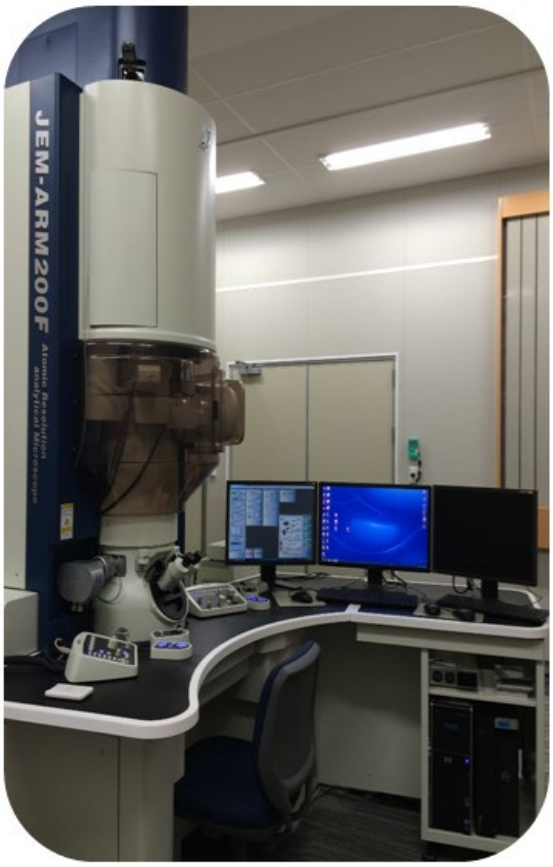
School of Mechanical Engineering (SME)

Faculty of Engineering



Bachelor Of Engineering (Mechanical-Materials)

ADMINISTRATION TEAM

Position	Name
Chair	Professor Dr. Mohd Hasbullah Idris hasbullah@utm.my 07-5534567
Associate Chair (Academic and Student Development)	Professor Dr. Izman Sudin izman@utm.my 07-5557051
Associate Chair (Research and Academic Staff)	Assoc. Prof. Dr. Zaini Ahmad azaini@utm.my 07-5557048
Associate Chair (Quality and Strategy)	Assoc. Prof. Dr. Haslinda Mohamed Kamar haslinda@utm.my
Associate Chair (Continuous Education and TNE)	Dr. Engku Mohammad Nazim Engku Abu Bakar nazim@utm.my
Associate Chair (Facility)	Assoc. Prof. Dr. Mohamed Ruslan Abdullah ruslanabdullah@utm.my
Director (Applied Mechanics & Design)	Assoc. Prof. Dr. Mohd Yazid Yahya yazidyahya@utm.my 07-5557044
Director (Aeronautics, Automotive & Ocean Engineering)	Assoc. Prof. Dr. Pakharuddin Mohd Samin pakhar@utm.my 07-5557043
Director (Materials, Manufacturing & Industrial Engineering)	Assoc. Prof. Dr. Muhamad Azizi Mat Yajid azizi@utm.my 07-5557038

Director (Thermal Fluids)	Dr. Aminuddin Saat aminuddin@utm.my 07-5557036

BACHELOR OF ENGINEERING (MECHANICAL – Materials)
PROGRAMME SPECIFICATIONS

1.	**Programme Name**	Bachelor of Engineering (Mechanical – Materials)
2.	**Final Award**	Bachelor of Engineering (Mechanical – Materials)
3.	**Awarding Institution**	Universiti Teknologi Malaysia
4.	**Teaching Institution**	Universiti Teknologi Malaysia
5.	**Professional or Statutory Body of Accreditation**	Engineering Accreditation Council (EAC)
6.	**Language(s) of Instruction**	Bahasa Melayu and English
7.	**Mode of Study (Conventional, distance learning, etc.)**	Conventional
8.	**Mode of Operation (Franchise, self-govern, etc.)**	Self-govern
9.	**Study Scheme (Full Time / Part Time)**	Full Time
10.	**Study Duration**	Minimum : 4 years Maximum : 6 years

Type of Semester	No of Semesters	No of Weeks/Semester
Normal	8	14
Short	1	8

11.	**Entry Requirements**	Matriculation/STPM/Diploma or equivalent
12.	**Programme Objectives (PEO)**	

(i) Demonstrate academic and technological excellence professionally and globally, particularly in areas related to mechanical engineering practices and contribute innovatively to the nation's wealth creation.
(ii) Career advancement by achieving higher levels of responsibility, leadership and acquiring professional and advanced academic qualifications.
(iii) Recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of the work and society.
(iv) Adapt and communicate effectively and be successful working with multidisciplinary teams.

13. Programme Learning Outcomes (PO)

(a) Technical Knowledge and Competencies

Intended Learning Outcomes	Teaching and Learning Methods	Assessment
PO1		
Acquire and apply fundamental knowledge of mathematics, science and engineering principles to solve complex mechanical and materials engineering problems Keywords: **Engineering Knowledge**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO2		
Identify, formulate and analyse complex mechanical and materials engineering problems Keywords: **Problem Analysis**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO3		
Design solutions for complex mechanical and materials engineering problems that fulfil health, safety, societal, cultural and environmental needs Keywords: **Design/Development of Solutions**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.

PO4		
Investigate complex mechanical and materials engineering problems using research-based knowledge and methods to produce conclusive results Keywords: **Investigation**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.

Intended Learning Outcomes	Teaching and Learning Methods	Assessment
PO5		
Use modern engineering and information technology (IT) tools in complex mechanical and materials engineering activities, with an understanding of limitations Keywords: **Modern Tools Usage**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
(b) Generic Skills		
PO6		
Apply professional engineering practice and solutions to complex mechanical and materials engineering problems related to societal, health, safety, legal and cultural issues with full responsibility and integrity Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Evaluate the sustainability and impact of professional engineering work in the solutions of complex mechanical and materials engineering problems in societal and environmental contexts Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.

PO8		
Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Communicate effectively on complex mechanical and materials engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO11		
Undertake lifelong learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

PO12		
Demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses

No.	Classification	Credit Hours	Percentage
i.	Programme Core	96	68.6
ii.	Programme Electives	21	15.0
iii.	Compulsory University Courses	23	16.4
	Total	**140**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	83.6
	Total credit hours for Part A	**117**	
B	Non-Engineering	23	16.4
	Total credit hours for Part B	**23**	
	Total credit hours for Part A and B	**140**	**100**
15.	**Total Credit Hours to Graduate**	**140**	

AREAS OF STUDY

For the first two years the students will be exposed to the basic mechanical engineering courses. Subsequently, they will be introduced to materials engineering related courses covering the following areas:

a) Physical Metallurgy

This course provides the physical basis, linking the structure of materials with their properties. It describes the microstructure, transformation and properties of metallic materials using solid state physics and chemical thermodynamics. Understanding the link between materials structure and mechanical properties will be discussed through the theory of crystallography.

b) Mechanical Properties of Materials

Understanding of the mechanical behaviour of engineering materials (metals, ceramics, polymers and composites) and the types of materials failures encountered during service are very important. Materials engineers would be able to select suitable engineering materials for a particular product design with the knowledge of this course.

c) Materials Characterisation

In understanding the materials bahaviour, the main techniques used for analyzing and characterizing engineering materials for their structure will be discussed. Materials characterization provides the understanding of the link between physical/ chemical properties, structural features and processing of materials and it is of important to successful product development and quality control.

d) Corrosion and Corrosion Control

Corrosion is concerned with the degradation and failure over time of all engineering materials due to their exposure to various environments such as seawater, atmosphere and chemicals. Apart from the high cost of repairing, the corroded structures may also endanger people's safety and result in loss of life. This course will expose prospective materials engineers on the importance of understanding the principles and mechanisms of corrosion and methods to control corrosion.

e) Materials Selection

Materials engineers are often required to undertake technical tasks such as predicting the expected service life of engineering components. They are also required to work with other engineers to design products or manufacturing processes. Materials selection covers all aspects related to the concepts and methods of selecting suitable material for a given mechanical design. The influence of elements such as cost, sustainability and environment on materials selection will also be discussed.

f) Non Destructive Test

This course aims to develop an understanding of the working principles associated with established and widely used techniques for non-destructive testing (NDT), specifically dye penetration, magnetic particle, eddy current, ultrasonic and radiography. Upon completion of this course, the students will be able to understand the working principle, needs and the technique to conduct the testing. This course will elaborate on the theory of each method, the probes needed, the mechanism to detect either surface or subsurface defects, the properties of materials to be tested, the test methods involved and the advantages and disadvantages of each method.

g) Surface Engineering

This course covers the aspects of surface engineering, to develop fundamental understanding and the role of materials to allow surface selection for mechanical contacts and their surrounding environmental conditions. The course will explore a range of surface treatments and advanced coatings that are designed to minimize wear, friction and surface oxidation / corrosion. Applications and economics of surface treatments/coatings will be addressed by means of industrial case studies. The lectures will draw on examples from applications within the marine, oil and gas, aerospace and biomedical sectors. Emphasis will be placed on gaining sustainability through correct surface engineering technology. The economics of surface selection will be discussed for various examples, e.g. subsea components, machine tool coatings and thermal barrier coatings for aerospace.

h) Advanced and Functional Materials

This course introduces students to the recent developments on the various classes of advanced and functional materials used in applications such as aerospace, automotive, biomedical and electronic industries. It will emphasize on the important properties exhibited by metallic, polymeric, ceramics and composite materials that make them selected for high-end and advanced applications. The physical and mechanical

properties of the various classes of advanced materials (super alloys, titanium and aluminium alloys, intermetallic, biomaterials, electronic and magnetic materials) will be detailed as well as the processing techniques associated with producing these materials. The course will also cover smart materials such as shape memory alloys, Solar cell materials, fuel cells, high density energy storage batteries, Green materials, Smart sensors and actuators. The students are enabled to describe structural setup and function of advanced and functional materials. They command modern synthesis techniques and are able to apply these techniques to the preparation of new compounds. The students can interpret and evaluate the results of various methods for structural analysis of functional materials and apply the knowledge to select suitable materials for a given engineering project.

i) Materials Processing

In addition, to select a suitable engineering material for a given product design, the processing method by which the selected material will be fabricated is also of crucial importance. It is to ensure that the final product conforms to the design specifications. This course introduces the various processing and fabrication techniques of engineering materials (metal, ceramic, polymer and composite)

j) Nanomaterials

This course introduces students to fundamental aspects of nanomaterials and nanotechnology. The importance of the nanoscale materials and their improved properties compare to conventional materials. The principles and relative merits of a range of techniques for the fabrication of nanostructures in one dimensional and two dimensional materials including single atomic layer and multilayers are discussed. The analytical and imaging characterization techniques and the recent applications of nanomaterials in engineering such as electronics, energy devices and biomaterials will be briefly discussed.

k) Modelling in Materials Engineering

This course introduces students to the basic concepts of computer modelling in materials science and engineering. The course covers basic principle in establishing numerical simulation for the evaluation of material properties and phenomena during material processing. It will emphasize on atomistic, mesoscopic and microscopic evaluation of material properties and behavior by computer simulations. In detail, molecular dynamic method will be given as an example of atomistic evaluation method, whereas discrete dislocation dynamics will be used for mesoscopic simulation method. For microscopic scale evaluation,

phase-field method will be introduced as an example. At the end of the course students should be able to construct simple numerical modelling both in atomistic, mesoscopic and microscopic scale.

CAREER PROSPECTS

Graduates of this programme are essentially Mechanical Engineers but those with specialization in Materials Engineering easily find job opportunities in various sectors. Alternatively, they can also be known as Materials Engineers depending on their job placements in industries they are in.

The career of a Materials Engineer calls for an individual with a good understanding of the basic knowledge in science and engineering of materials plus able to relate the characteristics, structure, properties, processing and performance of materials in accordance with their use and demand and in conformance with the development in technology. Because any new product starts with materials, Materials Engineers work on the leading edge in many industries. In fact, a Materials Engineer directly involved in the aspect of materials selection, quality control, component failure analysis and Research and Development (R & D) in new materials.

Every product to be produced from design to processing system will require materials which usually consist of metals, polymers, ceramics or composites. Hence, the role of a Materials Engineer will be crucial especially when it involves selection of suitable materials and processing. Career opportunities for graduates in this field are very wide including metal and non-metal manufacturing industry, quality control, research (R & D), consultancy and education.

Thus, the career in the field of Mechanical and Materials Engineering is wide open covering all sectors-public, statutory and private sector. This covers the automotive, manufacturing, processing, research and development, service and consultancy, petroleum and petrochemical industry, electronic and semi-conductor as well as the aerospace industry. In moving towards an industrialised nation, the role of a Materials Engineer will be very important especially in producing advanced material.

Award Requirements

To graduate, students must:

- Attain a total of not less than 140 credit hours with a minimum CGPA of 2.00.
- Has passed all specified courses.
- Has applied for graduation and has been approved by the University.
- Has completed all four (4) short courses and one (1) test in UTM Professional Skills Certificate Programme.
- Other condition as specified.

Entry Requirements

The minimum qualifications for candidates who intend to do a Bachelor of Engineering (Mechanical - Materials) are as follows:

1. Minimum results based on **the Malaysian High School Certificate (STPM)** (results would be based on the general requirements as well as other conditions as the pre-requisites for the programme set by the university).

University General Requirements:

i. Passed Malaysian Certificate Examination (SPM) or its equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July Paper.

ii. Passed the Malaysian High School Certificate (STPM) or its equivalent and obtained the following:

a) **Grade C (NGMP 2.00)** General Studies/General Paper, and

b) **Grade C (NGMP 2.00)** in two (2) other subjects

iii. Passed the Malaysian University English Test (MUET) with minimum result of **Band 1**.

Programme Specific Requirements

i. Obtained a **CGPA of 2.80**; and Passed with a minimum **Grade B- (NGMP 2.67)** in two (2) of the following subjects:

a) Mathematics T / Further Mathematics

b) Physics or Chemistry

ii. Passed with at least a **Grade C** in Mathematics and Physics in the SPM level or equivalent.

iii. Passed the Malaysian University English Test (MUET) with minimum result of **Band 2**.

iv. Do not have any health problems that may affect their studies.

2. Minimum requirements for **Matriculation Certificates (KPM) / UM Science Foundation / UiTM Foundation** (fulfil the general requirements set by the university as well as other conditions of the programme).

General University Requirements

i. Passed Malaysian Certificate Examination (SPM) or its equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July Paper.

ii. Passed the Matriculation Certificates (KPM) / UM Science Foundation / UiTM Foundation with a minimum **CGPA of 2.00** and passed all the core subjects.

iii. Passed the Malaysian University English Test (MUET) with minimum result of **Band 1**.

Programme Specific Requirements

i. Obtained a **CGPA of 2.80**; and Passed with a **Grade B- (2.67)** in two (2) of the following subjects:

a) Mathematics / Engineering Mathematics

b) Physics / Engineering Physics or Chemistry / Engineering Chemistry

ii. Passed with at least a **Grade C** in Mathematics and Physics in the SPM level or equivalent.

iii. Passed the Malaysian University English Test (MUET) with minimum result of **Band 2**.

iv. Do not have any health problems that may affect their studies.

3. Minimum qualifications for students with **Certificates/Diplomas** (fulfil the general requirements set by the university as well as specific requirements of the programme).

General University Requirements

i. Obtained a Diploma or equivalent qualification recognised by the Malaysian Government and approved by the Senate.

or

ii. Passed STPM examination in 2016 or before and obtained at least:

a) **Grade C (NGMP 2.00)** General Studies/General Paper, and

b) **Grade C (NGMP 2.00)** in two (2) other subjects

or

iii. Passed the Matriculation Certificates (KPM) / UM Science Foundation / UiTM Foundation in 2017 or before and obtained minimum **CGPA of 2.00.**

iv. Passed the Malaysian University English Test (MUET) with minimum result of **Band 1**.

v. Passed Malaysian Certificate Examination (SPM) or its equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July Paper.

Programme Specific Requirements

i. Obtained a Diploma in Mechanical Engineering from UTM or equivalent with minimum **CGPA of 2.75**.

or

ii. For those who obtained a **CGPA of less than 2.75** but have at least **two (2)** years working experience in related field are eligible to apply.

or

iii. Meet the minimum entry requirements as required for STPM holders.

or

iv. Meet the minimum entry requirements as required for those who have completed the Matriculation Certificates (KPM) / UM Science Foundation / UiTM Foundation.

v. Passed with at least a **Grade C** in Mathematics and Physics in the SPM level or equivalent.

or

vi. Obtained at least a **C Grade (2.00)** in any one of the Mathematic courses at Diploma level.

v. Passed the Malaysian University English Test (MUET) with minimum result of **Band 2**.

vii. Do not have any health problems that may affect their studies.

Note:

Candidates are required to submit the results transcript of all their examinations taken during their Diploma study (semester one until the final semester) to UTM. A copy of the diploma or a letter of completion of study will also have to be submitted together with their applications.

Code	Intended Learning Outcomes
PLO1	Acquire and apply fundamental knowledge of mathematics, science and engineering principles to solve complex mechanical and materials engineering problems.
PLO2	Identify, formulate and analyse complex mechanical and materials engineering problems.
PLO3	Design solutions for complex mechanical and materials engineering problems that fulfil health, safety, societal, cultural and environmental needs.
PLO4	Investigate complex mechanical and materials engineering

	problems using research-based knowledge and methods to produce conclusive results.
PLO5	Use modern engineering and information technology (IT) tools in complex mechanical and materials engineering activities, with an understanding of the limitations.
PLO6	Apply professional engineering practice and solutions to complex mechanical and materials engineering problems related to societal, health, safety, legal and cultural issues with full responsibility and integrity.
PLO7	Evaluate the sustainability and impact of professional engineering work in the solutions of complex mechanical and materials engineering problems in societal and environmental contexts.
PLO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
PLO9	Communicate effectively on complex mechanical and materials engineering activities both orally and in writing.
PLO10	Work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings.
PLO11	Undertake lifelong learning and manage information including conducting literature study.
PLO12	Demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill.

Year of entry and duration of study will be based on the credit exemptions approved by the UTM.

Programme Educational Objectives (PEO)

After having exposed to 3 to 5 years working experience, our graduates

should become professionals who demonstrate the following competencies:

Code	Intended Educational Objectives
PEO1	Demonstrate academic and technological excellence professionally and globally, particularly in areas related to mechanical engineering practices and contribute innovatively to the nation's wealth creation.
PEO2	Career advancement by achieving higher levels of responsibility, leadership and acquiring professional and advanced academic qualifications.
PEO3	Recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of the work and society.
PEO4	Adapt and communicate effectively and be successful working with multidisciplinary teams.

Programme Learning Outcomes (PLO)

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

PROFESSIONAL SKILLS CERTIFICATE (PSC)

Students are required to enrol in certificate programmes offered by the Centres of Excellence in the University and the School of Professional and Continuing Education (SPACE) during the duration of their studies in UTM. The four (4) short courses and one test are as follows:

1. How to Get Yourself Employed (HTGYE)
2. ISO 9001: 2008 Quality Management System Requirement (ISO)
3. Occupational Safety and Health Awareness (OSHA)
4. How to Manage Your Personal Finance (HTMYPF)
5. Test of English Communication Skills for Graduating Students (TECS):

(i) TECS 1001 (Paper I – Oral Interaction)
(ii) TECS 1002 (Paper II - Writing)

MOBILITY PROGRAMME (OUTBOUND)

Universiti Teknologi Malaysia (UTM) is offering five (5) types of mobility programs which allow UTM Student to go abroad and join academic programs in universities, institutions or organizations in all over the world. The opportunities offered are as below:

1. Study Abroad / Student Exchange

Study Abroad/Student Exchange programme is a programme which allow student to spend one or two semesters at universities abroad and take courses in regular semester with credit transfer opportunity.

2. Research Internship Abroad

Research Internship is a program which allow student to join research study or internship under the supervision of an academic staff at universities or industries abroad from all over the world.

3. Global Outreach Programme (GOP)

GOP is a 7 to 14 days academic based program to experience various cultures in other countries. It includes immersion elements such as research & academic activities, social responsibility and cross cultural activities.

4. International Invitation Programme

Students participate in program organised by international institutions/ organisations with the following themes:

(i) Seminar, Conference or Paper Presentation
(ii) Cultural Exhibition and Conference
(iii) Student Development Activity

5. Summer School Abroad

Summer School program is a program which is designed to provide educational opportunities in 4 to 8 weeks during summer holiday abroad. It is related to environment, local community, heritage and tradition.

Details and appropriate forms and procedures can be reached at **UTM International link: http://www.utm.my/international/outbound-mobility-programs/**

COURSE MENU

YEAR 1: SEMESTER 1						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 1203	**Static***	**3**	**1**	**0**	**3**	
SEMM 1503	**Engineering Drawing**	**2**	**0**	**3**	**3**	
SEMM 1911	**Experimental Methods**	**1**	**0**	**0**	**1**	
SEMM 1921	**Introduction to Mechanical Engineering**	**1**	**0**	**0**	**1**	
SSCE 1693	**Engineering Mathematics 1**	**3**	**1**	**0**	**3**	
SEEU 1002	**Electrical Technology**	**2**	**1**	**0**	**2**	
UHLB 1122	**Academic English Skills**	**3**	**0**	**0**	**2**	
UHIS 1012	**Islamic and Asian Civilization (local student)**	**2**	**0**	**0**	**2**	
UHMS 1022	**Malaysian Studies 3 (International student)**	**2**	**0**	**0**	**2**	
		Total			**17**	

YEAR 1: SEMESTER 2						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	0	3	3	
SEMM 1113	Mechanics of Solid I*	3	1	0	3	**SEMM 1203**
SEMM 1213	Dynamics*	3	1	0	3	**SEMM 1203**

SEMM 1513	Introduction to Design	2	0	3	3	**SEMM 1503**
UHMS 1172	Malaysian Dynamics (Local student)	2	0	0	2	
UHLM 1012	Malay Language for Communication 2 (International Student)	2	0	0	2	
UHMT 1012	Graduate Success Attributes	2	0	0	2	
UKQF 2xx2	Co-curriculum and Service Learning Elective	2	0	0	2	
		Total			**18**	

YEAR 2: SEMESTER 1						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 2123	**Mechanics of Solids II***	**3**	**1**	**0**	**3**	**SEMM 1113**
SEMM 2313	**Mechanics of Fluids I***	**3**	**1**	**0**	**3**	**SEMM 1203, SEMM 1013**
SEMM 2413	**Thermodynamics***	**3**	**1**	**0**	**3**	
SEMM 2921	**Laboratory I**	**0**	**0**	**2**	**1**	**SEMM 1911**
SSCE 1993	**Engineering Mathematics II**	**3**	**1**	**0**	**3**	**SSCE 1693**
UHLB 2122	**Advanced Academic English Skills**	**3**	**0**	**0**	**2**	**UHLB 1122**
UHIT 2302	**Thinking of Science and Technology**	**2**	**0**	**0**	**2**	
		Total			**17**	

YEAR 2: SEMESTER 2

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMM 2223	Mechanics of Machines and Vibration*	3	1	0	3	SEMM 1213
SEMM 2323	Mechanics of Fluids II*	3	1	0	3	SEMM 2313
SEMM 2433	Applied Thermodynamic and Heat Transfer*	3	1	0	3	SEMM 2413
SEMM 2613	Materials Science	3	1	0	3	
SEMM 2713	Manufacturing Process	3	1	0	3	
SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
		Total			18	

Subject to changes
*** Core Courses – minimum passing grade is C (50%)**
 # University general course for international student only, international students are not required to take UICI 1012 and UHAS 1172.

Notes: L – Lecture, T – Tutorial, P/S – Practical/Studio

YEAR 3: SEMESTER 1						
CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMB 3613	Physical Metallurgy	3	0	0	3	SEMM 2613**
SEMM 3233	Control Engineering	3	0	0	3	SEMM 1213**, SSCE 1793**
SEMM 3523	Component Design	2	0	3	3	SEMM 2123**, SEMM 1513
SEMM 3813	Industrial Engineering	3	0	0	3	
SEMM 3931	Laboratory II	0	0	2	1	SEMM 2921
SEEU 2012	Electronic	2	0	0	2	SKEU 1002

UBSS 1032	**Introduction to Entrepreneurship**	**2**	**0**	**0**	**2**	
		Total			**17**	

YEAR 3: SEMESTER 2						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMB 3623	**Mechanical Properties of Materials**	**3**	**0**	**0**	**3**	**SEMM 2613****
SEMM 3023	**Applied Numerical Methods**	**3**	**0**	**0**	**3**	**SEMM 1013, SSCE 1793**
SEMM 3242	**Instrumentation**	**1**	**0**	**3**	**2**	**SKEU 2012****
SEMM 3823	**Engineering Management, Safety and Economics**	**3**	**0**	**0**	**3**	
SEMM 3941	**Laboratory III**	**0**	**0**	**3**	**1**	**SEMM 3931**
SSCE 2193	**Engineering Statistics**	**3**	**1**	**0**	**3**	
UHLB 3132	**Professional Communication Skills**	**3**	**0**	**2**	**2**	**UHLB 1122, UHLB 2122**
		Total			**17**	

YEAR 3 : SHORT SEMESTER						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 3915	**Industrial Training**				**5**	**## SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2433****
		Total			**5**	

YEAR 4: SEMESTER 1

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMB 4613	Materials Characterization	3	0	0	3	SEMM 2613**
SEMB 4623	Corrosion and Corrosion Control	3	0	0	3	
SEMB 46x3	Elective I	3	0	0	3	
SEMM 4533	System Design	2	0	3	3	SEMM 3523
SEMM 4912	Undergraduate Project I	0	0	6	2	SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2433**
UXXX 2xx2	Generic Skills or Knowledge Expansion Cluster Elective	2	0	0	2	
		Total			16	

YEAR 4: SEMESTER 2						
CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMB 4633	Materials Selection in Mechanical Design	2	0	2	3	
SEMB 46x3	Elective II	3	0	0	3	
SEMM 4902	Engineering Professional Practice	1	0	3	2	Must be 3rd year
SEMM 4924	Undergraduate Project II	0	0	12	4	SEMM 4912
UHLX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQT 3001	Extra-Curricular Experiential Learning	1	0	0	1	
		Total			15	

**** Minimum grade D- (30%) in the pre-requisite courses**
Obtained minimum of 80 credits

Notes: L – Lecture, T – Tutorial, P/S – Practical/Studio

Elective Courses

1.	SEMB 4643	Non Destructive Testing
2.	SEMB 4653	Surface Engineering
3.	SEMB 4663	Advanced and Functional Materials
4.	SEMB 4673	Materials Processing
5.	SEMB 4683	Nanomaterials
6.	SEMB 4693	Modelling in Materials Engineering

GRADUATION CHECKLIST

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

NO	COURSE CODE	COURSE NAME	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (/) IF PASSED
MECHANICAL ENGINEERING COURSES					
1	SEMM 1013	Programming for Engineers	3	3	
2	SEMM 1113	Mechanics of Solids I	3	3	
3	SEMM 1203	Statics	3	3	

4	SEMM 1213	Dynamics	3	3	
5	SEMM 1503	Engineering Drawing	3	3	
6	SEMM 1513	Introduction to Design	3	3	
7	SEMM 1911	Experimental Methods	1	1	
8	SEMM 1921	Introduction to Mechanical Engineering	1	1	
9	SEMM 2123	Mechanics of Solids II	3	3	
10	SEMM 2223	Mechanics of Machines & Vibration	3	3	
11	SEMM 2313	Mechanics of Fluids I	3	3	
12	SEMM 2323	Mechanics of Fluids II	3	3	
13	SEMM 2413	Thermodynamics	3	3	
14	SEMM 2433	Applied Thermodynamics & Heat Transfer	3	3	
15	SEMM 2613	Materials Science	3	3	
16	SEMM 2713	Manufacturing Processes	3	3	
17	SEMM 2921	Laboratory I	1	1	
18	SEMM 3023	Applied Numerical Methods	3	3	
19	SEMM 3233	Control Engineering	3	3	
20	SEMM 3242	Instrumentation	2	2	
21	SEMM 3523	Component Design	3	3	
22	SEMM 3813	Industrial Engineering	3	3	
23	SEMM 3823	Engineering Management, Safety & Economics	3	3	
24	SEMM 3915	Industrial Training	5	HL	
25	SEMM 3931	Laboratory II	1	1	
26	SEMM 3941	Laboratory III	1	1	
27	SEMM 4533	System Design	3	3	
28	SEMM 4902	Engineering Professional Practice	2	2	
29	SEMM 4912	Undergraduate Project I	2	2	
30	SEMM 4924	Undergraduate Project II	4	4	
31	SEMB 3613	Physical Metallurgy	3	3	
32	SEMB 3623	Mechanical Properties of Materials	3	3	
33	SEMB 4613	Materials Characterization	3	3	
34	SEMB 4623	Corrosion & Corrosion Control	3	3	
35	SEMB 4633	Materials Selection in Mechanical Design	3	3	

36	SEMB 46x3	Elective I	3	3	
37	SEMB 46x3	Elective II	3	3	
		TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)	**101**	**96**	
ELECTRICAL COURSES (School of Electrical Engineering)					
1	SEEU 1002	Electrical Technology	2	2	
2	SEEU 2012	Electronics	2	2	
		TOTAL CREDIT FOR ELECTRICAL COURSES (B)	**4**	**4**	
MATHEMATICS COURSES (Faculty of Science)					
1	SSCE 1693	Engineering Mathematics I	3	3	
2	SSCE 1793	Differential Equations	3	3	
3	SSCE 1993	Engineering Mathematics II	3	3	
4	SSCE 2193	Engineering Statistics	3	3	
		TOTAL CREDIT FOR MATHEMATICS COURSES (C)	**12**	**12**	
UNIVERSITY GENERAL COURSES					
CLUSTER 1: APPRECIATION OF PHILOSOPHY, VALUE & HISTORY					
1	UHIS 1012	Islamic & Asian Civilization (for local students only)	2	2	

	UHMS 1022	Malaysian Studies 3 (for international students only)			
2	UHMS 1172	Malaysian Dynamics (for local students only)	2	2	
	UHLM 1012	Malay Language for Communication 2 (for international students only)			
CLUSTER 2: GENERIC SKILLS					
1	UHMT 1012	Graduate Success Attributes	2	2	
2	UHMT 2012	Leadership	2	2	
3.	UHMS 2022	Critical and Creative Thinking	2	2	
4.	UHMS 2032	The Human side of Knowledge Management	2	2	
5.	UHMS 2042	Development and Global Issues	2	2	
6.	UHMT 2042	Guidance & Counselling	2	2	
7.	UHMT 2062	Psychology of Adjustment	2	2	
8.	UBSS 2072	Fundamentals of Intellectual Property Law	2	2	
9.	UBSS 2082	Law for Entrepreneurs	2	2	
10.	UBSS 2092	Entrepreneuship and Enterprise Development	2	2	
11.	UBSS 2102	Social Entrepreneurship	2	2	
12.	UHMS 2112	Engineering Communication	2	2	
13.	UHMS 2122	Human Communication	2	2	
14.	UHMT 2132	Professional Ethics	2	2	

15.	UMJT 2142	Professional Ethics, Safety and Health (Ningen Ryoku)	2	2	
CLUSTER 3: KNOWLEDGE EXPANSION					
1.	UHIT 2302	Science and Technology Thinking	2	2	
2.	UHIT 1022	Science, Technology and Mankind	2	2	
3.	UHII 2012	Al-Qur'an and Human Civilization	2	2	
4.	UHIT 2032	Life Institutions and Sustainable Development	2	2	
5.	UHIZ 2042	Future Studies	2	2	
6.	UHIT 2052	Family Law	2	2	
7.	UHIZ 2062	World Scinece	2	2	
8.	UHIS 2072	Sustainable Economu	2	2	
9.	UHIS 2082	Practice and Concept of Halal Management	2	2	
10.	UHII 2092	Philosophy of Islamic Art	2	2	
11.	UHII 2102	Islam and Health	2	2	
12.	UHII 2132	Islamic Entrepreneurship	2	2	
13.	UETS 2142	Sustainable Energy	2	2	
CLUSTER 4: CO-CURRICULUM & SERVICE LEARNING					
1	UKQX xxx2	Co-curriculum & Service Learning Elective	2	2	
2	UKQT 3001	Extra Curricular Experiential Learning	1	1	
CLUSTER 5: LANGUAGE SKILLS					

1	UHLB 1112	English Communication Skills	2	2	
2	UHLB 2122	Academic Communication Skills	2	2	
3	UHLB 3132	Professional Communication Skills	2	2	
4	UHLB 1032	Introductory Academic English	2	2	
5	UHLB 1042	Intermediate Academic English	2	2	
6	UHLA 1112	Arabic Language	2	2	
7	UHLJ 1112	Japanese Language 1	2	2	
8	UHLC 1112	Mandarin Language I	2	2	
9	UHLF 1112	French Language	2	2	
10	UHLN 1112	Persian Language	2	2	
11	UHLJ 1122	Japanese Language for Communication I	2	2	
12	UHLM 1112	Malay Language for Communication	2	2	
CLUSTER 6: ENTREPRENEURSHIP					
1	UBSS 1032	Introduction to Entrepreneurship	2	2	
		TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)	**23**	**23**	
		TOTAL CREDIT TO GRADUATE (A + B + C + D)	**140**	**135**	

Note: # Choose one elective either from Cluster 2 (Generic Skills) or Cluster 3 (Knowledge Expansion) for UxxX 2xx2			
OTHER COMPULSORY COURSES			
PROFESSIONAL SKILLS CERTIFICATE (PSC)			
1	GLL 1001	How To Get Yourself Employed	
2	GLL 1029	ISO 9001:2008 Quality Management System Requirement	
3	GLL 1040	Occupational Safety, Health and Environment	
4	GLL 1041	How to Manage Your Personal Finance	
5	Test of English Communication Skills (TECS)		
	TECS 1001	Oral Interaction	
	TECS 1002	Writing	

COURSE SYNOPSIS

COURSE SYNOPSIS FOR B. ENG (MECHANICAL - MATERIALS)

CORE COURSES

SEMM 1013 Programming for Engineers
This course formally introduces the concept of computers, algorithms, programming languages, pseudo-code, and design of programs for solution to computational engineering problems. The two programming languages introduced in this course are C and MATLAB. Topics covered in this course include data types, constants, variables, arithmetic operations, assignment statement, looping, formatted I/O, functions, arrays, matrix operations, data structures, plotting and model building.

SEMM 1113 Mechanics of Solids I
The course provides students with the knowledge to determine the strength and stiffness of engineering structures being used. The structures that will be used in this course are bars, pins, bolts, shafts and beams and the types of applied loadings are axial forces, deformations due to the change in temperature, torsional loads, transverse loads and

combination of these loads. At the end of the course, students should be able to determine the mechanical properties of the materials with respect to their strength and stiffness. Students should be able to calculate stresses, strains and deformations in structures due to various types of loading conditions. In addition, they should be able to solve problems related to statically determinate and indeterminate structures.

SEMM 1203 Statics
This course introduces students to the part of mechanic which is a pre-requisite for most engineering courses including SEMM 1213, SEMM 2313 and SEMM 1113. The course enables student to acquire the essential basic knowledge of resultant and equilibrium of forces. It will examine key elements in producing free body diagrams for particles and rigid bodies, as essential first step in solving applied mechanics problems. Exposure to the concept of moment and equilibrium equations with reference of Newton's Law enhances the relevance of friction, trusses, frames and machines applications. Students are also introduced to the concept of distributed forces, which include centroid and centre of gravity and the generated surface area and volume of revolution. Hence, students will be able to demonstrate and apply the knowledge in continuing subjects which requires the analytical skills developed in this subject.

SEMM 1213 Dynamics
The course is an extension to SEMM 1203, which is the pre-requisite to this course. It introduces students to the part of mechanics which considers the action of forces in producing motion. This course provides an exposure to students on the theory of the kinetics and kinematics of particles and rigid bodies. The concepts of energy, work, momentum and impulse are also introduced. At the end of the course students should be able to apply the principles to study and analyse the behaviour and responses of dynamical systems. They should also be able to solve the dynamic problems related to the determination of forces energy and power to move a body.

SEMM 1503 Engineering Drawing
This subject introduces student to the use of technical drawing in an effective way for communicating and integrating with engineering concepts. Such environment will provide a platform where the engineer can share and exchange information. This subject will also enlighten the student on the significant changes in the engineering and technical graphic due to the use of computer and CAD (Computer Aided Design) software. At the end of the course, student should be able to apply the skill and knowledge of engineering drawing to interpret design, using graphics method such as geometric drawing, orthographic projection, isometric, machine drawing, detailed drawing, and basic CAD software.

SEMM 1513 Introduction to Design
This course is designed to introduce students to the concepts and methods of engineering design process in solving engineering design problems, creatively and effectively. The design process introduces problem background, concept generations and selections, development of selected concept and testing of selected concept by constructing and testing a prototype. This course serves as a preparation for students to proceed to higher level design classes.

SEMM 1911 Experimental Methods
This course is conducted via lectures and experimental case study data. Students are exposed to the experimental method theory for the initial weeks and then followed by case study data. The lecture contents shall cover the fundamental of experimental method and the basic principles in measurements, instrumentation and analysis of results. It shall focus on the design of mechanical experiments, selection of sensors and transducers, estimation of errors and display of results. It shall also cover the analysis of results and how to prepare proper report writing. Student comprehension will be tested in two written tests. Based on the given experimental data, students are also expected to conduct statistical

analysis of results and write the experimental outcome in a report.

SEMM 1921 Introduction to Mechanical Engineering
This course comprises of two modules intended to introduce students to the field of mechanical engineering. The first module raises the student's awareness to the importance and necessity of developing habits of systematic analysis in solving engineering problems. It introduces the UTM graduate attributes and highlights the importance of generic skills to engineers. It also provides students with a clear overview of different fields within Mechanical Engineering and a description of the mechanical engineer's work and professional responsibilities. It discusses the education requirements for today's mechanical engineers as well as exposes the students to the skill required for an engineer entrepreneur. This course introduces students to the field of mechanical engineering. It raises the student's awareness to the importance and necessity of developing habits of systematic analysis in solving engineering problems. It introduces the UTM graduate attributes and highlights the importance of both technical and generic skills to mechanical engineers. It also provides students with a clear overview of different fields within mechanical engineering and a description of the mechanical engineer's work and professional responsibilities. It discusses the education requirements for today's mechanical engineers as well as exposes the students to the skills required for an engineering entrepreneur.

SEMM 2123 Mechanics of Solids II
The course is an extension to SEMM 1113, which is the pre-requisite to this course. It aims to extend the student's knowledge and understanding of the behaviour of materials and structures under a variety of loading conditions. The course starts off with plane stress and plane strain transformation, following which several elastic failure criteria's are investigated. The course provides an opportunity to investigate thick cylinders, structural deformation behaviour by using the energy method, instability problems of struts and elasto-plastic bending of beams. Determinate and indeterminate problems will be examined. At the end of the course, students should be able to calculate and evaluate stress, strain and deformation of structures in torsion and bending. They should also be able to evaluate failure modes and estimate fracture life of structures and components. The aspect of designing safe components and structures shall also be emphasized to the students.

SEMM 2223 Mechanics of Machines and Vibration
The course requires SEMM 1213 as the pre-requisite. It is designed to expose students to the application of concepts in mechanics (statics and dynamics) to solve real world mechanical engineering problems pertaining to various machines which include belt and pulley systems, gears, flywheels, governors and gyroscopes. Students will also be exposed to the methods of balancing rotating masses and parts of a combustion engine. The concept of vibration with respect to one-degree-freedom is also studied. At the end of the course, the students should be able to solve problems related to various mechanical systems. In addition, they should be able to evaluate analytically the parameters of components of various machines under study.

SEMM 2313 Mechanics of Fluids I
The principle aim of this course is to provide students with an understanding of the properties of fluids and to introduce fundamental laws and description of fluid behaviour and flow. It will emphasize on the concept of pressure, hydrostatic pressure equation and its application in the measurement of pressure, static force due to immersed surfaces, floatation and buoyancy analysis. Dynamic flow analysis inclusive of technique in solving flow problems is introduced especially to solve flow measurement, mass or volumetric flow rate, momentum in flow and loss in pipe network. Lastly, some basic dimensional analysis and similarities will be introduced. At the end of the course, the student should be able to demonstrate an ability to analyze whether statically, dynamically or kinematically

problems related directly to fluids.

SEMM 2323 Mechanics of Fluids II
This course is designed to enhance the basic knowledge that has been developed in the first stage of Fluid Mechanics and expose the students in analysing hydrodynamically the flow field. It will emphasize on the analysis and the importance of ideal, boundary layer, and compressible flow in a practical engineering applications. The course will also provide the analysis of flow through fluid machines such as pump and turbine. At the end of the course, students should be able to demonstrate and apply the theory to solve problem related to flow of fluids.

SEMM 2413 Thermodynamics
Thermodynamics is a basic science that deals with energy. This course introduces students to the basic principles of thermodynamics. It will discuss basic concepts and introduces the various forms of energy and energy transfer as well as properties of pure substances. A general relation for the conservation of energy principle expressed in the First Law of Thermodynamics will be developed and applied to closed systems and extended to open systems. The second law of thermodynamics will be introduced and applied to cycles, cyclic devices and processes.

SEMM 2433 Applied Thermodynamics & Heat Transfer
This course aims to develop a fundamental understanding of the processes by which heat and energy are inter-related and converted and by which heat is transferred. The course will review major principles of energy conversion and the modes of heat transfer. The basic laws of thermodynamics and the governing equations for heat transfer and thermodynamics will be introduced and subsequently used to solve practical engineering problems involving thermodynamics and heat transfer. The course will also cover fundamental principles of power generation systems.

SEMM 2613 Materials Science
This course introduces students to the fundamentals of materials science and engineering with emphasis on atomic bonding, crystal structures and defects in metals. It will introduce students to the various classes of materials including metals, ceramics, polymers and composites and their fundamental structures. The course will also provide basic diffusion mechanisms, metal solidification phase diagrams and heat treatment processes. At the end of the course, students should be able to apply the knowledge of atomic bonding and crystal structures to predict the physical and mechanical behaviour of materials, and use the principles of phase diagrams and heat treatments to the design of materials and their properties.

SEMM 2713 Manufacturing Processes
This course discusses the fundamental aspect of various traditional and non-traditional manufacturing processes for metal and non-metal components. It starts from the overall introduction on manufacturing aspects followed by polymer shaping processes, casting processes, joining processes, metal forming processes and machining processes including CNC and CAM. At the end of this course, the students should be able to select suitable manufacturing processes to produce a part/product. The knowledge gained from this course also allows students to make right decision in designing products based on process requirements.

SEMM 2921 Laboratory I
This course is introduced in the second year of the Mechanical Engineering programme involving two hours per week session and experimental based courses. It consists of six laboratories; Strengths of Materials Laboratory, Materials Science Laboratory, Mechanics of Machines Laboratory, Electrical Laboratory and Fluid Laboratory. Students will be grouped into 5 to 6 people for each experiment. It is based on the theory that have been

learned in the particular courses at the same semester. In general, every student has to carry out a total of twelve experiments. At the end of the session, students have to submit a report for each experiment and will be evaluated based on this report.

SEMM 3023 Applied Numerical Methods
This course formally introduces the steps involved in engineering analysis (mathematical modelling, solving the governing equation, and interpretation of the results). Examples of case studies in applied mechanics, strength of materials, thermal science, and fluid mechanics are presented. Methods for solving the nonlinear equations, simultaneous linear algebraic equations, eigenvalue problem, interpolation, numerical differentiation, numerical integration, initial value problems, boundary value problem and partial differential equation are introduced.

SEMM 3233 Control Engineering
The course shall cover the essential and basic theory of control engineering. It shall cover the followings: open and closed-loop systems, manipulation of block diagram, signal flow graph and Mason's rule, concept of transfer function, time response analysis, classification of system, control action, stability analysis, Routh criteria, root locus method, frequency analysis, Nyquist and Bode plots, relative stability from Nyquist and Bode diagrams and design of control system. MATLAB and Simulink software package shall be taught and used as a tool in solving control engineering problems where appropriate.

SEMM 3242 Instrumentation
The course shall cover the essential and basic theory of instrumentation for undergraduate. It shall cover the following: fundamentals and components of instrumentation system, characteristics of instrumentation system, signal conditioning and application of sensors in measurements.

SEMM 3523 Components Design
This course is designed to expose students in analysing machine design element failure theories. This includes failure due to static and fatigue loads. It involves fatigue strength and endurance level, modified stress Goodman diagram and fatigue design under tensile and combined stresses. The content will encompass the design and selection of bolts, welding, spring, ball and roller bearing, gears and belts. At the end of the course, students should have the capabilities to identify, analyse and design the machine elements in the perspective of static and fatigue failure aspect.

SEMM 3813 Industrial Engineering
This course introduces students to various theories, principles and the importance in the area of industrial engineering and project management. It covers issues related to productivity, quality, work study, ergonomics, facilities planning and project scheduling. The contents give some brief exposure on the concept and application of overall discipline for an industrial engineer. Some calculations or measurements are introduced as an approach before deciding the best alternative. Students should be able to describe fundamental aspects of project management and integrate knowledge in engineering and project management. In project management, students are exposed to several steps in developing project plan, managing risks, scheduling resources reducing project duration, and progress and performance measurement. At the end of the course, students should be able to apply various concept and tools in selecting the best alternative in terms of man, machine, materials, method and management and planning and monitoring engineering projects.

SEMM 3823 Engineering Management, Safety and Economics
This course aims to prepare students with basic management knowledge, safety and engineering economy. The management part will examine key issues in management and

organization, past management and today, strategic management, organizational structure and design, human resource management, motivating employees and leadership. Major topics covered under safety are OSHA 1994, Factories and Machinery Act 1967, hazard identification, risk assessment and control, basic principles of accident prevention and occupational health. In engineering economy, students are exposed to engineering economic principles and methods of engineering economic analysis. At the end of the course, students should be able to describe fundamental aspects of management; integrate knowledge in engineering and management in making business decisions; apply the principles of hazard identification, risk assessment/control; plan, design and implement an effective safety program; and also perform engineering economic analysis to solve problems and evaluate engineering investment/projects.

SEMM 3915 Industrial Training
Industrial training exposes students to the real work setting in various industries for 12 weeks. The students are placed in industries that best suit their area of studies. It is an experiential learning that requires the students to learn the process and able to apply their knowledge acquired in class in actual industrial setting. The knowledge acquired during practical training may be used later in final year classes as well as to equip them with sufficient knowledge for job interviews.

SEMM 3931 Laboratory II
This course is introduced in the third year of Mechanical Engineering programme involving two hours per week and experimental based courses. It consists of six laboratories; Strength of Materials Laboratory, Thermodynamics Laboratory, Materials Science Laboratory, Mechanics of Machines Laboratory, Electrical Laboratory and Fluids Laboratory. Students will be grouped into 5 to 6 for each experiment. It is based on the theory learned in the particular courses at the same semester. In general, every student has to carry out a total of twelve experiments. At the end of the session, students have to submit a report for each experiment and will be evaluated based on this report.

SEMM 3941 Laboratory III
This course is introduced in the third year of the Mechanical Engineering programme involving two hours per week session and experimental based courses. It is divided into two parts; experimental work at System & Control and Vibration Laboratories and a problem- based-learning (PBL) laboratory (module) depending on the topics/labs facilitated by a lecturer. Students have to produce a short report for the experimental work similar to those in Laboratory I and II. The second part, i.e., the lab module is based on the PBL concept. Student have to plan and design their own experimental work right from the very beginning until the end of the module based on the topics given by the lecturer. Students will be grouped into 5 to 6 for each module. In general, every group have to conduct two experimental works and two modules. At the end of the session, students have to submit two short reports and two formal reports.

SEMM 4533 System Design
This course is designed for students to gain detailed topical exposure to design methodologies and principles specific to the practice of mechanical design. Emphasis is on developing efficient and effective design techniques as well as project-oriented skills from both technical and non-technical considerations. At the end of this course, students should be able to identify and apply appropriate methodologies in performing design tasks, recognize the fundamental principles of mechanical designs and practices, formulate and apply general problem-solving strategies in the analysis of situations and potential problems and apply relevant industry standards in design. Student should also be able to communicate ideas and solutions in verbal and written forms by means of oral presentation and technical report.

SEMM 4902 Engineering Professional Practice

This course introduces students to engineering ethics and an engineer's responsibilities towards safety, health and welfare of the public. It emphasizes on the engineer as a professional man, engineers & society, code of ethics and professional conduct, standards, laws and regulations pertaining to professional engineering practice. The course will also introduce students to organize, in a group, community service activities in a planned and structured manner. At the end of the course, students should be able to demonstrate and apply engineering professional ethics in their career as an engineer.

SEMM 4912 Undergraduate Project I
This course introduces the final year students on how to do academic research on their own by applying knowledge and skills they acquired from other courses. Given a topic on a project, students have to identify a problem, gather relevant information to the problem and propose solutions to problems. In this course, students have to do some literature surveys in order to understand the nature of the problem and investigate work done by other researchers in line with their work. The students are also required to propose a methodology on how to solve the problems. By the end of this course, the students are expected to submit and present their research proposal to be assessed by their supervisors and panel of assessors.

SEMM 4924 Undergraduate Project II
This course is the continuation of Undergraduate Project (UGP) I. It enhances the students' knowledge and ability to identify and solve problems through academic research. It will provide an exercise for the student in carrying out research with minimum supervision and the ability to plan and manage their work effectively. This course will also develop the students' capability to present, discuss and analyze results of the research clearly, effectively and confidently in both oral presentation and in dissertation.

SEMB 3613 Physical Metallurgy
The course introduces the student to the basics of materials crystal structures and stereographic projection. It also provides students with knowledge of atom diffusion in solids, phase diagrams and phase transformation. The course will provide detailed knowledge on steels using the Fe-C phase diagram and various heat treatments and the effect on mechanical properties. At the end of the course students should be able to apply knowledge acquired on phase diagrams and atomic diffusion to read, construct and predict the materials structure and mechanical properties and design suitable heat treatments that would give the optimum performance through the use of the interrelationship between microstructure-mechanical properties and processes.

SEMB 3623 Mechanical Properties of Materials
This course introduces students to the fundamentals of dislocation theory and the role of these dislocations in predicting the metal's ability to deform plastically. It will focus on the mechanical behavior of all classes of materials (metals, polymers, ceramics and composites) under different stressing conditions such as fatigue, creep, and fracture. The course will also provide students with the principles of fracture mechanics and its application. The students also will be able to simulate and predict the mechanical behavior of materials using modern tools. At the end of the course the student should be able to link between the behaviour of materials and their structures and design procedures to control failure of materials.

SEMB 4613 Materials Characterisation
This course will give an overview and the basic principles of the widely used materials characterisation techniques, namely, microstructure analysis using optical and electron microscopy, structure determination by x-ray diffraction and electron diffraction, chemical analysis by X-ray application, surface analysis by spectroscopy techniques and thermal analysis methods.

SEMB 4623 Corrosion and Corrosion Control
This course introduces students to the basic principles of electrochemical and aqueous corrosion and oxidation of metals. The course will provide the principles that lead to metal corrosion and oxidation based on thermodynamics and Pourbaix diagrams, mixed potential theory and theory and application

of passivity. The course will also provide knowledge on the various forms of corrosion and methods to control namely, by design, materials selection, cathodic protection, coatings and the use of inhibitors. At the end of the course students should be able to apply the knowledge to determine whether corrosion will occur in any given environment and recognize the different types of corrosion as well as able to suggest a corrosion control system for protection against corrosive environment.

SEMB 4633 Materials Selection in Mechanical Design
This course introduces students to the basic concepts of materials selection and provides systematic methodology for materials and process selection in engineering design. The course will emphasize on describing the relationship between component design and materials selection and how materials selection fits into the design process from concept to the final details. The interaction between the manufacturing process and material selection and the need to adopt concurrent engineering approach is described. The effect of environment and economic impact on materials and process selection is also introduced. The course provides students with case studies and project in which the methodology of materials and process selection utilizing computer and specialized software is used. By the end of the course students should be able to perform the necessary calculations, identify the design/functional requirements of materials properties and perform the selection of candidate materials.

ELECTIVE COURSES

SEMB 4643 Non Destructive Testing
This course aims to develop an understanding of the working principles associated with established and widely used techniques for non-destructive testing (NDT), specifically dye penetration, magnetic particle, eddy current, ultrasonic and radiography. Upon completion of this course, the students will be able to understand the working principle, needs and the technique to conduct the testing. This course will elaborate on the theory of each method, the probes needed, the mechanism to detect either surface or subsurface defects, the properties of materials to be tested, the test methods involved and the advantages and disadvantages of each method.

SEMB 4653 Surface Engineering
This course covers the aspects of surface engineering, to develop fundamental understanding and the role of materials to allow surface selection for mechanical contacts and their surrounding environmental conditions. The course will explore a range of surface treatments and advanced coatings that are designed to minimize wear, friction and surface oxidation / corrosion. Applications and economics of surface treatments/coatings will be addressed by means of industrial case studies. The lectures will draw on examples from applications within the marine, oil and gas, aerospace and biomedical sectors. Emphasis will be placed on gaining sustainability through correct surface engineering technology. The economics of surface selection will be discussed for various examples, e.g. subsea components, machine tool coatings and thermal barrier coatings for aerospace.

SEMB 4663 Advanced and Functional Materials
This course introduces students to the recent developments on the various classes of advanced and functional materials used in applications such as aerospace, automotive, biomedical and electronic industries. It will emphasize on the important properties exhibited by metallic, polymeric, ceramics and composite materials that make them selected for high-end and advanced applications. The physical and mechanical properties of the various classes of advanced materials (super alloys, titanium and aluminium alloys, intermetallic, biomaterials, electronic and magnetic materials) will be detailed as well as the processing techniques associated with producing these materials. The course will also cover smart materials such as shape memory alloys, Solar cell materials, fuel cells, high density energy storage batteries, Green materials, Smart sensors and actuators. The students are enabled to describe structural setup and function of advanced and functional materials. They command modern synthesis techniques and are able to apply these techniques to the preparation of new compounds. The students can interpret and evaluate the results of various methods for structural analysis of functional materials and apply the knowledge to select suitable materials for a given engineering project.

SEMB 4673 Materials Processing
This course introduces students to the manufacturing methods of engineering materials into the desired shapes. It starts with the basic concepts of manufacturing and processing and their applications to metals as it introduces students to solidification in casting, powder metallurgy, deformation processes. The course will examine the various processing methods for metals, ceramics, polymers and composite materials, including joining and recycling processes for metals, polymer and ceramics. The course emphasis on the role played by materials and their properties in selecting the optimum manufacturing method. At the end of the course students should be able to demonstrate the ability to relate structure of materials to properties and processing method.

SEMB 4683 Nanomaterials
This course introduces students to fundamental aspects of nanomaterials and nanotechnology. The importance of the nanoscale materials and their improved properties compare to conventional materials. The principles and relative merits of a range of techniques for the fabrication of nanostructures in one dimensional and two dimensional materials including single atomic layer and multilayers are discussed. The analytical and imaging characterization techniques and the recent applications of nanomaterials in engineering such as electronics, energy devices and biomaterials will be briefly discussed.

SEMB 4693 Modelling in Materials Engineering
This course introduces students to the basic concepts of computer modelling in materials science and engineering. The course covers basic principle in establishing numerical simulation for the evaluation of material properties and phenomena during material processing. It will emphasize on atomistic, mesoscopic and microscopic evaluation of material properties and behavior by computer simulations. In detail, molecular dynamic method will be given as an example of atomistic evaluation method, whereas discrete dislocation dynamics will be used for mesoscopic simulation method. For microscopic scale evaluation, phase-field method will be introduced as an example. At the end of the course students should be able to construct simple numerical modelling both in atomistic, mesoscopic and microscopic scale.