopsis: This course is offered for 2 semesters. It offers further understanding on selected topic in Materials Engineering. Each student is given a title for an individual research project in the first semester. Students are required to carry out literature study, analysis of previous work, research experimental design and prepare a proposal in the first semester. In the second semester, the students are required to carry out experimental work, collecting data, discussion, dissertation writing and oral presentation. The dissertation will be examined by an examiner. In the oral presentation, the student is expected to defend his/her finding in front of a panel of examiners.

EBB 410/4 : Materials Product Design

Objective: Application of prior knowledge of materials and material properties, the relationship of material selection-process-design-product performance, as well as the influence of aspects of product manufacturing such as cost, environmental impact and the impact of other external factors.

Synopsis: Engineering design project where the design and role of materials selection in any design process will be focused on. Students work in group, using knowledge that has been gained from previous courses. This includes fundamental of materials and material properties, relationship between structure of materials - properties - design - processing - performance of

product, along with economical aspect or cost of manufacturing, environmental impact, engineering analysis related to design and performance of product, as well as other external factors that influence the product.

EBB 440/3 : Metal Processing and Surface Engineering

Objective: To provide exposure to metal and alloy processing techniques, factors influencing manufacturing, typical defects and how to overcome them, as well as design aspects in product manufacturing.

Synopsis: The course covers the various processing techniques, parameters involved, common defects associated with each process and methods to eliminate them, and the design aspects. The processes include casting, powder metallurgy, metal deformation, sheet metal working, wire drawing, joining technology, machining and surface engineering.

EBB 444/3 : Industrial Ceramics

Objective: To supply knowledge related to concepts, technologies, designs and ceramic-based products that exist in related industries

Synopsis: This course covers topics on type of different industrial ceramic products. This course also covers on the processing, properties, characterization/testing methods for ceramic products such as refractory, thermal insulator, electroceramics, high strength and toughness of structural ceramics. It also discusses the sintering mechanism and the concepts in designing ceramic products.

EBB 424/3 : Semiconductor Devices and Opto-Electronics

Objective: To introduce semiconductor devices like dipolar junction transistors (BTT), FET etc. Basic principles of laser and optoelectric devices such as solar cells and photoreceptors are also contained in this course.

Synopsis: This course is divided into two major topics ; semiconductor devices and optoelectronics. The semiconductor devices part covers topic on bipolar junction transistors (BJT), metal oxide semiconductor (MOS) capacitor, field effect transistor (FET), metal oxide semiconductor field effect transistor (MOSFET), and the latest technology of single-electron transistor (SET). However, part of optoelectronics including light emitting diode (LED), laser, photodiode, photodetector, and photovoltaic materials and device configuration.

EBB 433/3 : Transport Processes

Objective: To learn about fluid dynamics (viscosity characters of fluid), transportation energy, energy equations and mass transportation.

Synopsis: The main aim of this course is to give a balanced overview of the field of transport phenomena which includes three closely related topics: (i) momentum transport, (ii) heat transfer and (iii) mass transfer. It presents the fundamentals of the three subjects emphasizing in the mathematical similarity of the equations used to describe the processes, and illustrate how to use them to solve problems.

EBB 442/3 : Quality Control and Management

Objective: To develop students' knowledge on quality concepts, control, improvement, and management.

Synopsis: This course presents knowledge and demonstrates skills necessary to structure, manage, maintain, and improve quality of an organization. Topics include: Introduction to quality, management aspects of quality, statistical methods to control and improve quality, and concept of reliability.

EBB 438/3 : Process Control

Objective: To introduce the basic concept of process control system.

Synopsis: This course covers the structure of feedback control theory from the basic mathematics to a variety of design applications. The design of an over-all process control system (open-loop and close loop) requires a good theoretical understanding of stability, the dynamic characteristics of controllers and general process control loop dynamic characteristics. The course discusses terminology, concepts, principles, procedures and computations used in the design activity to select, analyze, specify and maintain all parts of the control system.

4.11 PROGRAMME FOR BACHELOR OF MINERAL RESOURCES ENGINEERING WITH HONOURS

PROGRAMME OBJECTIVES

1) PEO1- Employable graduates with the knowledge and competency in Mineral Resources Engineering related fields
2) PEO2 – Graduates having good leadership and soft skills with the right attitudes and ethics
3) PEO3 – Graduates who possess interest in research and/or lifelong learning

PROGRAMME OUTCOMES

PO No	Programme Outcomes
PO1	Graduates able to apply the knowledge of mathematics, natural science, engineering fundamentals and engineering specialization related to the practice of **Mineral Resources Engineering** and solve complex engineering problems
PO2	Graduates have the ability to identify, formulate, conduct research literature and analyse complex engineering problems using first principles of mathematics, natural sciences and engineering sciences
PO3	Graduates have the ability to design solution for complex engineering problems and design systems, components or processes that meet specified needs for public health and safety, cultural, societal, and environmental considerations
PO4	Graduates have the ability to conduct an investigation of complex problems related to **Mineral Resources Engineering** using research based knowledge and research methods to provide valid conclusions
PO5	Graduates have the ability to select and apply appropriate techniques, resources and modern engineering and IT tools, to complex engineering problems with an understanding of the limitations
PO6	Graduates have the ability to reason using contextual knowledge in assessing societal, health, safety, legal and cultural issues, relevant to professional **Mineral Resources Engineering** practice and solutions to complex engineering problems
PO7	Graduates have the ability to understand and evaluate the sustainability, and impact of professional engineering work in the solution of complex engineering problems in society and the environment context

PO8	Graduates have the ability to apply ethical principles and commit to professional ethics and responsibilities, and norms of **Mineral Resources Engineering** practice
PO9	Graduates have the ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
PO10	Graduates have the ability to communicate effectively on complex engineering activities with the engineering community and with society at large
PO11	Graduates can demonstrate knowledge and understanding of engineering management principles and economic decision- making, and apply them to manage projects in multidisciplinary environments
PO12	Graduates recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

4.11.1 CURRICULUM STRUCTURE FOR BACHELOR OF MINERAL RESOURCES ENGINEERING WITH HONOURS

COURSE TYPE	LEVEL 100				LEVEL 200				LEVEL 300				LEVEL 400				TOTAL UNIT
	SEMESTER 1		SEMESTER 2		SEMESTER 1		SEMESTER 2		SEMESTER 1		SEMESTER 2		SEMESTER 1		SEMESTER 2		
	Code & Course	Unit	Code & Course	Unit	Code & Course	Unit	Code & Course	Unit	Code & Course	Unit	Code & Course	Unit	Code & Course	Unit	Code & Course	Unit	
CORE	EUM 113 Engineering Calculus	3	EUM 114 Advanced Engineering Calculus	3	EBS 238 Fluids Mechanics	3	EBS 210 Mining Engineering	2	EBB 300 Engineering Statistics	2	EBS 308 Materials Transport	2	EBS 423 Mine & Plant Design	4	EBS 430 Final Year Project	5	108
	EBP 105 Introduction to Statics& Dynamics	3	EEU 104 Electrical Technology	3	EBS 201 Mineral Deposits	3	EBS 215 Comminution & Sizing	3	EBS 322 Physical Mineral Processing	3	EBS 349 Mine Planning Economics	3	EBS 417 Geomechanics	3	EBS 433 Mining and Quarry Law	2	
	EBB 113 Engineering Materials	3	EBB 160 Physical chemistry of Engineering	3	EBS 209 Mineralogy	3	EBS 211 Mining Methods	3	EBS 315 Hydrometallurgy	3	EBS 319 Blasting Technology	2	EBS 449 Mine Environmental Engineering	3			
	EBS 111 Introduction to Mining Engineering	2	EBB 123 Basic Mechanical Behaviour	3	EUP 222 Engineers in Society	3	EBS 242 Petrography & Ore Microscopy	3	EBS 328 Geochemical Exploration	3	EBS 323 Pyrometallurgy	3	EBS 430 Final Year Project	1			
	EBS 110 Engineering Drawing	2	EML 102 Engineering Practice	2	EBB 250 Computer Methods for Engineers	2	EBS 263 Mine Geomatic Engineering	2	EBU 301 Digital Measurement and Data Acquisition	2	EBS 341 Mineral Processing Engineering Laboratory	2					
	EBS 121 Geology for Engineers	3			EBS 236 Analytical Chemistry	3											
	16		14		17		13		13		12		11		7		
UNIV REQ	Bahasa Malaysia/ Opsyen 2 Bahasa Inggeris/ Opsyen 4 Kokurikulum/ Opsyen 3 Falsafah dan Isu semasa 2 Penghayatan Etika dan Peradaban 2 KursusKemahiran/ Opsyen 2																15
ELECTIVE									EBS 325 Mineral chemistry Laboratory	2	EBB 438 Process Control	3	EBS 425 Industrial Mineral	3	EBS 418 Petroleum Engineering	3	12
									EBB 343 Engineering Materials Characterisation	3	EBS 329 Engineering Geophysic	3			EBS 432 Environment Chemistry for Engineering Practise	3	
											EBB 328 Occupational Safety & Health	2					
TOTAL UNIT FOR GRADUATION																	135

SEMESTER BREAK

EBS 350 10 Week INDUSTRIAL TRAINING

4.11.2 CURRICULUM

LEVEL 100

Semester 1		Unit		
		Total	**Lecture**	**Lab**
EUM 113/3	Engineering Calculus	3	3	0
EBP 105/3	Introduction to Statics and Dynamics	3	3	0
EBB 113/3	Engineering Materials	3	3	0
EBS 121/3	Geology for Engineers	3	3	0
EBS 110/2	Engineering Drawing	2	0	2
EBS 111/2	Introduction to Mineral Resources Engineering	2	2	0
		16	14	2
University Requirement				
LMT 100/2	English Language	2	2	0
SEMESTER BREAK				
Semester II		**Unit**		
		Total	**Lecture**	**Lab**
EUM 114/3	Advanced Engineering Calculus	3	3	0
EEU 104/3	Electrical Technology	3	3	0
EBB 123/3	Basic Mechanical Behavior of Materials	3	3	0
EBB 160/3	Physical Chemistry of Engineering Materials	3	3	0
EML 101/2	Engineering Practice	2	0	2
		14	12	2
University Requirement				
LKM 400/2	Bahasa Malaysia	2	2	0
WUS 101/2	Entrepreneurship	2	2	0
SESSION BREAK				

LEVEL 200

Semester I		Unit		
		Total	**Lecture**	**Lab**
EBS 238/3	Fluid Mechanics	3	3	0
EBS 201/3	Mineral Deposits	3	3	0
EBS 209/3	Mineralogy	3	2	1
EUP 222/3	Engineers in Society	3	3	0
EBB 250/2	Computer Methods for Engineer	2	0	2
EBS 236/2	Analytical Chemistry	2	2	0
		16	13	3
University Requirement				
LSP 300/2	Academic English	2	2	0
HFF 225/2	Philosophy and Current Issues	2	2	0

SEMESTER BREAK

Semester II		Unit		
		Total	**Lecture**	**Lab**
EBS 210/2	Mining Engineering Laboratory	2	0	2
EBS 211/3	Mining Methods	3	3	0
EBS 215/3	Comminution & Sizing	3	3	0
EBS 242/3	Petrography & Ore Microscopy	3	3	0
EBS 263/2	Mine Geomatic Engineering	2	2	0
		13	11	2
University Requirement				
LSP 404/2	Technical and Engineering English	2	2	0
HFE 224/2	Appreciation of Ethics and Civilisations	2	2	0

SESSION BREAK

LEVEL 300

Semester I		Unit		
		Total	**Lecture**	**Lab**
EBB 300/2	Engineering Statistic	2	2	0
EBS 315/3	Hydrometallurgy	3	3	0
EBS 322/3	Physical Mineral Processing	3	3	0
EBS 328/3	Geochemical Exploration	3	3	0
EBU 301/2	Digital Measurement and Data Acquisition	2	0	2
		13	11	2
Electives				
EBS 325/2	Mineral Chemistry Laboratory	2	0	2
EBB 343/3	Engineering Materials Characterization	3	3	0

SEMESTER BREAK

Semester II		Unit		
		Total	**Lecture**	**Lab**
EBS 308/3	Materials Transport Engineering	3	3	0
EBS319/2	Blasting Technology	2	2	0
EBS 323/3	Pyrometallurgy	3	3	0
EBS 349/3	Mine Planning and Economics	3	3	0
EBS 341/2	Mineral Processing Engineering Laboratory	2	0	2
		13	11	2
Electives				
EBB 338/3	Process Control	3	3	0
EBS 329/3	Engineering Geophysics	3	3	0
EBB 328/2	Occupational Safety & Health	2	2	0

SESSION BREAK – EBS 350/5 Industrial Training

LEVEL 400

Semester I		Unit		
		Total	**Lecture**	**Lab**
EBS 417/3	Geomechanics	3	3	0
EBS 423/4	Mine and Plant Design	4	4	0
EBS 449/3	Mine Environmental Engineering	3	3	0
EBS 430/1	Final Year Research Project	1	0	1
		11	10	1
Electives				
EBS 425/3	Industrial Minerals	3	3	0

SEMESTER BREAK

Semester II		Unit		
		Total	**Lecture**	**Lab**
EBS 430/5	Final Year Research Project	5	0	5
EBS 433/2	Mining and Quarry Law	2	0	2
		7	2	5
Electives				
EBS 418/3	Petroleum Engineering	3	3	0
EBS 432/3	Environmental Chemistry for Engineering Practice	3	3	0

SESSION BREAK

4.113 COURSE PROGRAMME OUTCOME MATRIX (MINERAL RESOURCES ENGINEERING)

Level		No.	Course	CODE		CREDIT UNITS	Emphasis to the Program Outcomes											
				SEM 1	SEM 2		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CORE	100	1	Engineering Calculus	EUM113		3	/	/										
		2	Introduction to Static and Dynamics	EBP105		3	/	/										
		3	Engineering Materials	EBB113		3	/	/										
		4	Geology for Engineers	EBS121		3	/	/										
		5	Engineering Drawing	EBS110		2	/				/							
		6	Introduction to Mineral Resources Engineering	EBS111		2	/		/			/						
		7	Advance Engineering Calculus		EUM114	3	/	/										
		8	Electrical Technology		EEU104	3	/											
		9	Basic Mechanical Behaviour of Materials		EBB123	3	/	/										
		10	Engineering Practice		EML101	2	/		/		/	/		/	/			
		11	Physical Chemistry of Engineering Materials		EBB160	3	/	/										
	200	12	Fluid Mechanics	EBS238		3	/	/										
		13	Engineering Society	EUP222		3						/		/			/	
		14	Mineral Deposit	EBS201		3	/	/										
		15	Mineralogy	EBS209		3	/				/							
		16	Computer Methods for Engineers	EBB250		2	/	/	/		/							
		17	Analytical Chemistry	EBS236		2	/				/							
		18	Mine Geomatic Engineering		EBS263	2	/	/							/			
		19	Mining Engineering Laboratory		EBS210	2	/	/	/				/					/
		20	Comminution and Sizing		EBS215	3	/	/										
		21	Petrography and Ore Microscopy		EBS242	3	/			/	/							
		22	Mining Methods		EBS211	3	/		/			/						
	300	23	Geochemical Exploration	EBS328		3	/	/	/									
		24	Hydrometallurgy	EBS315		3	/	/										
		25	Physical Mineral Processing	EBS322		3	/	/	/									
		26	Engineering Statistic	EBB300		2	/	/		/								
		27	Digital Measurement and Data Acquisition	EBU301		2	/				/							
		28	Materials Transport Engineering		EBS308	3		/	/									
		29	Mine Planning and Economics		EBS349	3	/										/	
		30	Blasting Technology		EBS319	2	/		/				/					
		31	Pyrometallurgy		EBS323	3	/	/										
		32	Mineral Processing Laboratory		EBS341	2	/	/	/						/			
		33	Industrial Training	EBS350	EBS350	5	/	/				/		/	/	/		/
	400	34	Mine and Plant Design	EBS423		4	/	/	/	/	/	/	/		/	/	/	/
		35	Geomechanics	EBS417		3		/		/	/							
		36	Mine Environmental Engineering	EBS449		3			/			/						
		37	Mining and Quarry Law		EBS433	2	/						/					
		38	Final Year Project	EBS430	EBS430	6	/	/	/	/	/	/				/	/	/
ELECTIVE	300	39	Mineral Chemistry Laboratory	EBS325		2	/	/	/	/	/		/	/	/	/		
		40	Engineering Materials Characterisations	EBB343		3	/	/	/									
		41	Engineering Geophysics		EBS329	3	/	/	/									
		42	Process Control		EBB338	3	/	/										
	400	43	Industrial Minerals	EBS425		3	/	/										
		44	Occupational Safety and Health		EBB328	3	/					/						
		45	Petroleum Engineering		EBS418	3	/			/							/	
		46	Environmental Chemistry for Engineering Practice		EBS432	3	/	/		/								

PO	Programme Outcome
PO1	Graduates able to apply the knowledge of mathematics, natural science, engineering fundamentals and engineering specialization related to the practice of Mineral Resources engineering and solve complex engineering problems
PO2	Graduates have the ability to identify, formulate, conduct research literature and analyze complex engineering problems using first principles of mathematics, natural sciences and engineering sciences
PO3	Graduates have the ability to design solution for complex engineering problems and design systems, components or processes that meet specified needs for public health and safety, cultural, societal, and environmental considerations
PO4	Graduates have the ability to conduct investigation of complex problems related to Mineral Resources engineering using research based knowledge and research methods to provide valid conclusions
PO5	Graduates have the ability to select and apply appropriate techniques, resources and modern engineering and IT tools, to complex engineering problems with an understanding of the limitations
PO6	Graduates have the ability to reason using contextual knowledge in assessing societal, health, safety, legal and cultural issues, relevant to professional Mineral Resources engineering practice and solutions to complex engineering problems
PO7	Graduates have the ability to understand and evaluate the sustainability, and impact of professional engineering work in the solution of complex engineering problems in society and the environment context
PO8	Graduates have the ability to apply ethical principles and commit to professional ethics and responsibilities, and norms of Mineral Resources engineering practice
PO9	Graduates have the ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
PO10	Graduates have the ability to communicate effectively on complex engineering activities with the engineering community and with society at large
PO11	Graduate can demonstrate knowledge and understanding of engineering management principles and economic decision- making, and apply them to manage projects in multidisciplinary environments
PO12	Graduates recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

4.11.4 COURSE DESCRIPTION

EUM 113/3 – Engineering Calculus

Objective: 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.

EBP 105/3 – Introduction to Statics and Dynamics

Objective: To provide students with the fundamental concepts and principles of rigid bodies in statics and dynamics equilibrium.

Synopsis: This course is an introduction to the mechanics of rigid bodies. It is divided into two areas: Statics and Dynamics. In Statics, the student will learn the fundamental concepts and principles of rigid bodies in static

equilibrium. In Dynamics, the student will learn the fundamental concepts and principles of the accelerated motion of a body (a particle). Consideration is given on the fundamental of mechanics and structure analysis, including concepts of free body diagram as well as force, moment, couples, kinematic of motion, momentum, impulse, conservation of energy and equilibrium analyses in two and three dimensions.

EBB 113/3 – Engineering Materials

Objective: Students are expected to acquire the fundamental knowledge on engineering materials especially on the classification of materials, properties and applications.

Synopsis: The course is an introductory course on engineering materials which is divided into two main parts. The first part includes the classifications of engineering materials that determine their applicability, the structure of the materials explained by bonding scheme of different materials, the structure of crystalline solids and introduction to imperfection in solids and diffusion mechanism. The first part also includes the introduction of phase diagram. The second part covers the behaviors and characteristics of engineering materials including mechanical and electrical properties. In general, this introductory materials science and engineering course deals with the different material types (i.e., metals, ceramics, polymers, composites), as well as the various kinds of properties exhibited by these materials (i.e., mechanical, electrical, magnetic, etc.) which intended to equip the students with necessary knowledge on material science and engineering.

EBB 111/2 – Introduction to Mineral Resources Engineering

Objective: The course is an introductory and as an introduction to sustainable and appropriate mining and quarrying engineering

Synopsis: The course introduces types of mining and quarrying operations towards sustainable operation. The course covers mineral development process, strategic minerals worldwide & significance, impact of minerals in national & industrial development and professional career development and ethical responsibilities. The course also covers mineral prospecting, mineral prospecting, drilling techniques and rock fragmentation, introduction to mining methods and technology, introduction to mineral processing, introduction to pyrometallurgy, introduction to hydrometallurgy, environmental management and occupational safety and health.

EBS 110/2 - Engineering Drawing

Objective: To give basic knowledge in drawing concept applicable to engineering.

Synopsis: This course emphasizes on basic engineering design and drawings through manual method and by using CAD software. It covers basic methodology for traditional and concurrent design as well as basic engineering graphic principles such as drawing size, line styles, texts, conventional symbols, orthographic and isometric projection, multi-view drawings, dimensioning, section, part list and assembly and production drawings as well as standards in engineering drawing.

EBS 111/3 – Geology for Engineers

Objective: To give an introduction to geological aspects and its application in engineering.

Synopsis: Introduction to geological principles with emphasis on the application for the purpose of finding solutions to engineering problems. Chemical and physical properties of the earth and the internal structure of the earth. Geological time scale and method to determine geological age. Internal and external processes.
Magma activities, earthquake, volcanoes, metamorphism. Weathering, erosion, gravity action.
Mineral and rock identification according to its types - igneous rock, sedimentary rock and metamorphic rock.
Geological structure, joint, fault, discontinuity, unconformity, fold, strata.
Geological map. Use and interpretation. Apparatus used. Plate tectonic theory. Continent drift, opening and closing of ocean, convection current. Formation of mountains and other earth landforms.
Engineering properties on rocks, basics on the stability of slope and tunnels.

EUM 114/3 – Advance Engineering Calculus

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 nonlinear PDE, wave, heat and Laplace equations.

EEU104/3 – Electrical Technology

Objective: To study characteristics of various elements of electrical engineering and analyze the electrical circuits and magnetic devices

Synopsis: **Units, Definitions, Experimental Laws and Simple Circuits**
System of units, charge, current, voltage and power types of circuits and elements. Ohms law, Kirchhoff's laws, analysis of a single-loop current, single node-pair circuit, resistance and source combination, voltage and current division.

Circuit Analysis Techniques
Nodal and mesh analyses, linearity and Superposition, source transformations, Thevenin's and Norton's theorems.
Inductance and Capacitance
The V-I relations for inductor and capacitor, inductor and capacitor combinations, duality, linearity and its consequences.

Source-free Transient Response of R-L and R-C Circuits
Simple R-L and R-C circuits, exponential response of source free R-L, R-C circuits.

Response to Unit Step Forcing Function
Response of R-L, and R-C circuits to unit step forcing functions.

Response to Sinusoidal Forcing Function.
Characteristics of sinusoidal forcing functions, response of R-L and R-C circuits to sinusoidal forcing functions.

Phasor Concept

The complex forcing function, the phasor, phasor relation-ships for R, L, and C, impedance and admittance.

Average Power and RMS Values

Instantaneous power, average power, effective values of current and voltage, apparent power and power factor, complex power.

Power System Circuits

An overview of single and three phase systems, wye and delta configurations of three circuits, wye and delta transformations, and power calculations in three phase systems.

Magnetic Circuits and Devices

Concept and laws of magnetism and analysis of transformers. Introduction to electromechanical energy conversion, operation of machines as generators and motors, power loss, efficiency and operations at maximum efficiency.

EBB 160/3 - Physical Chemistry of Engineering Materials

Objective: Students are expected to be able to understand the basic concept of thermodynamics, kinetics and electrochemistry.

Synopsis: This course covers topics on introduction to thermodynamics, kinetics and electrochemistry. The concepts of mass and energy conservation (1st law) and reversibility (2nd law) applied to closed and open (control volume) systems. Thermochemistry, stoichiometry, chemical equilibrium, reaction kinetics. Relations between state functions and their derivatives. Total differentials, partial differentials and their meaning. Introductory description of thermodynamic energy functions (U, H, A and G), departure functions and thermodynamic reference states. Kinetics of reaction-effects of reactant and product concentration, determination order of reaction, effect of temperature on reaction kinetics, activation energy, catalysis. Electrolytes, conductance, electrode potentials, Galvanic cell, determination of emf electrode potential, thermodynamics of electrochemical cell, Nersnt equation, Electrolysis, Faraday's Law.

EBB 123/3 - Basic Mechanical Behaviour of Materials

Objective: To provide basic knowledge of applied mechanics related to the behavior of solid bodies of materials when subjected to loads.

Synopsis: This course provides the basic fundamental on relationships between external loads (forces and moment) and internal forces to deformation induced in the body of engineering materials.

EML 101/2 – Engineering Practice

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 also 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.

EBS 238/3 - Fluid Mechanics

Objective: To introduce the concept, analysis and the fluid in static and dynamic condition.

Synopsis: Basic information on characteristics of floating bodies, forces when constant linear acceleration and constant rotational acceleration is applied. Fluid kinematics, momentum and Bernoulli equation and flow measurements. Boundary layers, control and separation, lift and drop forces.

Flow in pipes, pipe network analysis. Flow in open channel, critical flow and normal flow, hydraulic pump, fully developed flow that varies gradually. Hydraulic machines and pressure changes in pipes. Dimensional analysis, similarity models and hydraulic models.
Hydraulic machine, impulse turbines, reaction turbines and centrifugal pump. Pressure change in pipes, simple methods, surge tank.

EBS 201/3 - Mineral Deposits

Objective: To give an introduction to the occurrence mineral deposits.

Synopsis: Morphological properties of ore bodies. Textural and structural properties of ore and gangue minerals. Fluid inclusions. Geothermometry and geobarometry. Paragenesis sequence. Zoning. Regional and metallorgraphy epoch. Theories on ore genesis. Sulphide stratiform deposits: Pb-Zn stratabound deposits. Alluvial deposits (Au, Sn) including paleoplacer. Banded iron formations. Manganese, phosphate and evaporate deposits. Coal. Residual deposits. Secondary enrichment. Raw materials: ceramic and construction. Sulfide deposits. Stratabound volcanogenic massive. Porphyry Copper. Quartz veins hydrothermal deposits (gold, tin, uranium, copper). Contact

metamorphism and metamorphic deposits.

EBS 209/3 - Mineralogy

Objective: To identify and to understand the development of mineral crystals, the physical properties of minerals, the basic method in mineral classification system and mineral types

Synopsis: To prepare student with a broad and fundamental knowledge of minerals, which is a major constituent of earth material (rock and ore), and formed in various geological environments. Emphasis is given in understanding of mineral definition and characteristics in terms of formation phenomenon, crystallography, mineral chemistry, physical properties, classification system and groups, including mineral identification and analysis techniques.

EUP 222/3 - Engineers in Society

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.

EBB 250/2 - Computer Methods for Engineers

Objective: To give exposure about several vital computer techniques in engineering - Visual Basic, Excel.

Synopsis: The course covers the basic of programming related to engineering environment. Visual Basic has been chosen as programming language because of its easy to implement and its object oriented methods. Students are also introduced to various concepts of programming logics, types of data, decision making, procedural and advanced database object. Basic fundamental of MySQL technique of implementation and data linking are also covered.

EBS 236/2 - Analytical Chemistry

Objective: Provide knowledge to the students the basic principles to analytical chemistry and wet application analytical techniques and tools in identifying and determining the content of a substance in qualitative and quantitative

Synopsis: This course deals with the principles and techniques of quantitative analysis and instrumental analysis. The students will learn the basic tools and operations of analytical chemistry, data handling and statistical analysis. The topic also covers guidelines of good laboratory practice (GLP) to assure validation of analyses (QA). General concepts of chemical equilibrium, acid base titrations and equilibria, complexometric titrations, gravimetric analysis and precipitation titrations and redox titrations will be covered in this course. This course is divided into 4 sections.

Section A: Concepts in analytical chemistry - will review fundamental concepts such as moles and concentrations of solutions, various types of analysis, importance of statistics in analytical chemistry and sampling. Section B will touch on the classical methods such as titrations, gravimetry and separations (e.g. solvent extraction). Instrumental techniques in Section C will cover spectrochemical analysis which include uv-viz spectrometry and section D will discuss on Atomic spectrometric methods and introduction and application of x-ray Fluorescence spectrometry. Examples and emphasis will be given to geological, ore and mineral samples.

EBS 210/2 - Mining Engineering Laboratory

Objective: To give some exposure on the basic experiments that covers the engineering and mining aspects.

Synopsis: Course specially designed for hands-on knowledge and experience on the ability to conduct experiments, data interpretation and data analysis based on basic engineering principles for various aspects of mining engineering. Experiments incorporated in this course include that for effective Geological Identification of rocks and minerals, Grain Size Analysis for soil mechanics, Determination of Soil Plasticity and Liquid Limits, Tensile Strength Analysis, Hardness Testing, Uniaxial Compressive Strength of rock materials, Determination of Point Load Strength Index of rocks and the understanding, calculation and evaluation of Direct Shear Test results.

EBS 215/3 - Comminution and Sizing

Objective: To give an introduction to the crushing and grinding of rock with size

classification and sampling for the purpose of mineral recovery or for the purpose of rock size reduction as required in mining and quarrying.

Synopsis: The course covers the basic comminution and sizing processes and technologies for rocks, minerals and mineral related products. Students are introduced to the basic theories and principles of comminution and sizing processes, type of equipments, their operations and performance. Students are also introduced to various concepts which include basic calculations and using simulation softwares in comminution/sizing flowsheet design. Real plant examples with the awareness of its impact on environment and sustainability of natural resources are also covered.

EBS 211/3 – Mining Methods

Objective: To strengthen the ability to evaluate and select appropriate and sustainable mining or quarrying methods for mining and quarry operations.

Synopsis: This course covers mining methods for mineral and rock extraction on surface and underground extraction related to the mining and quarrying operation.
stages of mining: prospecting, exploration, development and exploitation
prospecting: general logic, geochemical and geophysical methods
exploration: target investigation, methods and evaluation and reserve estimation
development: general logic, land acquisition, environmental protection, financing and implementation, taxation and costs.
exploitation: mining methods, management and cost
This course also covers units' operations of mining, surface mine development, surface mining mechanical extraction methods, underground mine development, underground mining: unsupported and supported methods
unsupported methods: classification of methods, shrinkage stoping, sublevel stoping, room and pillar mining, stope and pillar mining.
supported methods and summary of mining methods and their selection

EBS 242/3 - Petrography & Ore Microscopy

Objective: To give some exposure to the students on the concept, theoretical and practical aspects on optical mineralogy.

Synopsis: To equip students with a broad techniques and methodologies in mineral and rock identification and classification by petrographic study for most of the silicate minerals and ore microscopic study for metallic mineral using polarized microscope (petrographic microscope). Familiarized

with petrographic identification, and classification techniques (textural and composition) of various igneous (including pyroclastic rock), sedimentary rock and metamorphic rocks. Provide broad knowledge of microscopic study of metallic ore that have economic important and process mineralogy (mineral processing) and other geological paragenesis study of the ore occurrence.

EAK 263/2 – Mine Geomatic Engineering

Objective: To provide an introduction to geomatics measurement concepts and applications in mining engineering and develop an understanding in the use of survey equipment, measurement methods, analysis of observational data and display of measurement work results.

Synopsis: Introduction to geomatics engineering, vertical control, horizontal control, detailing, data processing and earthworks. Practical work encompassing levelling survey, traverse survey, tacheometric surveying, plotting and reporting.

EBB300/3 : Engineering Statistics

Objective: Strengthening knowledge and skills in mathematical modeling to provide students in understanding engineering mathematics concepts then able to formulate and solve engineering problems.

Synopsis: This course covers the topics: The role of experimental design in engineering fundamentals and applications of experimental design such as sampling distributions, data analysis, factorial design, regression and correlation. Provide an understanding of the concept of complex numbers. Provides approaches to problem solving and mathematical modeling rules.

EBS 322/3 - Physical Mineral Processing

Objective: Gravity concentration. Jigging, flowing film devices, concentration tables. Application of gravity methods to concentration. Flowsheet design.

Synopsis: The course covers the standard physical mineral processing methods and equipments that are widely used in the mineral industries. Students are introduced to theories, principles, mechanism and the performance of the processes. The methods covered are gravity concentration using gravity concentrator such as panning, *palong*, jig, spiral, shaking table, Mozley table, heavy medium separation, wet and dry magnetic separation, high-tension separation and froth flotation. Students are also introduced to

material balancing such as process performance and efficiency concepts which include basic calculations of grade, recovery, enrichment ratio and concentration ratio. Designing of flow sheet using real plant examples with the awareness of its impact on environment and sustainability of natural resources are also covered.

EBS 315/3 - Hydrometallurgy

Objective: Introduction of hydrometallurgical and electrometallurgical principles in the extracting of metals from minerals.

Synopsis: The course is designed to provide an introduction to the central principles and practices of hydrometallurgical and electrometallurgical unit processes, basic metal and mineral dissolution and separation processes to recover metals and metal compounds from ores, concentrates and secondary resources and how they are used to design and control plant process to successfully produce the desired metals. Major unit processes involved leaching, solution purification, metal recovery, materials production and water pollution control discussed includes lectures, and coursework assignments. The course is also design for student to apply the fundamental aspects of hydrometallurgy, thermodynamics and kinetics of hydrometallurgical processes for the aqueous extraction of metals. Finally, the factors that determine the success of a difficult electrolytic process will also be considered. Modern applications and emerging metal extractive processes used in hydrometallurgy and electrometallurgy will be addressed.

EBS 328/3 – Geochemical Exploration

Objective: To introduce the exploration methods using geochemistry and its approaches to mineral resource assessment.

Synopsis: Types of geochemical survey: soil, stream sediment, hydrogeochemistry, heavy minerals, lithogeochemistry, and biogeochemical. Environment. Primary versus secondary.

Dispersion patterns (primary and secondary), pathfinder elements, path indicator elements. The role of chemical and physical weathering. The role of pH, Eh, adsorption, mobility on dispersion patterns.

Basic principles: contamination, orientation surveys, anomalies, false anomalies, reconnaissance survey, regional and detailed surveys. Sampling, sampling media, magnitude of sampling.

Statistical treatment of geochemical data - simple statistics, lognormal statistics, geostatistics. The application of statistical interpretation to

geochemical survey.

Students are required to do field work employing the techniques that they've learned from the course work. They will do sampling, analyze the samples and interpret the geochemical data.

Case studies will be used as guides to the usefulness of geochemistry in mineral exploration.

EBU 301/2 – Digital Measurement and Data Accquisition

Objective: To provide students with an understanding and basic skills of digital data acquisition and measurement as well as the importance of both aspects in the field of engineering. Such skills can help students perform important and often required digital data measurement and acquisition activities in the field of materials and mineral resources engineering.

Synopsis: This course will train students to develop a simple circuit suitable for the functions and requirements of digital data measurement and acquisition in the engineering field. Students will be exposed to basic concept of digital measurement involving conversion of basic physical quantities such as distance, temperature, pressure, current and light intensity into electrical signals. The use of sensors / transducers which are capable of detecting these physical changes will be interfaced with a basic data acquisition system for recording digital data often needed in real engineering applications. The basic skills of digital data acquisition will be applied in specialized projects relevant to the study of materials and mineral resources engineering.

EBS 308/3 - Materials Transport Engineering

Objective: To give knowledge on transport in the activities related to mining and quarrying.

Synopsis: The course covers the material handling methods and equipments that are widely used in mining and mineral industries. Student are introduced to theories, principles, mechanism and the performance of the equipments. The topics covered are conveyor belt conveyors, chain conveyors and bucket elevators, screw conveyors and elevators, shaking and vibratory conveyors, fluid transport, rope haul systems, monorails and aerial ropeways, locomotive haulage and hoist and mine winders. Students are also introduced to the basic of calculation of tonnage, speed, motor power, and the efficiency of the equipments. Designing of flow

sheet using real plant examples with the awareness of its impact on environment at cost effective are also covered.

EBS 349/3 – Mine Planning and Economic

Objective: To expose students to the concepts of economics and management in exploiting mineral resources

Synopsis: Introduction to economic important of mineral. Mine planning and management (short/long term) and their relationship in economic. Methods of investment analysis for new mining projects. Cashflow analysis. Comparison between alternative investment types. Evaluate the costing for investment appraisals. Economic evaluation of mineral resource industry projects. Economic ore evaluation and optimum selection of ore reserve evaluation techniques. Factors effecting planning costs, phases of work for preparation of feasibility studies and preliminary system reports. Ore reserve evaluation techniques using geostatistical method, which includes semi-variography (structural analysis), kriging, global estimation, optimisation of sampling grids, topographical profiling; complemented by triangular, polygonal and weighted/inverse distance evaluation methods.

EBS 319/2 - Blasting Technology

Objective: To give a comprehensive in the usage of explosive in rock blasting and its control in the operation and in the environmental aspect.

Synopsis: The course covers the basic types of commercial explosives and usage of explosives materials in rock blasting for mining, quarrying and also in construction.

EBS 323/3 Pyrometallurgy

Objective: To know the general principles and different techniques of metals extraction and refining from ores at high temperatures for both ferrous and non-ferrous metals.

Synopsis: This course is a general introduction to pyrometallurgy. It covers the basic principles and actual industrial practice of extraction and refining of iron, steel, and other important non-ferrous metals. The topics covered are: thermodynamic principles, Ellingham diagram, blast furnace iron making including the physicochemical reactions, direct reduction processes, principles of steel making, major reactions and refining of steel, principles and practice of clean steel making, major process steps in non-ferrous metal extraction, roasting, matte smelting, vapour

metallurgy, refining of non-ferrous metals, industrial practice for common non-ferrous metals.

EBS 341/2 - Mineral Processing Engineering Laboratory

Objective: To give practical exposures to processes in mineral recovery.

Synopsis: Students will conduct practical relating to the operations and in determining the performance and efficiency of equipments in the mineral-processing laboratory.

Physical processing
Comminution: Crushing and screening, fine grinding and classification methods.
Mineral concentration methods: Gravity, flotation, magnetic and high-tension separation.

Chemical Processing
Leaching: Introduction to several techniques of leaching e.g.
Solvent extraction: for refining pregnant solution from the solvent extraction step.
Electrowining and Electrorefining processes to recover valuable metal from solution.

EBS 325/2 - Mineral Chemistry Laboratory

Objective: To give emphasis on the practical aspect related to atomic adsorption spectrometry XRF and UV the analysis in determining the composition minerals in rocks or samples.

Synopsis: This laboratory course focuses on the application of "wet" classical methods of mineral analysis from the acid base titration to the use of modern instrumental techniques in mineral analysis. To perform or carry out chemical analyses using the basic tools and operations of analytical chemistry in the determination, separation and extraction of a mineral or an ore sample, quantitatively through wet chemical analyses and instrumental analyses

The students will be given hands on experience on using analytical tools and volumetric glass wares apparatus in learning the analytical process to acquire analytical data of high accuracy and precision in the mineral chemistry lab like learning to use the analytical balance, accurate sample weighing, learning to carry out chemical measurements, learning the basic principles of titration and determining and preparing standard solutions for a standard calibration plot in instrumental analysis.

The students will gain practical experience in using the ultraviolet-visible spectrophotometry, atomic absorption spectroscopy, x-ray fluorescence and x-ray diffraction techniques in the identification and detection of elements and mineral phases and practically conduct the elemental and mineral analysis to quantitatively determine the ions and mineral presence in the ores and unknown samples.

EBB 343/3 – Engineering Materials Characterization

Objective: To give some introduction to materials characterization methods in theory and applications.

Synopsis: This course is on materials characterization techniques from the theoretical aspect, instrumentation and applications. It covers three topics: (a) Microstructural Analysis which includes electron microscopy, (b) Thermal Analysis and (c) Spectroscopy: phases and surface analysis for example x-ray techniques and electrons spectroscopy.

EBS 329/3 - Engineering Geophysics

Objective: To introduce the geophysical aspects in mineral exploration.

Synopsis: Application of various common geophysical techniques in subsurface condition investigation which have practical and economic objective. To provide students with sufficient knowledge in the basic principles of geophysics and geophysical methods, instrumentation, field procedures, to make simple interpretation and application. The use of the geophysical methods in mineral, mining and oil exploration, archeology and phenomenon/features which are likely to have engineering implication in geological engineering and environmental management.

EBB 328/3 - Occupational Safety and Health

Objective: To give exposure to students about the health and safety requirement in industry.

Synopsis: Introduction to holistic and global occupational safety and health (OSH) engineering concepts towards efficient industrial development, significance of occupational safety and health in quality assurance, complemented by professional and ethical responsibilities towards safety in the industry. Major course components towards competence in occupational safety and health engineering include importance of OSH in national development, OSH legislation, benefits of OSH training and professionalism, OSH management policies and protocols, OSH

performance monitoring, OSH assessment and audit techniques, hazard identification, risk assessment and implementation of safe worksite practices.

EBS 350/5 - Industrial Training

Objective: A ten weeks industrial training during long vacation i.e. after the second semester final examination (third year level). Students will get their placement at various industrial sectors related to mineral resources engineering. They should experience the real exposure as an engineer in this field. Students will be given training on various aspects such as analysis, design, management, quality control and economy, which related to their career as a materials engineer. This is a compulsory training.

EBB 438/3 – Process Control

Objective: To introduce the basic concept of process control system.

Synopsis: This course covers the structure of feedback control theory from the basic mathematics to a variety of design applications. The design of an over-all process control system (open-loop and close loop) requires a good theoretical understanding of stability, the dynamic characteristics of controllers and general process control loop dynamic characteristics. The course discusses terminology, concepts, principles, procedures and computations used in the design activity to select, analyze, specify and maintain all parts of the control system.

EBS 417/3 - Geomechanics

Objective: To acquire the knowledge related to soil and rock and the stresses involve in rock excavation.

Synopsis: The course covers the soil mechanics and rock mechanics appropriate for mining and geotechnical practice.

EBS 423/4 - Mine and Plant Design

Objective: To give the exposure to the students in conducting design of a mine or quarrying operation that begins from the raw data and investigates the feasibility of the project.

Synopsis: The course begins with the boreholes data and geological data of an area with mineral or rock potential for a mine or for a quarry respectively.

Then the students have to apply their own knowledge and other references in producing a report on a design of a mine and plant. The report is akin to a feasibility report that contains the treatment of the data, the planning of a mine, designing of a mine and mineral processing circuit, economic study and recommendations

EBS 449/3 – Mine Environmental Engineering

Objective: To provide knowledge and understanding to students of environmental concepts in the field of engineering to address and solve environmental problems, especially in mining activities.

Synopsis: Understanding and critique on the various environmental legislations and guidelines. Analysis and Evaluation of environmental pollution; complemented by monitoring and assessment of the critical levels and movement of pollutants supplemented by in-depth studies on the health effects of the various types of pollution. Explanation and appraisal on the various causes, monitoring, assessment and control practices in the industry for effective pollution management and control aimed towards sustainable development. Understanding and description of the mechanisms for creating an Environmental Impact assessment and Environmental Audit. Justification on the importance of energy conservation and environmental-friendly (green) technology

EBS 425/3 - Industrial Minerals

Objective: To enforce the students' knowledge in the occurrence of industrial minerals and their application due to the requirement of the industries. Emphasis is given to the local mineral resources.

Synopsis: To develop knowledge and awareness about the important and development of various industrial mineral and other related mineral-based industries including energy mineral in practical and integrated ways. Be able to discuss about the broad aspects of industrial mineral in term of geological occurrence, distribution, marketing, economic and application technology. Broad knowledge about process technology and methods apply in mineral development, exploitation and evaluation techniques

EBS 433/2 – Mining and Quarry Law

Objective: This course introduces and explains the laws related to mining and quarrying operations towards sustainable management.

Synopsis: This course was specially design to introduce the related laws towards sustainable management in the mining and quarrying operation. Specific law covers the Mineral Development Act, Quarry and State Mineral Enactment and Explosive Act and Explosive Rules. Common law includes the National Land Code, Factory and Machineries Act, Environmental Quality Act and Registration of Engineers Act.

EBS 430 - Final Year Research Project

Objective: To give an exposure in running a research project.

Synopsis: This course offers further understanding on selected topic in Mineral Resources Engineering. Each student is given a title for an individual research project. Research include literature review, analysis of previous work, research experimental design and experimental set up. Executing experimental work, collecting data, discussion, dissertation writing and oral presentation. In the oral presentation, the student is expected to produce a written report and to be defended in front of a panel of examiners.

EBS 418/3 - Petroleum Engineering

Objective: To give an introduction toward the upstream operation in recovery of petroleum.

Synopsis: The course covers the occurrence of petroleum, geology, exploration, basic reservoir engineering, drilling method, drilling fluid, formation evaluation, production technology, natural gas, transport of crude oil, production sharing contract and the operation areas of Petronas and its contractors.

EBS 432/3 - Environmental Chemistry for Engineering Practice

Objective: To give a knowledge in the application of chemistry in the assessing the environmental quality for engineering application.

Synopsis: This course introduces a new branch of the discipline of chemistry which is the most interdisciplinary that provide us with the specific knowledge on the theoretical basis for understanding the distribution, transformation, toxicity and other environmental properties of chemicals. It also introduces the concept of physical chemistry, analytical knowledge and the fundamental chemical principles of different processes adopted by environmental engineering. It is designed to assist the engineering students and environmental practitioners in

understanding how the chemical applications fit their daily needs in environmental chemistry. The fundamental aspects are also utilized in considering the great global environmental chemistry processes including respiration, photosynthesis and chemical evolution. The management of hazardous chemicals and risk assessment are treated as an aspect of environmental chemistry. The first section of the syllabus text will cover a review of basic chemistry topics relevant to environmental engineering which includes physical chemistry, organic chemistry and analytical chemistry. The next section deals with discussion on the major spheres (atmospheres, hydrospheres and pedospheres) and their inter-relationships. The last section deals with processes involving chemical equilibria, followed by chemical processes and the physiochemical processes used in the treatment of industrial wastes water. The basic principles governing some of the most important processes will be covered.

4.12 PROGRAMME FOR BACHELOR OF POLYMER ENGINEERING WITH HONOURS

PROGRAMME OBJECTIVES

1) PEO1- Employable graduates with the knowledge and competency in Polymer Engineering related fields
2) PEO2 - Graduates having good leadership and soft skills with the right attitudes and ethics
3) PEO3 - Graduates who possess interest in research and/or lifelong learning

PROGRAMME OUTCOMES

PO No	Programme Outcomes
PO1	Graduates able to apply the knowledge of mathematics, natural science, engineering fundamentals and engineering specialization related to the practice of **Polymer Engineering** and solve complex engineering problems
PO2	Graduates have the ability to identify, formulate, conduct research literature and analyze complex engineering problems using first principles of mathematics, natural sciences and engineering sciences
PO3	Graduates have the ability to design solution for complex engineering problems and design systems, components or processes that meet specified needs for public health and safety, cultural, societal, and environmental considerations
PO4	Graduates have the ability to conduct an investigation of complex problems related to **Polymer Engineering** using research based knowledge and research methods to provide valid conclusions
PO5	Graduates have the ability to select and apply appropriate techniques, resources and modern engineering and IT tools, to complex engineering problems with an understanding of the limitations
PO6	Graduates have the ability to reason using contextual knowledge in assessing societal, health, safety, legal and cultural issues, relevant to professional **Polymer Engineering** practice and solutions to complex engineering problems
PO7	Graduates have the ability to understand and evaluate the sustainability, and impact of professional engineering work in the solution of complex engineering problems in society and the environment context

PO8	Graduates have the ability to apply ethical principles and commit to professional ethics and responsibilities, and norms of **Polymer Engineering** practice
PO9	Graduates have the ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
PO10	Graduates have the ability to communicate effectively on complex engineering activities with the engineering community and with society at large
PO11	Graduates can demonstrate knowledge and understanding of engineering management principles and economic decision- making, and apply them to manage projects in multidisciplinary environments
PO12	Graduates recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

4.12.1 CURRICULUM STRUCTURE FOR BACHELOR OF POLYMER ENGINEERING WITH HONOURS

COURSE TYPE	LEVEL 100				LEVEL 200				LEVEL 300			EBP 350 10 Week	LEVEL 400			TOTAL UNIT
	SEMESTER 1		SEMESTER 2		SEMESTER 1		SEMESTER 2		SEMESTER 1		SEMESTER 2		SEMESTER 1		SEMESTER 2	
	Code & Course Unit		Code & Course Unit		Code & Course Unit		Code & Course Unit		Code & Course Unit		Code & Course Unit		Code & Course Unit		Code & Course Unit	
CORE	EUM 113 3 Engineering Calculus	SEMESTER BREAK	EBB 160 3 Physical Chemistry of Engineering Materials	SESSION BREAK	EUP 222 3 Engineers in Society	SEMESTER BREAK	EBP 212 3 Latex Processing	SESSION BREAK	EBP 308 3 Rubber: Processing and Products	SEMESTER BREAK	EBP 306 3 Eng Properties Polymer Materials	INDUSTRIAL TRAINING	EBP 400 4 Polymer Product Design & Development	SEMESTER BREAK	EBP 401 5 Final Year Project	108
	EBP105 3 Introduction to Statics & Dynamics		EBB123 3 Basic Mechanical Behaviour of Materials		EBP 204 3 Elastromeric Material		EBP 216 2 Latex Laboratory		EBU 301 2 Acquisition and Measurement of Digital Data		EBP 307 2 Polymer Rheology		EBP 420 2 Rubber Engineering		EBB 442 3 Quality Control & Management	
	EBB 113 3 Engineering Materials		EUM 114 3 Advance Engineering Calculus		EBP 201 3 Polymer Synthesis React Engineering		EBP 207 3 Fluid Dynamics and Transport Phenomena in Polymer		EBB 300 2 Engineering Statistics and Modelling		EBP 302 3 Mould and Die Design		EBP 401 1 Final Year Project			
	EBS 110 2 Engineering Drawing		EML101 2 Engineering Practice		EBP 202 3 Structure of Polymeric Materials		EBP 215 3 Polymer in Electronics		EBP 317 3 Advance Polymer Composite		EBP 324 3 Polymer Degradation and Environment					
	EBP 103 3 Polymer Organic Chemistry		EEU 104 3 Electrical Technology		EBB 250 2 Computer Methods for Engineer		EBP 210 3 Plastic Compunding and Processing		EBP318 2 Plastic Laboratory		EBP 315 2 Polymer Industrial Management					
			EBP 116 2 Polymer Engineering Lab		EBP 220 2 Rubber Laboratory						EBB 328 3 Occupational Safety and Health					
	14		16		16		14		12		16	5	7		8	
UNI REQ	Bahasa Malaysia/Option 2 Bahasa Inggeris/Option 4 Co-Curriculum/Option 3 Ethics and Civilizations 2 Philosophy and Current Issues 2 Entreprenuership 2															15
ELECTIVE									EBP314 Resin Manufacturing 3		EBP 311 Polymer Analytical Method & Failure Analysis 3		EBP 323 Semiconductor Fabrication Technology 3		EBP 412 Specialty Engineering Polymer 3	12
TOTAL UNIT FOR GRADUATION																135

4.12.2 CURRICULUM

LEVEL 100

Semester I			Unit		
			Total	Lecture	Lab
EUM	113/3	Engineering Calculus	3	3	0
EBP	105/3	Introduction to Statics & Dynamics	3	3	0
EBB	113/3	Engineering Materials	3	3	0
EBS	110/2	Engineering Drawing	2	0	2
EBP	103/3	Polymer Organic Chemistry	3	3	0
			14	12	2
University Requirement					
LMT	100/2	English Language	2	2	0
SEMESTER BREAK					
Semester II			Unit		
			Total	Lecture	Lab
EBB	160/3	Physical Chemistry of Engineering Materials	3	3	0
EBB	123/3	Basic Mechanical Behaviour of Materials	3	3	0
EUM	114/3	Advanced Engineering Calculus	3	3	0
EML	101/2	Engineering Practice	2	2	0
EEU	104/3	Electrical Technology	3	3	0
EBP	116/2	Polymer Engineering Laboratory	2	0	2
			16	14	2
University Requirement					
LKM	400/2	Malaysian Language	2	2	0
WUS	101/2	Core Entrepreneurship	2	2	0
SESSION BREAK					

LEVEL 200

Semester I			Unit		
			Total	Lecture	Lab
EBP	201/3	Polymer Synthesis & Reaction Engineering	3	3	0
EBP	202/3	Structure of Polymeric Materials	3	3	0
EBP	204/3	Elastomeric Material	3	3	0
EUP	222/3	Engineers in Society	3	3	0
EBB	251/2	Basic Programming and Engineering	2	2	0
EBP	220/2	Design Rubber Laboratory	2	0	2
			16	14	2
University Requirement					
LSP	300/2	English Language	2	2	0
HFF	225/2	Philosophy and Current Issues	2	2	0
SEMESTER BREAK					
Semester II			Unit		
			Total	Lecture	Lab
EBP	207/2	Fluid Dynamics and Transport Phenomena in Polymer	3	3	0
EBP	210/3	Plastic Compounding and Processing	3	2	0
EBP	212/3	Latex Processing	3	3	0
EBP	215/3	Polymer in Electronics	3	3	0
EBP	216/2	Latex Laboratory	2	0	2
			14	12	2
University Requirement					
LSP	404/2	Technical and Engineering English	2	2	0
HFE	224/2	Appreciation of Ethics and Civilisations	2	2	0
SESSION BREAK					

LEVEL 300

Semester I			Unit		
			Total	Lecture	Lab
EBP	301/3	Acquisition and Measurement of Digital Data	2	2	0
EBP	308/3	Rubber : Processing & Products	3	3	0
EBP	317/3	Advanced Polymer Composite	3	3	0
EBP	318/2	Plastic Laboratory	2	0	2
EBB	300/2	Engineering Statistics	2	2	0
			12	10	2
Electives					
EBP	314/3	Resin Manufacturing	3	3	0

SEMESTER BREAK

Semester II			Unit		
			Total	Lecture	Lab
EBP	306/3	Engineering Properties Polymer Materials	3	3	0
EBP	307/2	Polymer Rheology	2	2	0
EBP	302/3	Mould and Die Design	3	3	0
EBP	315/3	Polymer Industrial Management	2	2	0
EBP	324/3	Polymer Degradation & The Environment	3	3	0
EBB	328/3	Occupational Safety and Health	3	3	0
			16	16	0
Electives					
EBP	311/3	Polymer Analytical Methods & Failure Analysis	3	3	0

EBP 350/5 - Industrial Training

LEVEL 400

Semester I			Unit		
			Total	Lecture	Lab
EBP	400/3	Polymer Product Design & Development	3	3	0
EBP	420/2	Rubber Engineering	2	2	0
EBP	401/1	Final Year Project	3	3	0
			1	0	1
			7	6	1
Electives					
EBB	323/3	Fabrication Technology of Semiconductor	3	3	0
SEMESTER BREAK					
Semester II			Unit		
			Total	Lecture	Lab
EBP	401/5	Final Year Project	5	0	5
EBB	442/3	Quality Control and Management	3	3	0
			8	3	5
Electives					
EBP	412/3	Specialty Engineering Polymers	3	3	0
SESSION BREAK					

4.12.3 COURSE PROGRAMME OUTCOME MATRIX (POLYMER ENGINEERING)

Level	No.	Code		Course	Emphasis to the Programme Outcomes											
		Sem I	Sem II		1	2	3	4	5	6	7	8	9	10	11	12
CORE																
100	1.	EUM 113/3		Engineering Materials	/	/										
	2.	EBP 105/3		Introduction to Statics & Dynamics	/	/										
	3.	EBB 113/3		Engineering Calculus	/	/										
	4.	EBS 110/2		Engineering Drawing	/				/							
	5.	EBP 103/3		Polymer Organic Chemistry	/											
	6.		EBP 116/2	Polymer Engineering Laboratory				/	/							
	7.		EUM 114/3	Advanced Engineering Calculus	/	/										
	8.		EEU 104/3	Electrical Technology	/											
	9.		EBB 123/3	Basic Mechanical Behaviour of Materials	/	/										
	10.		EML 101/2	Engineering Practice	/		/		/	/		/		/		
	11.		EBB 160/3	Physical Chemistry of Engineering Materials	/	/										
200	12.	EBP 201/3		Polymer Synthesis & Reaction Engineering	/	/										
	13.	EBP 202/3		Structure of Polymeric Materials	/	/										
	14.	EUP 222/3		Engineers In Society	/					/		/				/
	15.	EBB 251/2		Basic Programming and Engineering Design	/	/	/		/				/			
	16.	EBP 204/3		Elastomeric Materials	/	/										
	17.	EBP 220/2		Rubber Laboratory				/	/							
	18.		EBP 207/2	Fluid Dynamics and Transport Phenomena in Polymer	/	/										
	19.		EBP 210/3	Plastic Compounding and Processing	/		/									
	20.		EBP 215/3	Polymer in Electronics	/		/									
	21.		EBP 212/3	Latex Processing	/	/								/		
	22.		EBP 216/2	Latex Laboratory				/	/						/	
300	23.	EBB 300/2		Engineering Statistics	/	/			/							
	24.	EBU 301/2		Acquisition and Measurement of Digital Data					/							
	25.	EBP 308/3		Rubber: processing and Products	/		/									
	26.	EBP 317/3		Advanced Polymer Composite			/									
	27.	EBP 318/2		Plastic Laboratory				/	/						/	
	28.		EBP 302/3	Mould and Die Design			/		/							
	29.		EBP 306/3	Engineering Properties of Polymeric Materials	/	/										
	30.		EBP 307/2	Polymer Rheology	/	/										
	31.		EBP 324/3	Polymer Degradation and Environment	/					/						
	32.		EBP 315/2	Polymer Industrial Management											/	/

	33.		EBB 328/3	Occupational Safety and Health						/							
400	34.	EBP 400/4		Polymer Product Design and Development					/		/		/	/	/	/	
	35.	EBP 401/1		Final Year Project	/	/	/	/	/			/	/		/	/	
	36.	EBP 420/2		Rubber Engineering	/			/									
	37.		EBB 442/3	Quality Control and Management	/	/	/	/	/				/				
	38.		EBP 401/5	Final Year Project	/	/	/										
ELECTIVE																	
	39.	EBP 314/3		Resin Manufacturing	/		/										
	40.		EBP 311/3	Polymer Analytical Methods & Failure Analysis	/		/										
	41.	EBB 323/3		Fabrication Technology of Semiconductor	/	/											
	42.		EBP 412/3	Specialty Polymer			/										

Programme Outcomes

PO1	Graduates able to apply the knowledge of mathematics, natural science, engineering fundamentals and engineering specialization related to the practice of Polymer engineering and solve complex engineering problems (WK1 to WK4)
PO2	Graduates have the ability to identify, formulate, conduct research literature and analyze complex engineering problems using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4)
PO3	Graduates have the ability to design solution for complex engineering problems and design systems, components or processes that meet specified needs for public health and safety, cultural, societal, and environmental considerations (WK5)
PO4	Graduates have the ability to conduct investigation of complex problems related to Polymer engineering using research based knowledge (WK8) and research methods to provide valid conclusions
PO5	Graduates have the ability to select and apply appropriate techniques, resources and modern engineering and IT tools, to complex engineering problems with an understanding of the limitations (WK6)
PO6	Graduates have the ability to reason using contextual knowledge in assessing societal, health, safety, legal and cultural issues, relevant to professional Polymer engineering practice and solutions to complex engineering problems (WK7)
PO7	Graduates have the ability to understand and evaluate the sustainability, and impact of professional engineering work in the solution of complex engineering problems in society and the environment context (WK7)
PO8	Graduates have the ability to apply ethical principles and commit to professional ethics and responsibilities, and norms of Materials/Mineral Resources/Polymer engineering practice (WK7)
PO9	Graduates have the ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
PO10	Graduates have the ability to communicate effectively on complex engineering activities with the engineering community and with society at large
PO11	Graduate can demonstrate knowledge and understanding of engineering management principles and economic decision- making, and apply them to manage projects in multidisciplinary environments
PO12	Graduates recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

4.12.4 COURSE DESCRIPTION

EUM 113 Engineering Calculus

Objective: 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.

EBP 105/3 – Introduction to Statics & Dynamics

Objective: To provide students with the fundamental concepts and principles of rigid bodies in statics and dynamics equilibrium.

Synopsis: This course is an introduction to the mechanics of rigid bodies. It is divided into two areas: Statics and Dynamics. In Statics, the student will learn the fundamental concepts and principles of rigid bodies in static

equilibrium. In Dynamics, the student will learn the fundamental concepts and principles of the accelerated motion of a body (a particle). Consideration is given on the fundamental of mechanics and structure analysis, including concepts of free body diagram as well as force, moment, couples, kinematic of motion, momentum, impulse, conservation of energy and equilibrium analyses in two and three dimensions.

EBB 113/3 - Engineering Materials

Objective: Students are expected to acquire the fundamental knowledge on engineering materials especially on the classification of materials, properties and applications.

Synopsis: The course is an introductory course on engineering materials which is divided into two main parts. The first part includes the classifications of engineering materials that determine their applicability, the structure of the materials explained by bonding scheme of different materials, the structure of crystalline solids and introduction to imperfection in solids and diffusion mechanism. The first part also includes the introduction of phase diagram. The second part covers the behaviors and characteristics of engineering materials including mechanical and electrical properties. In general, this introductory materials science and engineering course deals with the different material types (i.e., metals, ceramics, polymers, composites), as well as the various kinds of properties exhibited by these materials (i.e., mechanical, electrical, magnetic, etc.) which intended to equip the students with necessary knowledge on material science and engineering.

EBS 110/2 - Engineering Drawing

Objective: To give basic knowledge in drawing concept applicable to engineering.

Synopsis: This course emphasizes on basic engineering design and drawings through manual method and by using CAD software. It covers basic methodology for traditional and concurrent design as well as basic engineering graphic principles such as drawing size, line styles, texts, conventional symbols, orthographic and isometric projection, multi-view drawings, dimensioning, section, part list and assembly and production drawings as well as standards in engineering drawing.

EBP 103/3 - Polymer Organic Chemistry

Objective: To introduce and expose students to carbon compounds and organic polymers, types of polymerization and general reactions of polymers.

Synopsis: This course will focus on the carbon compounds and organic polymer. Topics that will be covered include carbon compound and chemical bonds, alcohols, ethers, unsaturated systems, aromatic compounds, carboxylic acids, amine, phenols and aryl halides together with their reactions structural analysis through FTIR spectroscopy. In addition, the course will also covers classification of polymerization, types of polymer synthesis, mechanism of free radical polymerization, cationic polymerization, anionic polymerization and step-growth polymerization, as well as general reaction of polymers.

EBB 160/3 - Physical Chemistry of Engineering Materials

Objective: Students are expected to be able to understand the basic concept of thermodynamics, kinetics and electrochemistry.

Synopsis: This course covers topics on introduction to thermodynamics, kinetics and electrochemistry. The concepts of mass and energy conservation (1^{st} law) and reversibility (2^{nd} law) applied to closed and open (control volume) systems. Thermochemistry, stoichiometry, chemical equilibrium, reaction kinetics. Relations between state functions and their derivatives. Total differentials, partial differentials and their meaning. Introductory description of thermodynamic energy functions (U, H, A and G), departure functions and thermodynamic reference states. Kinetics of reaction-effects of reactant and product concentration, determination order of reaction, effect of temperature on reaction kinetics, activation energy, catalysis. Electrolytes, conductance, electrode potentials, Galvanic cell, determination of emf electrode potential, thermodynamics of electrochemical cell, Nersnt equation , Electrolysis, Faraday's Law.

EBB123/3 - Basic Mechanical Behaviour of Materials

Objective: To provide basic knowledge of applied mechanics related to the behavior of solid bodies of materials when subjected to loads.

Synopsis: This course provides the basic fundamental on relationships between external loads (forces and moment) and internal forces to deformation induced in the body of engineering materials

EUM 114/3 – Advanced Engineering Calculus

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.

EML 101/2 – Engineering Practice

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 also 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.

EEU104/3 – Electrical Technology

Objective: This course introduces students to the fundamental concepts and electrical elements. This course covers direct current (DC) circuit analysis, alternate current (AC) one-phase circuit analysis, three-phase AC circuit analysis, and electromagnetic circuits.

Synopsis:

Units, Definitions, Experimental Laws and Simple Circuits
System of units, charge, current, voltage, and power types of circuits and elements. Ohm's law, Kirchhoff's laws, analysis of a single-loop current, single node-pair circuit, resistance and source combination, voltage and current division.

Circuit Analysis Techniques
Nodal and mesh analyses, linearity and superposition, source transformations, Thevenin's and Norton's theorems.

Inductance and Capacitance
The V-I relations for inductor and capacitor, inductor and capacitor combinations, duality, linearity and its consequences.

Source-free Transient Response of R-L and R-C Circuits
Simple R-L and R-C circuits, exponential response of source free R-L, R-C circuits.

Response to Unit Step Forcing Function
Response of R-L and R_C circuits to unit step forcing functions.

Response to Sinusoidal Forcing Function
Characteristic of sinusoidal forcing functions, response of R-L and R-C circuits to sinusoidal forcing functions.

Phasor Concept
The complex forcing function, the phasor, phasor relationships for R, L and C, impedance and admittance

Average Power and RMS Values
Instantaneous power, average power, effective values of current and voltage, apparent power and power factor, complex power.

Power System Circuits
An overview of single and three phase systems, wye and delta configurations of three circuits, wye and delta transformations, and power calculations in three phase systems.

Magnetic Circuits and Devices
Concept and laws of magnetism and analysis of transformers. Introduction to electromechanical energy conversion, operation of machines as generators and motors, power loss, efficiency and operations at maximum efficiency.

EBP 116/2 - Polymer Engineering Laboratory

Objective: To provide exposure to students of polymer synthesis methods as well as polymer based chemical and physical testing techniques ASTM standards.

Synopsis: This laboratory has been divided into 10 experiments that cover 14 weeks of laboratory work (total 56 hours of lab. hour).

Contents of these 10 experiments are as follows:

i. Polystyrene emulsion polymerization: Preparation of polystyrene sample using emulsion polymerization and investigate the effects of surfactant concentration on the rate of polymerization.

ii. Phenol-formaldehyde resin formation: Investigate resin formation in acid or alkali conditions and to determine reaction progress based on formation of free formaldehyde and study the curing properties.

iii. Estimation of gel time and curing time for unsaturated polyester: Investigation of curing reaction for commercial unsaturated polyester resin by observing effects of curing agents on the gel time and curing time.

iv. Synthesis and Study of chemical stability of Polyimide: To synthesis a polyimide through condensation polymerisation, performing step thermal curing and investigating chemical stability test of the polymer in various solvents.

v. Determination of Mv of polystyrene using Mark Houwink equation: Solution viscosity of polystyrene synthesised from exp. 1 is used to determine its Mv using Mark Houwink equation.

vi. Cold drawing and anisotropy of polymeric materials: Isotropic properties will be introduced to sample with isotropic property using cold drawing. Anisotropy properties that exist will be studied.

vii. Annealing of polymeric materials: Polymer samples will be roll using two roll mill and anisotropy conditions are introduced. Sample will be annealed at temperature below melting temperature and anisotropy properties will be studied.

viii. Flexural properties of polymeric materials: To investigate flexure properties of polymeric materials by using cantilever beam.

ix. Creep properties of polymeric materials: To investigate creep properties of polymeric materials.

x. Impact strength of polymeric materials: Determination of impact strength for polymeric materials by using falling weight method with different condition.

EBP 201/3 - Polymer Synthesis and Reaction Engineering

Objective: To introduce the concept of polymer synthesis comprising of mechanism, copolymerization and reactor system during polymer synthesis

Synopsis: This course introduces concepts and principles of polymer reaction engineering. It covers polymerization mechanisms and kinetics, polymerization processes and polymerization reactors. This course is designed to expose student to the reaction parameters that affect properties of polymer and how these parameter could be modified to tailor the properties of the polymer. The course also emphasis issues related to the polymerization reactors and control.

EBP 202/3 - Structure of Polymeric Materials

Objective: For students to understand polymer structures, dimension of polymer chain, transition theory, polymer molecule orientation and the application of various microscopy techniques to investigate structures of polymers.

Synopsis: This course will focus on structure of polymers in their amorphous and crystalline state. Topics that will be covered include polymer chain dimensions, conformation, configuration and statistical analysis of polymer chain. For the amorphous state, subjects such as five regions of viscoelastic behaviour, glass transition theories, secondary transitions and measurement methods for transitions in polymers will be discussed. As for the crystalline state, topics including polymer crystal structure, polymer crystallisation, melting of polymers and methods of monitoring morphological changes will be covered, in addition, topics regarding polymer molecular orientation and the use several characterisation techniques such as microscopy and X-ray diffraction in polymer studies will also be introduced.

EBP 204/3 - Elastomeric Materials

Objective: To expose students to basic concept of rubber/elastomer processing, type of elastomers and their classification, the behaviour of these rubber/elastomers, type of fillers that are commonly used and also testing on vulcanizate properties

Synopsis: This course covers topics on visco-elastic concept and rubber elasticity, raw rubber properties including plasticity, plastic retention index, and Mooney viscosity. The course also covers types of rubber including natural rubber, modified natural rubber, SBR, EPDM, IR, BR, CR, NBR, CSM etc with their properties and applications. It also discusses rubber curing and kinetic of vulcanization; curemeter and curing characteristics such as scorch and cure time. It also covers about crosslinks density measured using Mooney-Rivlin and Flory-Rehner equations and their effects on properties, sulphur vulcanization and other types of vulcanization systems such as peroxide, moisture, radiation etc. Fillers and reinforcement. This course also covers the different types of filler, factors which determine the degree of reinforcement, the importance of filler dispersion and various reinforcement theories. It also includes the vulcanizate testing and interpretation: stress-strain, hardness, tearing, compression set, etc.

EBP 220/2 - Rubber Laboratory

Objective: To introduce the rubber processing techniques and also tests that should be conducted on a rubber product.

Synopsis: This course covers experiments involved in rubber processing and testing. The experiments will involve on viscosity and plasticity of raw rubber; processing of rubber involving with mixing and compounding; curing; rubber vulcanization. Experiments also cover on rubber testing that include tensile and tearing tests; hardness, resilience, compression set, accelerated ageing and determination of cross-link density. It also covers an experiment that comparing tensile properties and hardness between natural rubber and synthetic rubber and effects of addition of different fillers on hardness, resilience and compression set.

EUP 222/3 - Engineers in Society

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.

EBB 251/2 - Basic Programming and Engineering Design.

Objective: To introduce programming methods and develop structured engineering programming programs. Introduce Solidworks software as a 3-D design tool
that covers the creation, retrieval and modification of 3-D and drawing layouts using basic Solid Works instructions.

Synopsis: This course focuses on hands-on practical training that ensure students are familiar with the "Visual Basic" and "Solidworks" softwares for engineering applications.

EBP 207/2 - Fluid Dynamics and Transport Phenomena in Polymer

Objective: To give exposure to students regarding transport phenomena and its importance in Polymer Engineering field.

Synopsis: The course covers the basic concepts of transport phenomena and its application in Polymer Engineering. These include general equations used in the discussion of transport phenomena such as Newton's Law on viscosity, Fourier's Law for heat transfer and Fick's Law on diffusion process in polymer processing unit operation. Discussions on heat transfer problem in polymer processing, for example, plasticization / melting, product cooling process, its role in injection moulding, heat generation due to "viscous dissipation", etc., will be put forward. Besides that, the role of mass transfer in Polymer Engineering application and introduction to important transport properties will also be covered.

EBP 210/3 - Plastic Compounding and Processing

Objective: To expose students to various techniques to produce products from plastics.

Synopsis: The main focus of this course is to emphasize on the aspects of compounding process and technique to produce plastic product such as extrusion, extrusion blown film, injection moulding and so forth including factors that control the quality of plastic products.

EBP 212/3 - Latex Processing

Objective: To enhance student knowledge on latex, methods of producing latex products and to train students in problem solving related to latex products.

Synopsis: This course covers topics on introduction to latex types, class and properties and various testing used to determine properties of latex. The course also covers on how to understand a mechanism of film forming from latex and factors that controls the film properties. It also includes ingredient for compounding, preparation, techniques to measure curing state and curing mechanism for latex compounds. The course also includes the understanding of several techniques used to produce latex products with the testing involved together with problem solving during production of latex products. It also discuss problems with waste generate during latex processing and steps to minimize the problems and explain the allergy problems that exist because of latex compound ingredients, n-nitrosoamine generate that evaporated, and protein contents that can be absorbed in the latex products.

EBP 215/3 – Polymer in Electronics

Objective: To introduce and expose the student to semiconductor materials including their physical and chemical properties, and their applications in semiconductor devices

Synopsis: This course will focus on use polymers in electronic application. Several types of polymers and their characteristic will be introduced particularly the conductivity and dielectric properties. Basic fabrication and electronic packaging involving polymer will be introduced. Emphasis will be made on material selection, design problem solving involving photolithography and electronc packaging.

EBP 216/2 - Latex Laboratory

Objective: To train students the various test methods used to control the quality of natural rubber latex.

Synopsis: This course covers experiments involved in latex processing and testing. The experiments involved basic test methods to determine latex quality in their chemical composition, colloid stability, and physical properties according to ISO standard. Experiments also cover preparation of latex compound, manufacturing of products from latex using dipping methods and test methods to determine mechanical properties of the latex products. It also covers an experiment that investigates the effects of pre-vulcanization time, fillers and leaching on the tensile properties of latex films.

EBB 300/2 : Engineering Statistics

Objective: Strengthening knowledge and skills in mathematical modelling to provide students in understanding engineering mathematics concepts then able to formulate and solve engineering problems.

Synopsis: This course covers the topics: The role of experimental design in engineering fundamentals and applications of experimental design such as sampling distributions, data analysis, factorial design, regression and correlation. Provide an understanding of the concept of complex numbers. Provides approaches to problem solving and mathematical modeling rules.

EBU 301/2 : Acquisition and Measurement of Digital Data

Objective: To provide students with an understanding and basic skills of digital data acquisition and measurement as well as the importance of both aspects in the field of engineering. Such skills can help students perform important and often required digital data measurement and acquisition activities in the field of materials and mineral resources engineering.

Synopsis: This course will train students to develop a simple circuit suitable for the Functions and requirements of digital data measurement and acquisition in the engineering field. Students will be exposed to basic concept of digital measurement involving conversion of basic physical quantities such as distance, temperature, pressure, current and light intensity into electrical signals. The use of sensors / transducers which are capable of detecting these physical changes will be interfaced with a basic data acquisition system for recording digital data often needed in real engineering applications. The basic skills of digital data acquisition will be applied in specialized projects relevant to the study of materials and mineral resources engineering.

EBP 308/3 - Rubber: Processing and Products

Objective: To introduce the student various rubber processing techniques, various types of synthetic rubber, rubber-rubber blends, rubber-plastic blends, rubber waste recycling and various production of rubber products.

Synopsis: Rubber processing - compounding techniques, molding and vulcanization. Preparation, vulcanization and properties of synthetic rubbers: butadiene, styrene butadiene, butyl, nitrile, ethylene propylene**,** thermoplastic elastomer, silicone etc. Rubber products manufacture such as tire, shoes, hose, household and engineering product. Rubber compounds - compounding principal, factors that effecting compounds, the used of compatible agent in compounds, co-vulcanization agents and co-vulcanization behavior and several examples of compound products.

Rubber-plastic or thermoplastic elastomer compounds - principal and aim, criteria for compounding, chemical/physics or mixed compounds, rubber reinforced plastic, dynamic vulcanization and several examples of TPE. Rubber recycling - environmental consideration, the need for recycling, latex products such as gloves, dry rubber products such as tire etc. Research innovation- new rubbers, novel vulcanization and rubber reinforcement, rubber compounds and TPE with current recycling techniques.

EBP 317/3 - Advance Polymer Composites

Objective: To introduce polymer composites from the aspects of materials, processing, and characteristics. To introduce various fundamentals of mechanical theories of composites. Various aspects of testing of polymer composites are also emphasized.

Synopsis: Composites material: history and classification, polymer composites. Polymer matrix: types of matrices, selection criteria. Inter-phase: bonding mechanisms, inter-phase treatment. Fabrication techniques: Type of fabrication techniques, selection criteria. Composites mechanic: stiffness, strength and elasticity for fiber reinforced composites. Environmental effects: moisture effect, solvent and chemical effect, thermal and thermo-oxidative. Testing and quality assurance: destructive and non-destructive testing, quality assurance. Design protocol and product development.

EBP 318/2 - Plastic Laboratory

Objective: To introduce techniques for compounding, processing and testing of plastic materials

Synopsis: The course contains 10 experiments that cover various types of polymer processing and compounding techniques for both thermoplastic and thermosets. In this course, several characterization techniques will be conducted by students in order to evaluate parameters that are investigated in each experiment.

Experiment 1: Studies on polymer melt flow - To measure and study the melt flow behavior of polymer, and its relationship with polymer processing parameter.

Experiment 2: Shrinkage and warpage analysis of injection moulded products using Cadmould software - To understand and evaluate the effect of processing parameters on shrinkage and warpage of injection moulded products using Cadmould simulation software.

Experiment 3: Preparation of poly(vinyl chloride) compounds - To prepare and characterize the inorganic filler filled PVC compounds

Experiment 4: Studies on extrusion technique - To study the effects of extrusion processing parameter on the melt flow and quality for extrudate.

Experiment 5: Studies on blow film extrusion - To study the effects of blow molding processing parameter on the mechanical properties of thermoplastic film.

Experiment 6: Thermoforming of thermoplastics - To study the concept of thermoforming and determine the optimum processing condition of thermoplastics.

Experiment 7: Polymer identification - To identify polymeric materials by using simple technique

Experiment 8: Studies on injection molding - To determine the optimum cooling time of injection-molded thermoplastic samples.

Experiment 9: Plastics compounding by internal mixer - To determine the factors that influences the effectiveness of plastic compounding process by internal mixer

Experiment 10: Preparation of thermoset composites - To prepare and characterize the properties of thermoset composites.

EBP 302/3 - Mould and Die Design

Objective: To introduce students with mould and die design techniques in producing polymer products

Synopsis: Selection criterion for selecting materials for mould and die which include design criterion and detailed analysis using computer design software; design of 2-plate mould, multiple-plate mould, runnerless mould, side core etc.; die design to produce rod, tube, sheet and profile will be put forward. Flow characteristics in mould and gate; calculations of parameters for mould feed system, force to eject product, distortion of product wall, and the variables for mould cooling will be discussed. Flow characteristics in die, pressure gradient, die dimensions, and output of die will also be discussed. Designing of mould or die for a specific polymer product using manual technique and computer (CAD) will be introduced.

EBP 306/3 - Engineering Properties of Polymeric Materials

Objective: To give explanation to students regarding the fundamental aspect of polymer physics that covers rubber elasticity, failure and yield and fracture behaviours.

Synopsis: This subject covers the fundamental aspect of polymer physics. It is involve the stress-strain relationship viz definition, curve, temperature and effect of strain rates. It also covers rubber elasticity including network, thermodynamic, statistical theory of rubber elasticity, elasticity network, stress-strain behaviour, network defects and phenomenological theory. Deformation and yield behaviour for instance necking and crazing failure and also molecular model rubber reinforced plastic. It also discuss on linear viscoelastic viz stress relaxation, Boltzmann superposition principal, creep test, time-temperature superposition conditions, relaxation behaviour. Besides that polymer cracking for instance ductile-brittle change, strength theory, Griffith theory, visco-elastic, mechanical failure, fatigue and environmental stress cracking will be put forward. It also covers the testing which includes the specification and sampling standard procedure and finally testing techniques.

EBP 307/2 - Polymer Rheology

Objective: To give students knowledge regarding the basic principles of polymer rheology and the role of polymer rheology in polymer processing.

Synopsis: This course will introduce students to viscoelastic nature of polymers and its association with polymer rheological behaviour which subsequently has significant roles in polymer processing. The subject will also focus on factors affecting the rheological behaviour of polymeric materials such as types of materials, polymer composition and process parameters. In addition, specific rheological behaviour of polymer for example, Newtonian, pseudoplastic, dilatant, etc will be discussed in certain components of the course. Instruments for measurement or characterization of polymer rheological behaviour and the viscoelastic phenomena of polymer fluid like extrudate swell and flow instabilities will also be covered in this course.

EBP 315/2 - Polymer Industrial Management

Objective: To expose students to the basic principles of operations management, production and marketing and expose students to accounting, creativity, innovation and globalization.

Synopsis: The course is on engineering management and finance focusing on their relevance in Polymer Engineering. The course is divided into two parts: (i) engineering management and (ii) accounting and marketing in general. Topic on the engineering management is divided into several subtopics including the important of engineering management, technology management, accounting and marketing. Creativity, innovation and globalization aspects relating to the real issues and challenges face by polymer industry are also emphasized in this course.

EBP 324/3 - Polymer Degradation and the Environment

Objective: To introduce and expose students to types of polymer degradation, stabilization of polymers and management of polymer waste

Synopsis: This course will focus on polymer degradation and environment. Topics that will be covered include separation and sorting technique, size reduction of waste plastics, recycling of various plastics, feedstock recycling and Insineration of waste plastics with energy recovery. In addition, topics regarding polymer degradation and stabilization, weathering and biodegradation of polymers will also be introduced.

EBB 328/3 - Occupational Safety and Health

Objective: To give exposure to students about the health and safety requirement in industry.

Synopsis: Introduction to holistic and global occupational safety and health (OSH) engineering concepts towards efficient industrial development, significance of occupational safety and health in quality assurance, complemented by professional and ethical responsibilities towards safety in the industry. Major course components towards competence in occupational safety and health engineering include importance of OSH in national development, OSH legislation, benefits of OSH training and professionalism, OSH management policies and protocols, OSH performance monitoring, OSH assessment and audit techniques, hazard identification, risk assessment and implementation of safe worksite practices.

EBP 350/5 - Industrial Training

Objective: To give students experience regarding real working environment in related industries

Synopsis: Students will get their placement at various industrial sectors related to polymer engineering. This is a ten-week industrial training during long vacation i.e., after the second semester final examination (third year

level). They should experience the real exposure as an engineer in this field. Students will be given training on various aspects such as analysis, design, management, quality control and economy, which related to their career as a polymer engineer. This is a compulsory training.

EBP 400/3 – Polymer Product Design and Development

Objective: To give students knowledge on important aspects in polymer product design, starting from material selection until towards commercialized product

Synopsis: This course will focus on the factors that are interrelated in product design, development, and manufacturing. Students have to apply their own knowledge and other references in producing a full report on the design of the product. It begins with product design and life cycle considerations in the design and manufacture. Materials and process selection, together with their effect on the design and manufacturing and followed by discussions of the economic factor are also emphasized. This course also focuses on the use of computer-aided tools/software in the product design process.

EBP 401 - Final Year Research Project

Objective: To train students in the aspect of planning and implementing a research project as well as writing a project dissertation.

Synopsis: This course offers platform for students to enhance their knowledge in Polymer Engineering which have been acquired prior to this course. Each student is given a title for an individual research project. Research components that are covered in this course include conducting literature review, analysis of previous work on the given title, research experimental design, experimental set up and executing the experimental work itself. Data collection and analysis, discussion, report writing will be addressed when students prepare their final dissertation. Lastly, the students will be tested with an oral presentation where each student is required to present and defend their research findings in front of a panel of examiners.

EBP 420/2 - Rubber Engineering

Objective: To introduce students to fundamental principles of rubber engineering and design of several rubber products.

Synopsis: The main focus of this course covers an application of mathematics in rubber elasticity including classical, statistical, and phenomological

theory. It also covers an effects of reinforcement on Young's, shear, and bulk elasticity moduli and concept and behavior of force-deformation including compression, shear, combined compression and shear, torque, bending and buckling. The course also covers the effects of structure and lamination; models of inclined rubber mounting and slender column and application in bridge bearing, dock fender, and others. It also include dynamic mechanical behavior with storage and loss modulus, tan δ, damping and hysteresis, vibrate isolation and transmissibility. The course also covers about the strength and mechanical fatigue of rubbers, tire as a engineering product which include wet grip, rolling resistance and application of finite elements analysis (FEA) in prediction of rubber engineering products.

EBB 442/3 - Quality Control and Management

Objective: To develop students' knowledge on quality concepts, control, improvement, and management.

Synopsis: This course presents knowledge and demonstrates skills necessary to structure, manage, maintain, and improve quality of an organization. Topics include Introduction to quality, management aspects of quality, statistical methods to control and improve quality, and concept of reliability.

EBP 314/3 - Resin Manufacturing

Objective: To introduce factors that need to be considered in the production of resin starting from plant design to manufacturing, compounding processes, resin properties and resin applications.

Synopsis: Plant design: Introduction to plant design, development process of plant design, general considerations for designing, material selection and fabrication. Manufacturing, compounding, processing, characteristics and application for (1) thermoset resins such as alkyd**,** phenolic**,** aminoplast, polyester, epoxy, polyurethane, and silicone. (2) commercial and engineering thermoplastic resins such as polyolefin, vinyl, polystyrene and copolymer, polyamide, synthetic rubber; (3) specialty polymeric resins and heat resistance types such as polyimide, polybenzimidazole, LCP and others.

EBP 311/3- Polymer Analytical Methods and Failure Analysis

Objective: Introducing to students the analytical techniques for polymer and applying these techniques during polymer failure analysis.

Synopsis: This course introduces analytical testing methods for polymer in conjunction with failure analysis of polymer products. This course will not delve into techniques of general materials characterization except where the method differs when applied to polymers. Instead, the methods studied will typically be aimed at the elemental and structural characterization, thermo-mechanical characterization, dynamic testing and accelerated testing. The benefits of the methodologies is utilised in assessing the mode and the cause of the polymer product failure. The description of failure analysis is supplemented by a series of case studies and the use computer-aided tools/software in failure analysis of polymer product is included.

EBB 323/3 - Fabrication Technology of Semiconductor

Objective: To introduce **s**ilicon wafer production technology and integrated circuits.

Synopsis: This course focuses on the major process technologies used in the fabrication of integrated circuits (ICs) and other semiconductor devices. Each lecture topic covers important scientific aspects of silicon wafer processing steps. Topics include: crystal growth and wafer preparation, crystal purification techniques, contamination control, oxidation, diffusion, ion implantation, lithography, thin film deposition technology, etching, metallization, process integration, electronic packaging and yield.

EBP 412/3 - Specialty Engineering Polymer

Objective: To introduce several type of polymers used in special applications including electrical/electronic, medical and advanced engineering fields. Relationship between structure and properties will be discussed as well as the processing methods that involve advanced technology.

Synopsis: This course is focused on few types of specialty polymers which are used for specialized applications, such as fluoropolymers, liquid crystal polymers, biodegradable polymers, polymers for electronic and medical applications and polymer used in heavy engineering applications. The correlation of the structure, processing, properties and applications of various types of specialty polymers are also presented in the course.

INDEX

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STUDENTS' FEEDBACK

The aim of this feedback form is to obtain students' response regarding the content of this guidebook. This information will be useful for the university in improving 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

Please circle the number.

1. This guidebook is very useful.

1	2	3	4

2. The information provided in this guidebook is accurate.

1	2	3	4

If you chose 1 or 2 for question no. 2, please provide the number of the pages(s) that contain the inaccurate information.

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

1	2	3	4

4. Overall, I would rate the quality of this guidebook as good.

1	2	3	4

5. I prefer to use the CD that is provided compared to this guidebook.

1	2	3	4

6. If there is any other information that you think should be included in the guidebook, please suggest in the space below.

Please send this feedback form to School's General Office in the 4th week of Semester I, Academic Session 2022/2023