UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Faculty of
Mechanical Engineering

ACADEMIC SESSION 2022/2023

UNDERGRADUATE HANDBOOK

innovative • entrepreneurial • global

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FOREWORD BY THE DEAN

Assalamu'alaikum and Greetings

I am grateful to the Almighty Allah S.W.T for enabling me to compose a few words in this Undergraduate Handbook 2022/2023.

Welcome to the Faculty of Mechanical Engineering, Universiti Teknologi Malaysia (UTM). I would like to congratulate all new students on being admitted to the various degree programs offered by the faculty. I hope that the opportunity given will be taken up to strive to your utmost performance in acquiring the knowledge, necessary skills and transformative life experiences to be a holistic talent and successful engineer.

The Undergraduate Handbook contains brief information on the curriculum structures and syllabuses of the programmes offered by the faculty which is applicable to the students of the 2022/2023 session intake. It also serves as your main source of reference related to your academic affairs and provides the required information for students, particularly on the implementation of programs and detailed courses offered. This handbook can be used by the students throughout their studies for the graduation plan. In addition, a special topic on Academic Advising is also included so that both students and academic advisors can play their roles effectively.

We hope that all new students will use the information in this handbook for your benefit in enhancing your educational experience toward a high-quality graduate.

On behalf of the faculty, I would like to extend my utmost appreciation and sincere gratitude to all parties involved in the publication of this Undergraduate Handbook. I wish all the new students to perform at your very best in the studies and we hope that this handbook will be useful to all. I really hope that the students could give your full effort and commitment with great perseverance during your study period toward a successful journey with knowledgeable, skilful, holistic and balanced attributes.

Thank you.

Best regards,
Assoc. Prof. Ir. Ts. Dr. Zaini Ahmad
Dean,
Faculty of Mechanical Engineering

Vision of the Faculty

To become a world-class Mechanical Engineering Faculty

Mission of the Faculty

To develop the human resource required by the nation through training, development, dissemination of knowledge, research, and consultancy.

Client's Charter

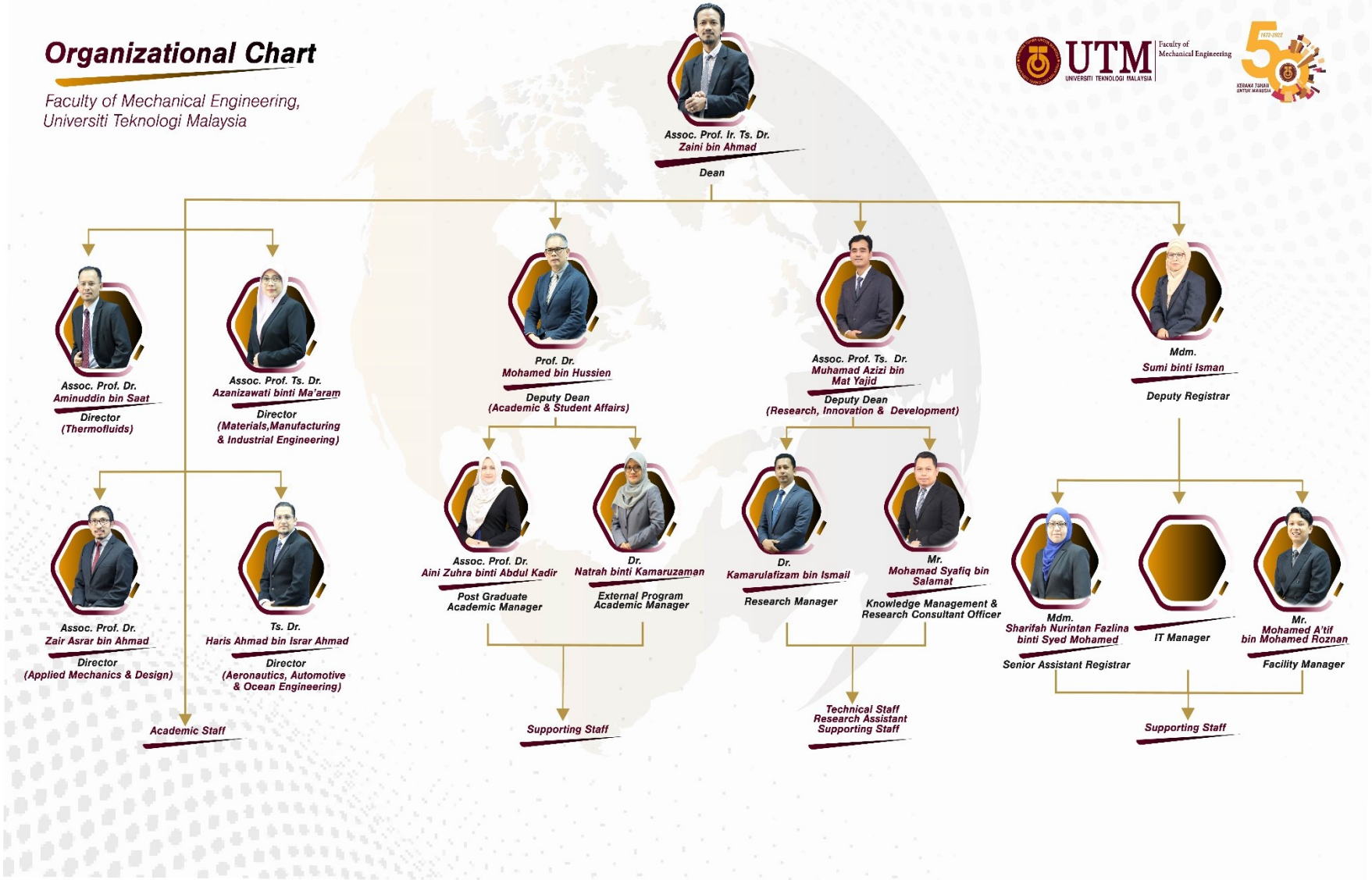
Realising the main role of the faculty is developing human resources in the field of Mechanical Engineering to fulfil the needs of the country, university and society, whereby pledge:

- to produce capable and ethical Mechanical Engineers;
- to design and implement a world class curriculum recognized by the professional bodies;
- to provide efficient, ethical and professional staffs who are capable of executing quality academic and administrative tasks in a planned, orderly and controlled manner;
- to provide suitable and conducive infrastructure for teaching and learning;
- to concern students self-development

ORGANISATIONAL STRUCTURE

Organizational Chart

Faculty of Mechanical Engineering,
Universiti Teknologi Malaysia



ADMINISTRATIVE STAFF

Dean
Associate Professor Ir. Ts. Dr. Zaini Ahmad
BEng (Mech.),UTM
MSc (Structures, Impact & Crashworthiness), UK
PhD (Structural Impact), Australia
Room : E07-04.03.09 Tel : +607-5534567
Email : azaini@utm.my, azaini@mail.fkm.utm.my

Deputy Dean
Academic & Student Affairs
Professor Dr. Mohamed Hussein
BEng (Mech.),UTM
MSc (Adv, Mfg Sys. & Tech.), UK
PhD (Mechatronics), UK
Room : E07-04.02.14 Tel : +607-5557074
Email : tdafkm@utm.my , mohamed@utm.my

Deputy Dean
Research, Innovation and Development
Associate Professor Ts. Dr. Muhamad Azizi Mat Yajid
BEng (Hons)(Materials Eng.), USM
MSc (Nanoscale Science and Technology), UK
PhD (Materials Engineering), UK
Room : E07-04.03.08 Tel : +607-5557048
Email : azizi@utm.my, azizi_my@mail.fkm.utm.my

Director of Department
Applied Mechanics and Design
Associate Professor Dr.-Ing. Zair Asrar Ahmad
BEng (Aeronautics), UTM
MSc (Mech. Eng), UTM
PhD (Mech. Eng), Germany
Room : E07-04.02.15 Tel : +607-5557044
Email : zair@utm.my, zair@mail.fkm.utm.my

Director of Department
Thermofluids
Associate Professor Dr. Aminuddin Saat
BEng (Mech.) UTM
MSc (Automative Eng), UK
PhD (Thermofluids), UK
Room : E07-04.02.07 Tel : +607-5557051
Email : kjtbfkm@utm.my, aminudin@utm.my

Director of Department
Materials, Manufacturing, and Industrial Engineering
Associate Professor Ts. Dr. Azanizawati Ma'aram
BEng (Mech-Industrials), UTM
MSc (Advance Manufacturing Tech.), UTM
PhD (Management), UK
Room : E07-04.02.17 Tel : +607-5557038
Email : kjbpifkm@utm.my, niza@utm.my

Director of Department
Aeronautics, Automotive and Ocean Engineering
Ts. Dr. Haris Ahmad Israr Ahmad
BEng (Mech-Aero), UTM
MSc (Aerospace Mechanics & Avionics), France
PhD (Mechanics & Materials), France
Room : E07-04.02.16 Tel : +607-5557043
Email : kjaasfkm@utm.my, harisahmad@utm.my

Post Graduate Academic Manager
Associate Prof Dr Aini Zuhra Abdul Kadir
BEng (CAD/CAM), UM
MEng (Manufacturing), UM
PhD (Mech. Engineering), New Zealand
Room : E07-04.02.05 Tel : +607-5557061
Email : pgamfkm@utm.my, ainizuhra@utm.my

External Program Academic Manager
Dr Natrah Kamaruzaman
BEng (Mechanical System), Japan
MEng (Mech. Eng.), UTM
PhD (Mech. Eng.), UTM
Room : C23-215.02 Tel : +607-5534663
Email : paplfkm@utmspace.edu.my, natrahk@utm.my

Research Manager
Dr Kamarulafizam Ismail
BSc (Computer), UTM
MSc (Electrical), UTM
PhD (Med. Eng.), UTM
Room : C25 – 412 Tel : +607-5534760
Email : kamarulafizam@utm.my, kamarulafizam@mail.fkm.utm.my

Knowledge Management and Research Consultant Officer
Mr. Mohamad Syafiq Salamat
BEng (Information Studies Literature), UiTM
Room : E07-04.02.10 Tel : -
Email : msyafiqs@utm.my

Deputy Registrar
Mdm. Sumi Isman
Bach. (Hons) (Business Administration), UUM
Ms. (Tech. Management), UTM
Room : E07-04.02.11 Tel: +607-5557073
Email : sumi@utm.my

Senior Assistant Registrar
Mdm. Sharifah Nurintan Fazlina Syed Mohamed
BBA (Hons)(International Business), UiTM.
Room : E07-04.03.18 Tel: +607-5557036
Email : sp-intan@utm.my

UNDERGRADUATE STUDY

ENTRY REQUIREMENTS BACH-

ELOR'S DEGREE

For Malaysian Students

General Entry Requirements:

1. A pass in Malaysian Certificate of Education (SPM) or equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia (July paper), **and**
2. Having Diploma or equivalent qualification recognized by the Malaysian Government, **or**
3. A pass in Malaysian Higher School Certificate (STPM) with at least C grade (CGPA 2.00) in General Paper and C grade (CGPA 2.00) in any two of the taken subjects in the STPM, **or**
4. A pass in Malaysian Matriculation Certificate / Foundation with minimum CGPA of 2.00, **or**
5. Hold A–Level **/** International Baccalaureate **/** Australian Matriculation (Ausmat) Certificate.
6. Attained a minimum Band 2 in Malaysian University English Test (MUET)/ Band 5.5 in IELTS/ Score of 500 in TOEFL PBT/ Score of 59 in TOEFL IBT.

Special Requirements for the Programme

1. Comply to university general requirements, **and**
2. Comply to special requirements for the programme.
   Please refer to *admission.utm.my/undergraduate-malaysian/* for further details.
3. Do not have any physical disabilities.

For International Students

General Entry Requirements:

1. Passed General Certificate of Education (GCE), 'A' Level, Diploma in related field or other equivalent pre-university examinations; **or**
2. Any other certificate that is recognized by Senat of the University equivalent to the above; **or**
3. Participate in the bridging program organized by the university, **and**
4. Pass the English Proficiency requirements.
5. Pass the Health requirements.

Please refer to *admission.utm.my/entry-requirements-ug-international/* for further details.

Note: - Year of entry and duration of study will be based on the credit exemptions or credit transfer awarded by the university.

English Language Requirement for International Students

If English is not your native language and you are attending a school where English is not the language of instruction, you must take the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System Academic (IELTS Academic)

Applicants who do not meet the English proficiency requirements of their chosen programme at Universiti Teknologi Malaysia (UTM) can improve their English at Intensive English Programme (IEP) at Language Academy, UTM or CIEP at ELS Language Centers in Malaysia.UTM accepts IELTS Level 5.5 and above upon completion of IEP conducted by Language Academy, UTM or ELS English Certificate (level 107) as an ENGLISH LANGUAGE ENTRY REQUIREMENTS FOR INTERNATIONAL STUDENTS. Students who choose to attend IEP (Language Academy, UTM) must attain IELTS 5.5 or attend ELS and must pass the required English course(s) before starting their programmes in UTM

COURSE REGISTRATION

It is mandatory for all students who have registered for a programme – a full time or external candidate – to register every course that will be taken for the semester. Students who did not enrol in the programme will not be allowed to register for any course.

Students can only register for courses that are offered for a particular semester based on the regulations set by the faculty. Students cannot register for any course that is not offered in the semester.

Students can withdraw (TD) any course registered for the semester. Application to withdraw must be made by using the Course Withdrawal Form.

If student fails to do the registration or does not do the registration of courses within the specified duration as mentioned above, unless valid reasons are given, he or she will be dismissed from the University.

AWARD REQUIREMENTS

Bachelor's Degree

- Attain a total of not less than 136 credit hours with a minimum CGPA of 2.0.
- Professional Skill Certificate (PSC)

Compulsory:

1. Talent and Competency Management
2. English Communication Skills Graduating Students (ECS)
3. Design Thinking for Entrepreneur

Elective (Choose two only):

1. Data Analytics for Organization
2. Professional Ethics and Integrity
3. Construction Measurement (Mechanical & Electrical)
4. OSHE for Engineering Industry and Laboratory
5. OSHE for Construction Industry and Laboratory Works
6. Quality Management for Built Environment and Engineering Professionals
7. Safety and Health Officer Introductory Course

Cross-Campus Programme

Students are given the opportunity to enrol in a few courses in participating universities. The grades and credits obtained during this period are transferable.

The programme is open to undergraduates who have undergone a minimum of two semesters of their studies with the following conditions:

(i) The total number of credits allowed to be taken is between twelve (12) and eighteen (18) credits only.
(ii) The student should hold a minimum CGPA of 3.00 at the time of application.
(iii) The student is not a residence of or originated from the state where the university that he/she intends to attend is located.

The student will not be charged tuition fees by the participating university but shall pay the regular tuition fees at UTM. However, should the participating university provide accommodation, the student will need to pay accommodation fees.

Professional Skills Certificate (PSC)

Students must enrol in certificate programmes offered by the Centres of Excellence in the University and the School of Professional and Continuing Education (SPACE) as part of the award requirement:

- Students are required to enrol and pass FIVE (5) PSC courses, to be eligible to graduate.

FACULTY BACKGROUND

Faculty of Mechanical Engineering (FME) formerly known as Fakulti Kejuruteraan Jentera (FKJ), was set up in 1975 at UTM Kuala Lumpur campus. FKJ initially had two departments, namely, the Department of Mechanical Engineering and Department of Petroleum Engineering. The faculty was managed by a Dean with the assistance of a Deputy Dean and two Heads of Department.

The faculty initially offered degree and diploma programmes in Mechanical Engineering and Petroleum Engineering. The student population during the 1976/1977 session was 544 with the number of students undergoing the Diploma in Mechanical Engineering (DKJ) programme and Diploma in Petroleum Engineering (DKP) programme totaling of 312 and 66, respectively, while for the Degree in Mechanical Engineering (SKJ) programme and Degree in Petroleum Engineering (SKP) programme, it was 126 and 40, respectively. As a result of the UTM-TUDM initiative, a new programme, Diploma in Aeronautical Engineering was offered during the 1980/1981 session. A total of 30 students enroled in the programme. During the 1981/1982 session, another new programme were offered by the Faculty, namely, Diploma and Bachelor Degree in Ocean Engineering. A total of 29 students enroled the diploma programme and 25 students for the degree programme.

In 1981, the faculty introduced a new position, the Deputy Dean II and set up a new department known as the Department of Production and Industrial Engineering. 15th of March 1983 marked a significant occasion in the history of FKJ when the Department of Petroleum Engineering was officially separated from FKJ to form a new faculty known as the Faculty of Chemical and Natural Resources Engineering. FKJ moved to a new main campus in Skudai, Johor in June 1989. As an effort to make the faculty more internationally marketable, the University has agreed to rename the Fakulti Kejuruteraan Jentera (FKJ) to the Fakulti Kejuruteraan Mekanikal (FKM) or Faculty of Mechanical Engineering (FME) on the 20th of December 1995. Since then, the faculty has considerably thrived and grown into a reputable and healthy organisation through a number of changes and transformation related to the expansion of academic programmes, new departments, improved facilities and infrastructures, and increased in number of staff and students.

FACULTY STRUCTURE AND DEPARTMENTS

FME is currently led by a Dean and assisted by two Deputy Deans; the Deputy Dean (Academic and Student Affairs) and Deputy Dean (Research, Innovation, and Development). A Deputy Registrar with the assistance of a Senior Assistant Registrar handles the administrative matters of the faculty. The administration of the Information Technology (IT) unit is headed by an IT Manager and the Teaching Laboratories are headed by a Research Manager. Currently, the Faculty has four (4) academic departments, each headed by a Director of Department. They are as follows:

- Department of Applied Mechanics & Design
- Department of Thermo-Fluids
- Department of Materials, Manufacturing & Industrial Engineering
- Department of Aeronautics, Automotive & Ocean Engineering

ACADEMIC PROGRAMMES

The faculty currently offers the following programmes:

Undergraduate Programmes :

1. Bachelor of Mechanical Engineering with Honours
2. Bachelor of Mechanical Engineering (Materials) with Honours
3. Bachelor of Mechanical Engineering (Industrial) with Honours
4. Bachelor of Mechanical Engineering (Manufacturing) with Honours
5. Bachelor of Mechanical Engineering (Aeronautics) with Honours
6. Bachelor of Mechanical Engineering (Automotive) with Honours
7. Bachelor of Engineering (Naval Architecture and Offshore Engineering) with Honours

Postgraduate Programmes :

Master programmes taught by course:

1. Master of Science (Mechanical Engineering)
2. Master of Science (Industrial Engineering)

Master of Philosophy (Field of Research) :

1. Mechanical Engineering
2. Marine Technology

Doctor of Philosophy :

Mechanical Engineering

FACILITIES

The faculty is well-equipped with lecture halls, smart classrooms, lecture and tutorial rooms, seminar halls and resource centre (mini library). To support teaching and research activities, laboratories and workshops are available and headed by a Research Manager, who supervises the following Teaching Laboratories:

- Industrial Engineering Laboratory
- Metrology Laboratory
- Metal Forming Laboratory
- Fabrication Laboratory

- Mechanics of Materials & Structures Laboratory
- Systems & Control Laboratory
- Mechanics of Machines Laboratory
- Noise & Vibration Laboratory
- Thermodynamics Laboratory
- Fluid Mechanics Laboratory
- Foundry Laboratory

Workshop facilities are available as follows:

- Machine Shop

The faculty is also equipped with the following Laboratories of Excellence:

- Marine Technology Laboratory
- Aeronautical Laboratory
- Automotive Laboratory
- Materials Science Laboratory
- Production Laboratory

Apart from the above the faculty also has a number of Centre of Excellence:

- Institute of Noise and Vibration
- Marine Technology Centre
- Automotive Development Centre
- Composite Centre
- Aeronautics Research Centre

Computing and IT Facilities

Five computer laboratories with more than 250 computers are available for students use. To facilitate computer aided teaching and learning, fully licensed software packages such as Solidworks, MATLAB/Simulink, S-Plus, Witness, LS-Dyna, Alias Wavefront, Rhino 3D, Patran, Nastran, AutoCAD, Fluent and Catia as well as Open Source software are readily available to use. Students are also able to access e-mail and e-learning facilities provided by the faculty and university. Internet facilities are widely available through both cabled and wireless configurations installed across the faculty. Additional computing facilities are also available in the Centre for Information and Communication Technology (CICT), main library and student hostels.

The faculty academic web portal can be accessed directly from:

https://engineering.utm.my/mechanical/

PROGRAMME SPECIFICATIONS AREAS OF STUDY, CAREER PROSPECTS AND CURRICULUM

Programme Educational Objectives (PEO)

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:

Code	Intended Learning Outcomes
PO1	Acquire and apply fundamental knowledge of mathematics, science andengineering principles to solve complex mechanical and materials / Industrials / Manufacturing / Aeronautics / Automotive engineering problems. Keywords: **Engineering Knowledge**
PO2	Identify, formulate and analyse complex mechanical and materials / Industrials / Manufacturing / Aeronautics / Automotive engineering problems. Keywords: **Problem Analysis**
PO3	Design solutions for complex mechanical and materials / Industrials / Manufacturing / Aeronautics / Automotive engineering problems that fulfilhealth, safety, societal, cultural and environmental needs. Keywords: **Design/Development of Solutions**
PO4	Investigate complex mechanical and materials / Industrials / Manufacturing / Aeronautics / Automotive engineering problems using research-based knowledge and methods to produce conclusive results. Keywords: **Investigation**
PO5	Use modern engineering and information technology (IT) tools in complex mechanical and materials / Industrials / Manufacturing / Aeronautics / Automotive engineering activities, with an understanding of the limitations. Keywords: **Modern Tools Usage**
PO6	Apply professional engineering practice and solutions to complex mechanical and materials / Industrials / Manufacturing / Aeronautics / Automotive

	engineering problems related to societal, health, safety, legal and cultural issues with full responsibility and integrity. Keywords: **The Engineer and Society**
PO7	Evaluate the sustainability and impact of professional engineering work in the solutions of complex mechanical and materials / Industrials / Manufacturing / Aeronautics / Automotive engineering problems in societal and environmental contexts. Keywords: **Environment and Sustainability**
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. Keywords: **Ethics**
PO9	Work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings. Keywords: **Team Working**
PO10	Communicate effectively on complex mechanical and materials / Industrials / Manufacturing / Aeronautics / Automotive engineering activities both orally and in writing. Keywords: **Communication**
PO11	Demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill. Keywords: **Project Management, Finance & Entrepreneurship**
PO12	Undertake lifelong learning and manage information including conducting literature study. Keywords: **Lifelong Learning**

BACHELOR OF MECHANICAL ENGINEERING WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Mechanical Engineering with Honours is offered on a full-time basis at the UTM Main Campus in Johor Bahru. The duration of study for the programme is subjected to the student's entry qualification and lasts between four (4) years and a maximum of six (6) years.

The programme is offered full-time and is divided into two semesters per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) and eighteen (18) credit hours per semester. Assessment is based on course works and final examinations given throughout the semester.

General Information

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

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

12.	**Entry Requirements**	Matriculation / STPM / Diploma or equivalent

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.8%
ii.	Programme Core (including Mathematics and Electrical subject)	105	77.2%
iii.	Programme Electives	15	11.0%
	Total	**136**	**100%**
Classification of courses for engineering programme			
A	Engineering Courses (a) Lecture/Project/ Laboratory (b) Workshop/Field/Design Studio (c) Industrial Training (d) Final Year Project	 94 0 5 6	77.0%
	Total Credit Hours for Part A	**105**	
B	Non-Engineering (a) Applied Science/Mathematic/Computer (b) Management/Law/Humanities/Ethics/Economy (c) Language (d) Co-Curriculum	 12 11 6 2	23.0%
	Total Credit Hours for Part B	**31**	
Total credit hours for Part A and B		**136**	**100%**
Total Credit Hours to Graduate		**136 credit hours**	

AWARD REQUIREMENTS

To graduate, students must:

- Attain a total of not less than 136 credit hours 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 five (5) Professional Skills Certification (PSC) courses in UTM
- Other condition as specified.

AREAS OF STUDY

Mechanical Engineering programme makes up the core of the engineering studies in the Faculty of Mechanical Engineering. Students pursuing specialisation in a particular field shall take additional elective courses. The fundamental areas of study in mechanical engineering are described as follows:

(a) Applied Mechanics

Applied Mechanics is the application of mechanics principles to real world problems. It is a field of engineering which combines the fundamental physical sciences with mathematical, computational and experimental techniques. The term mechanics refers to the formulation of rules predicting the behaviour of physical system under the influence of any type of interaction with its environments, particularly due to the action of the forces that cause the behaviour or response of the physical system at rest (statics) or in motion (dynamics).

Applied Mechanics covers the following disciplines:

- Mechanics of Materials and Structures
- Mechanics of Machines
- Dynamic Systems and Control

The above sub-fields provide the essential knowledge which is required by the mechanical-based engineers to include Aeronautical, Automotive, Naval Architecture and Offshore Engineering, Materials, Manufacturing and Industrial Engineering counterparts.

Examples of the elective courses in Applied Mechanics are:-

- Mechanics of Composite Materials
- Failure of Engineering Component and Structures
- Mechanical Vibration
- Machine Condition Monitoring
- Noise
- Robotics

(b) Thermodynamics

Thermodynamics is taught at two levels – basic and applied. In the basic level, focus is given to the understanding of the concept of system, heat, work as well as material properties in relation to heat and work and their influence on a particular thermodynamic system. The second level involves application of theories based on thermodynamic laws instudying and analysing primary devices. Focus is on the methods of generating heat and power, minimisation of fuel usage, efficiency and other parameters. Thermodynamics is an important field, very much needed in several industrial sectors such as power generation, petrochemistry, automotive, and building maintenance. It is a course which directly involved in power generation/energy savings, different engine designs and supporting systems with high capability and cost effectiveness.

Examples of elective courses in Thermodynamics are:

- Combustion Processes
- Air Conditioning
- Internal Combustion Engine
- Heat Transfer
- Power Plant Technology

(c) Fluid Mechanics

It is a field of study which deals with fluid properties, surface hydrostatic force (examples: dam gate, reservoir, pressure and flow measurement, piping system design, potential flow and boundary layer) to determine flow type and resulting force, pumps and turbines. The principles applied include Newton's law, thermodynamic laws and basic knowledge in Mathematics. The scope of study is based on its application in the engineering field.

Examples of elective courses:

- Turbomachinery
- Hydraulic and Pneumatic Systems
- Computational Fluid Dynamics (CFD)

(d) Design

Introduction to Design

Students are exposed to the concepts and methods to develop an efficient design process and applying it to solve engineering design problems creatively and effectively.

Component Design

Students are exposed to analysis in machine design element failure theories. This includes failures 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 bearings, gears and belts. At the end of the course, a student should have the capabilities to identify, analysis and design the machine elements in the perspective of static and fatigue failure aspect.

System Design

Students are able to design methodologies and principles specific to the practice of mechanical design. Emphasis is on developing efficient and effective design techniques aswell as project-oriented skills from both technical and non-technical consideration. Studentsare able to identify and apply appropriate methodology in performing design tasks, recognise the fundamental principles of mechanical design and practices as well as formulate and apply general problem-solving strategy in the analysis of situation problem and potential problem. Students are able to identify and apply industry standards in designcommunication.

(e) Materials Science and Materials Technology

This course is important to engineers because it provides the basic knowledge on engineering materials such as metals, polymers, ceramics and composites so that proper materials can be selected for a particular design or product. This course relates the structure to the properties of materials so the behaviour of materials can be better understood.

CAREER PROSPECTS

Graduates of the program are expected to work in Mechanical Engineering field, one of the oldest areas of engineering activity. The career of a Mechanical Engineer involves the efficient application of physical and human resources in improving the standard of living. A Mechanical Engineer combines the basic knowledge of physical sciences and engineering education with experience and expertise to invent, design and manufacture, run and maintain mechanical

equipment, machineries and tools in all branches of industry including automotive, aerospace, marine/shipbuilding, manufacturing, processing and those involving heavy machinery. Graduates in this area can fulfil the task of an engineer cum technologist in the government, semi- government and private firms. Graduates will be able to find job opportunities in various sectors and industries as previously mentioned.

A Mechanical Engineer may further his career as a product designer, building contractor manufacturer of machines or engineering products, researcher in Research and Development (R&D) departments/institutes or an academician in institutions of higher learning. Indeed, the career of a Mechanical Engineer is deemed very versatile thus it is not surprising at all that Mechanical Engineering graduates are able to take up various relevant positions without much hassle.

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 organisations 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**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	
SEMM 1203	Statics*	3	
SEMM 1503	Engineering Drawing	3	
SEMM 1911	Experimental Methods	1	
SEMM 1921	Introduction to Mechanical Engineering	1	
SSCE 1693	Engineering Mathematics I	3	
ULRS 1012	Value and Identity	2	
UHLB 1112	English Communication Skills	HL	Refer English courses requirement section
	Total	**16**	

YEAR 1 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1113	Mechanics of Solids I*	3	SEMM 1203
SEMM 1213	Dynamics*	3	SEMM 1203
SEMM 1513	Introduction to Design	3	SEMM 1503
SEEU 1002	Electrical Technology	2	
SSCE 1793	Differential Equations	3	SSCE 1693
SEMM 2921	Laboratory 1	1	SEMM 1911
UHMS 1182	Appreciation of Ethics and Civilisations	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLM 1012	Malay Language for Communication 2 (For International Students Only)		
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 2 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2123	Mechanics of Solids II*	3	SEMM 1113
SEMM 2223	Mechanics of Machines & Vibration*	3	SEMM 1213
SEMM 2313	Mechanics of Fluids I*	3	SEMM 1203, SEMM 1013**
SEMM 2413	Thermodynamics*	3	
UHLX 1112	Foreign Language Elective	2	
UKQF 2xx2	Service Learning and Community Engagement	2	
	Total	**16**	

YEAR 2 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2323	Mechanics of Fluids II*	3	SEMM 2313
SEMM 2423	Applied Thermodynamics*	3	SEMM 2413
SEMM 2613	Materials Science	3	
SEEU 2012	Electronics	2	SEEU 1002
SSCE 1993	Engineering Mathematics II	3	SSCE 1693
UHLB 2122	Professional Communication Skills 1	2	
UHIS 1022	Philosophy and Current Issues	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLM 1012	Malay Language for Communication 2 (For International Students Only)		
	Total	**18**	

Remarks:

i) ***Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).**

ii) **For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.**

iii) ****Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.**

iv) **For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).**

v) **Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.**

YEAR 3 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2713	Manufacturing Processes	3	
SEMM 3023	Applied Numerical Methods	3	SEMM 1013, SSCE 1793**
SEMM 3233	Control Engineering	3	SEMM 1213**, SSCE 1793**
SEMM 3242	Instrumentation	2	SEEU 2012**
SEMM 3931	Laboratory II	1	SEMM 2921
SSCE 2193	Engineering Statistics	3	
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
	Total	**17**	

YEAR 3 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3033	Finite Element Methods	3	SEMM 1113**
SEMM 3253	Mechatronics	3	SEMM 1013**, SEEU 2012**
SEMM 3443	Heat Transfer	3	SEMM 2413**, SSCE 1793**
SEMM 3523	Component Design	3	SEMM 2123**, SEMM 1513
SEMM 3813	Industrial Engineering	3	
SEMM 3941	Laboratory III	1	SEMM 3931
ULRS 3032	Entrepreneurship and Innovation	2	
	Total	**18**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

SHORT SEMESTER			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3915	Industrial Training	5	##, SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2423**
	Total	**5**	

Remarks:

Obtained minimum of 80 credits

YEAR 4 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3823	Engineering Management, Safety and Economics	3	
SEMM 4533	System Design	3	SEMM 3523
SEMM 4912	Undergraduate Project I	2	SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2423**
SEMX 4xx3	Elective I	3	
SEMX 5xx3	PRISMS Elective 1		
SEMX 4xx3	Elective II	3	
SEMX 5xx3	PRISMS Elective II		
	Total	**14**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 4 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4902	Engineering Professional Practice	2	
SEMM 4924	Undergraduate Project II	4	SEMM 4912
SEMX 4xx3	Elective III	3	
SEMX 5xx3	PRISMS Elective III		
SEMX 4xx3	Elective IV	3	
SEMX 5xx3	PRISMS Elective IV		
SXXX xxx3	Free Elective	3	
	Total	**15**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

ENGLISH COURSES REQUIREMENT

Students with English qualification shown in table below are exempted from Compulsory Attendance (HL) for UHLB 1112

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exempted

ELECTIVE COURSES

Apart from the core course, students must also take 12 credits of elective course.

Areas	Code	Elective Courses
Area 1: Mechanical Engineering	SEMM 4113	Plasticity & Application
	SEMM 4123	Structural Analysis
	SEMM 4133	Failure of Engineering Components & Structures
	SEMM 4143	Mechanics of Composite Materials
	SEMM 4153	Applied Stress Analysis

Area 1: Mechanical Engineering	SEMM 4163	Surface Mount Technology
	SEMM 4213	Mechanical Vibration
	SEMM 4233	Mechanisms & Linkage
	SEMM 4243	Advanced Control
	SEMM 4253	Industrial Automation
	SEMM 4273	Robotics
	SEMM 4293	Noise
	SEMM 4313	Turbomachinery
	SEMM 4323	Fluid Power
	SEMM 4333	Computational Fluid Dynamics
	SEMM 4343	Hydraulic Machine & Pipe System
	SEMM 4353	Lubrications
	SEMM 4413	Internal Combustion Engine
	SEMM 4423	Power Plant Engineering
	SEMM 4433	Refrigeration & Air Conditioning
	SEMM 4443	Thermal Fluid System Design
	SEMM 4453	Combustion
	SEMM 4463	Energy and Environment
	SEMM 4513	Computer Aided Design
Area 2: Materials	SEMM 4633	Materials Selection
	SEMB 4613	Materials Characterization
	SEMB 4623	Corrosion & Corrosion Control
	SEMB 4643	Non-Destructive Testing
	SEMB 4653	Surface Engineering
	SEMB 4663	Advanced and Functional Materials
	SEMB 4673	Materials Processing
	SEMB 4683	Nanomaterials
	SEMB 4693	Modelling in Materials Engineering
Area 3: Manufacturing	SEMP 4033	CAD/CAM
	SEMP 4013	Additive Manufacturing
	SEMP 4023	Sustainable Manufacturing
	SEMP 4753	Non-conventional Machining
	SEMP 4763	Quality Engineering and Metrology
	SEMP 4783	Casting Technology
	SEMP 4793	Product Design and Manufacture
Area 4: Industrial	SEMI 4813	Industrial System Simulation
	SEMI 4823	Operation Research
	SEMI 4843	Facilities Design
	SEMI 4853	Quality Engineering
	SEMI 4873	Reliability and Maintenance
	SEMI 4883	Supply Chain Management and Sustainability

PRISMS ELECTIVE COURSES

For students who intend to enrol in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

dyna:Mech@UTM

dyna:Mech is an initiative by the Faculty of Mechanical Engineering UTM which aims to strengthen the currently available Mechanical Engineering Programme, at the same time improving the employability and competitiveness of the graduates. dyna:Mech is the first of its kind in Malaysia; which no other universities in the country offer a dynamic Mechanical Engineering programme like this.

While other University-Industry collaborations involve research funding and technology transfer, the Mechanical Engineering programme in UTM takes one step further, allowing involvement of the industry in the curriculum. Our new initiative offers approximately 20 flexible credits which are based on the needs of the industry; some are taught by lecturers of the faculty, and some others by experienced personnel from the industry. The courses offered under the dyna:Mech programme to Mechanical Engineering students will be categorised intoclusters according to the skillset required by specific industries. Students will also experienceindustrial training with industries related to the respective cluster they had chosen. Consequently, Mechanical Engineering students can experience the working world while theyare still studying and will be trained with specific skills according to the current needs of the industry. This dyna:Mech initiative provides industrial benefit through reducing the period taken significantly to train and prepare the young engineers.

This collaboration between the University and industry will help students in getting an early chance to identify employment opportunities, simultaneously providing industries with the opportunity to select excellent students before they even graduate. The Faculty of Mechanical Engineering at UTM will stop at nothing to ensure its program is always the best in Malaysia to produce outstanding engineers in the country.

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 2423	Applied Thermodynamics	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 3033	Finite Element Methods	3	3	
20	SEMM 3233	Control Engineering	3	3	
21	SEMM 3242	Instrumentation	2	2	
22	SEMM 3253	Mechatronics	3	3	
23	SEMM 3443	Heat Transfer	3	3	
24	SEMM 3523	Component Design	3	3	
25	SEMM 3813	Industrial Engineering	3	3	
26	SEMM 3823	Engineering Management, Safety & Economics	3	3	
27	SEMM 3915	Industrial Training	5	HL	
28	SEMM 3931	Laboratory II	1	1	
29	SEMM 3941	Laboratory III	1	1	
30	SEMM 4533	System Design	3	3	
31	SEMM 4902	Engineering Professional Practice	2	2	
32	SEMM 4912	Undergraduate Project I	2	2	
33	SEMM 4924	Undergraduate Project II	4	4	

34	SEMX 4xx3	Elective I	3	3	
	SEMX 5xx3	PRISMS Elective I			
35	SEMX 4xx3	Elective II	3	3	
	SEMX 5xx3	PRISMS Elective II			
36	SEMX 4xx3	Elective III	3	3	
	SEMX 5xx3	PRISMS Elective III			
37	SEMX 4xx3	Elective IV	3	3	
	SEMX 5xx3	PRISMS Elective IV			
TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (Faculty 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					
UNIVERSITY FREE ELECTIVE					
1	SXXX xxx3	Free Elective	3	3	
MALAYSIA CORE VALUE					
1	UHIS 1022	Philosophy and Current Issues	2	2	
2	UHMS 1182	Appreciation of Ethics and Civilizations	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			
VALUE AND IDENTITY					
1	ULRS 1012	Value and Identity	2	2	
GLOBAL CITIZEN					
1	UKQF2XX2	Service Learning and Community Engagement	2	2	
COMMUNICATION SKILLS					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHLX 1112	Foreign Language for Communica-tion	2	2	
ENTERPRISING SKILLS					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)			**19**	**19**	
TOTAL CREDIT TO GRADUATE (A + B + C + D)			**136**	**131**	

OTHER COMPULSORY COURSES			
OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATION (PCS) • **Students are required to enrol and pass FIVE (5) PCS courses, in order to be eligible to graduate**			
Compulsory PSC Courses			
1	GSPX XXXX	Design Thinking for Entrepreneur	
2	GSPX XXXX	Talent and Competency Management	
3	GSPX XXXX	English Communication Skills for Graduating Students (ECS)	
Elective PSC Courses (Choose 2 only)			
1	GSPX XXXX	Data Analytic for Organization	
2	GSPX XXXX	Quality Management for Built Environment and Engineering Professionals	
3	GSPX XXXX	Construction Measurement (Mechanical & Electrical)	
4	GSPX XXXX	Professional Ethics and Integrity	
5	GSPX XXXX	OSHE for Engineering Industry and Laboratory	
6	GSPX XXXX	OSHE for Construction Industry and Laboratory Works	
7	GSPX XXXX	Safety and Health Officer Introductory Course	

COURSE SYNOPSIS

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 conceptof 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 applythe 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 dueto 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 errorsand 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 Profession

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 MechanicalEngineering and a description of the mechanical engineer's work and professional responsibilities. It discusses the education requirements for today's mechanical engineers aswell 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 importanceof 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 structuresin 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 buoyancyanalysis. Dynamic flow analysis inclusive of technique in solving flow problems is introduce specially to solve flow measurement, mass or volumetric flow rate, momentum in flow and lossin pipe network. Lastly, some basic dimensional analysis and similarities will be introduced. Atthe 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 application. 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 flowof 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 2423 - Applied Thermodynamics

The aim of this course is to teach second-year mechanical engineering students on the application of thermodynamics principles to evaluate the performance criteria of various thermal systems. These include the reciprocating air-compressor, internal combustion engines, vapour power plants, gas turbine plants and refrigeration systems. Also, principles ofconservation of mass and energy are applied to various air-conditioning processes to assessthe properties changes and energy transfer during the 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 powergeneration 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 principlesof 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, castingprocesses, 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 theparticular 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 casestudies in applied mechanics, strength of materials, thermal science, and fluid mechanics arepresented. 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 3033 - Finite Element Methods

This course gives students an exposure to the theoretical basis of the finite element method and its implementation principles, and introduces the use of general purpose finite element software for solving real-life engineering problems.

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 3253 - Mechatronics

The course provides students with an introduction to mechatronics and its application. It will examine a number of key topics of mechanical engineering, electrical/electronic and computer control disciplines with an emphasis on the integrated approach. At the end of the course, students should be able to explain the concept of mechatronics and related components, identify specific sensor and actuator for mechatronic application, apply the concepts of PLC, microcontroller and Data Acquisition System (DAS), controller design and integration, and mechatronic system design.

SEMM 3443 - Heat Transfer

In this course, conduction, convection and radiation, the three basic modes of heat transfer will be covered. Emphasis will be on developing a physical and analytical understanding of the three modes of heat transfer, as well as its applications. Students will develop an ability toapply governing principles and physical intuition to solve single and multi-mode heat transfer problems. This course also introduces methods for calculating rates of heat transfer by thesethree modes.

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 havethe capabilities to identify, analyse and design the machine elements in the perspective of static and fatigue failure aspect.

SEMM 3622 - Materials Technology

This course introduces students to the basic concepts required to understand and describe the mechanical behaviour and failure mechanism of metals. It will emphasise on the concept of stress intensity factor and fracture mechanics to predict failure of materials and provide understanding on conditions under which fatigue, and creep occur. The course will also introduce students to the theory of electromechanical corrosion in metallic materials, estimatethe corrosion rate and understand the methods to control and manage corrosion. By the end of the course, students should be able to apply the criteria of failure to the design of materialsand conduct failure analysis of engineering components. This course also covers the properties, processing and applications of non-metallic materials mainly polymer, ceramic and composite.

SEMM 3623 - Materials Engineering

This course is designed to introduce students to the concept of fracture mechanics and how engineering materials respond to mechanical loads. The failure behaviour of engineering materials will cover fracture, fatigue, creep, wear and corrosion. The course will also provide students with knowledge of how to conduct failure analysis and determine the root cause of failure under different mechanical loading. The mechanical behaviour of polymeric materials,ceramics and composites will also be covered examples of case studies as well of selecting engineering materials for specific product designs.

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 andtools in selecting the best alternative in terms of man, machine, materials, method and management and planning and monitoring engineering 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. Studenthave to plan and design their own experimental work right from the very beginning until theend 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 identifyand apply appropriate methodologies in performing design tasks, recognize the fundamental principles of mechanical designs and practices, formulate and apply general problem-solvingstrategies 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 4823 - 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 economicprinciples 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 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 aprofessional 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, a community service activity in a planned and structured manner. At the end of the course, students should be able to demonstrate and applyengineering 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). 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 analyse results of the research clearly, effectively and confidently in both oral presentation and in dissertation.

ELECTIVE COURSES

SEMM 4113 - Plasticity and Applications

This course addresses the background of metal under plastic behaviour and their possible generalizations under combined stresses. It aims to enhance the student's knowledge and understanding of the plastic behaviour of materials under various loading conditions particularly in 3D state of stresses. Plastic behaviour due to variety hardening rules and their characteristics has been extended to comprehend the deformation of structures under loadingand unloading states. The course also provides an opportunity to examine in-depth plastic bending and torsion behaviour of metal with hardening rules. For inclusion of safety design aspect, the yield and failure criteria analysis for evaluating plastic behaviour has also been introduced. To enhance student's understanding on theory to practice aspect, plasticity analysis of beam and frame is included to fundamentally analyse a complicated structure. It also deals with the current technologies and analyses in various applications namely sheet metal forming, blanking, stamping, cup-drawing, indentation, stretching and drawing over a radius, wire drawing, extrusion and pultrusion processes. For practical purposes, students will be given chances to visit metal stamping industry via technical visit. Commercial finite elementsoftware will be introduced in this course to simulate any plasticity problems. At the end of thecourse, the student should be able to analyse and state the loading and unloading behaviourof metal materials with the hardening rules. They should also be able to analyse the plastic bending and torsion, the stresses and strains in 3-D as well as apply the yield and failure criteria analysis for plastic applications. From engineer point of view, they should have a capability to present, differentiate and enlighten various processes using established technologies

SEMM 4123 - Structural Analysis

This course builds upon the materials covered in Solid Mechanics I and II, to develop an understanding of structural behaviour. Matrix analysis methods are used as the basis for modern, computer-based structural analysis. Analytical techniques are used to analysetrusses, beams, frames, flat plates and curved shells.

SEMM 4133 - Failure of Engineering Components and Structures

This course presents a systematic approach in performing failure analysis of engineering components and structures. It reviews basic engineering knowledge of the mechanics of materials, fracture mechanics and engineering materials for applications to failure analysis. Cases studies involving different types of failures including static overload, low and high cyclefatigue, creep and creep rupture, buckling of slender structures and fatigue crack growth are considered. Rationale and justification on the proposed causes of failure are critically discussed. Writing of failure analysis report is coached. (Optional) Computational approach (FE simulation) for relevant cases is introduced.

SEMM 4143 - Mechanics of Composite Materials

This course introduces students to some major views and theories in the area of composite materials especially in the polymer based composite learning with emphasis on the types of materials, production methods, failure analysis and the mechanics of laminated composites. It will examine some key issues in the mechanics of laminated composites with special focus

on the stress-strain relationship and interaction to the extensional, coupling and bending stiffness matrices in promoting learning. Sandwich structures and interlaminar fracture toughness will also be included in this syllabus. The course will also provide a visit to industries dealing with polymer based composite materials in order the students to understand more regarding the practical sides of the subject.

SEMM 4153 - Applied Stress Analysis
In this course students learn the fundamental concept of elasticity and apply modern experimental stress analysis techniques to measure strains and stresses in engineering components and structures. Topics include stress, strain and displacement, equilibrium and compatibility, use of Airy stress function in rectangular and polar coordinates, stress field, plane stress and plain strain, torsion of prismatic thin-walled bars, combined bending, shear and torsion in beams, plane stress in membrane loaded plates, strain gauge technology and photo elasticity.

SEMM 4163 - Surface Mount Technology
This course presents an overview of surface mount electronics packaging. The scope covers identification of surface mount components and printed circuit board, description of surface mount technology processes, reliability aspects and manufacturing practices.

SEMM 4213 - Mechanical Vibration
Fundamental of vibration analysis of 1, 2 and multi DOF mechanical systems including the effects of damping; free response; the significance of natural modes, resonance frequency, mode shape, and orthogonality; vibration absorbers and isolators; introduction to vibration measurement. A measurement project involves the use of an accelerometer, signal conditioning and analysis instrumentation.

SEMM 4233 - Mechanisms and Linkages
This course is designed to introduce the concept and techniques of analysing and synthesizing motion in mechanism and machines. The student shall use the concept of velocity and acceleration done during their first year to analyse the motion of mechanisms. Topics for practical application include linkages and mechanisms, design of mechanisms, cam and follower, and kinematics of different types of gear.

SEMM 4243 - Advanced Control
The course shall cover the essential and basic theory of design and analysis of control system that are not covered by SEMM3233. It shall cover the followings: Cascade compensation using lead and lag compensator, non-linear system analysis, discrete system and state-space analysis. MATLAB and Simulink software package shall be taught and used as a tool in solvingcontrol engineering problems throughout the course.

SEMM 4253 - Industrial Automation
The course shall introduce the students to the methods, tools, and technologies used to automate a product or a system. Primary automation technologies include sensors and actuators technology, automation actuators, logic and sequence control, and in-depth industrial controller are covered in this course. An introduction to artificial intelligence for

industrial application is also introduced.

SEMM 4273 - Robotics

This course is designed to enable the students at undergraduate level to develop the necessary insight into the area of robotics. It will examine the fundamental elements of robot system related to anatomy and configuration, robot main components, programming feature and methods and robot's performance specifications. The students are expected to acquire analytical skills through the analyses of robot manipulators related to their kinematics, staticsand dynamics which typically constitute the important prerequisites to designing the mechanical structure, planned trajectory path and control aspects. The robot control topic thatis included in the later section provides a platform for the students to explore various control algorithms that address the stability, accuracy and robustness of the systems. Particular emphasis is laid on the mathematical modelling and simulation of the control schemes. A number of case studies pertaining to selected robotic systems are expected to further strengthen the students understanding and insight into the actual systems.

SEMM 4293 - Noise

This course prepares the future engineers with the physical principles of noise together with the tools and analysis techniques for noise measurements. Students will be taught on the physics of sound, measurement instrumentations, analysis techniques, sound/noise inside room & enclosure, transmission of sound/noise through structure and outdoor sound/noise. Students will also be introduced and exposed to the typical noise measurement instrumentations available in the noise laboratory. International and domestic noise regulations are also highlighted. The project/s assigned to students during this course requires understanding on the basic principles of noise along with the use of noise measurement instrumentations and data analysis. At the end of this course, students should understand thoroughly all the underlying physical principles of noise and should be able to measure and analyse noise levels whenever required.

SEMM 4313 - Turbomachinery

This course is designed to provide students a fairly broad treatment of the fluid mechanics of turbomachinery. Emphasis is placed on the more utilitarian equipment, such as compressors, blowers, fans, pumps and wind turbines that will be encountered by most mechanicalengineers as they pursue careers in industry. The course covers the basic fundamentals of fluid mechanics needed to develop and manipulate the analytical and empirical relationships and concepts used in turbomachinery, analysis of flow through several fluid machines, selection of fluid machine type that best suited for a specified task and preliminary estimationof speed, size, and perhaps other performance characteristics. At the end of the course, students should be able to compare and choose fluid machines for various operations.

SEMM 4323 - Fluid Power System

This course introduces the theory and practical aspects of hydraulic and pneumatic systems, and their related issues. Students will be exposed to the function and operation of each system components, all related symbols and construction of circuits. Students will be able to carry out calculations to determine the size of components and their performance. Basic knowledge from this course will be able to guide students in order to select appropriate components,

design simple circuits, handle and maintain the actual system in industrial sectors. Safety aspect as well as act and regulations in relation to hydraulic and pneumatic systems are introduced to highlight and promote safe and healthy working conditions.

SEMM 4333 - Computational Fluid Dynamics

This course introduces students to fundamentals and practical skills of Computational Fluid Dynamics (CFD). The governing equations of fluid flow and their mathematical classification are introduced. The course will also provide the basic concept of CFD and numerical procedures such as Finite Difference Method (FDM) and Finite Volume Method (FVM). Student are also exposed to practical issues associated with the implementation of the use of CFD codes, such as turbulence modelling, boundary conditions, and the importance of verification and validation. At the end of the course, students should be able to demonstrateand apply the theory to solve problem related to complex flow of fluids using open source and commercial CFD codes.

SEMM 4343 - Hydraulics Machines and Pipes System

This course is designed to enhance the basic knowledge that has been developed in Mechanics of Fluids 1 through the understanding on the principle of open channel flow and itsflowrates calculation. Basic elements of water flow in pipes which are applied to practical problems in pipelines and networks for steady, quasi-steady and unsteady flow are emphasized. Students will be exposed with the flow distribution analysis through the use of Hardy-Cross method, pressure wave analysis, water hammer analysis, pump operation and pipe system analysis. This course will also cover the analysis of various pump type such as centrifugal pump, axial pump and positive displacement pump. At the end of this course, students should be able to demonstrate an ability to analyse problems related directly to fluidsin hydraulic machines and pipe systems.

SEMM 4353 - Lubrication

The principle aim of this course is to provide students with an understanding of physical principles of the classic theory of hydrodynamic lubrication as a basis for bearing design; application to simple thrust and journal bearings and pads of various geometries; and hydrostatic lubrication. Students will be introduced to types of hydrodynamics bearings and bearing operation; properties of lubricant; theory of steady state hydrodynamic lubrication; hydrostatic and squeeze film lubrication applied to slider and journal bearings, bearing designwith side leakage; and thermal balance.

SEMM 4413 - Internal Combustion Engines

This course is intended to provide students an introduction, terminology, definition, and operating characteristics of internal combustion engines (ICE). It covers all topics needed fora basic engineering knowledge of the design, operation, analysis and performance of ICE. Principles of all types of ICE are covered including spark ignition (gasoline), compression ignition (diesel), four-stroke, and two-stroke engines. On top of that, students will be equippedwith basic knowledge and understanding of engine heat transfer, frictions and lubrication. Moreover, an introduction on fuel-cell, hybrid and other alternative fuels are also covered.

SEMM 4423 - Power Plant Engineering

The study of power plant technology is one of the important fields of engineering science. Power plant technology problems are of great importance in many branches of engineering such as mechanical, chemical, nuclear and electrical. In this course economizers, steam generators, fuel and combustion, gas turbines, combined cycles and environmental consideration will be covered in detail. The emphasis will be laid on both analytical techniquesand physical understanding of the subjects.

SEMM 4433 - Refrigeration and Air Conditioning

Refrigeration is the process of removing heat from an enclosed space, or from a substance, and moving it to a place where it is unobjectionable. The primary purpose of refrigeration is lowering the temperature of the enclosed space or substance and then maintaining that lower temperature. Probably the most widely used current applications of refrigeration are for the air conditioning of private homes and public buildings, and the refrigeration of foodstuffs in homes, restaurants and large storage warehouses. The importance of refrigeration system and air conditioning system in domestic, commercial and industrial sectors, for both comfort and process applications, cannot be over emphasized. Advances in electronics, communications, computers, medicine, etc. demand stringently controlled air conditions. Food refrigeration from small domestic refrigerators to large cold storages is important to avoid spoilage, thus prolonging its shelf life. Thus, refrigeration and air conditioning system play an important rolein this modern world.

SEMM 4443 - Thermal Fluid System Design

The course first reviews fundamentals of fluid mechanics, thermodynamics and heat transfer which are necessary basis for design of thermal fluid systems - heat exchanging devices. Cooling and heating components require fast and accurate design procedure towards effective and efficient systems considering global concerns towards our sustainable environment. The course provides a systematic approach in the basic principles, component identification and description, solution approach, modelling, and optimization (where applicable) of general macro-to-micro design of heat exchanging devices in the present and future applications. This is followed by the theory and design of specific heat exchangers. Heat exchangers are vital in power producing plants, process and chemical industries, and in heating, ventilating, air- conditioning, refrigeration systems, and cooling of electronic systems. This course provides asystematic approach to the understanding on the design, selection and analysis of heat exchangers with focus on the selections, thermo-hydraulic designs, design processes, ratings, and operational problems of various types of heat exchangers.

SEMM 4453 - Combustion

Students will be exposed to the concepts and the basic combustion processes. Various aspects of combustion such as the thermodynamics of combustion, the chemical kinetics, transport phenomena, Rankine-Hugoniot theory, Chapman-Jouguet waves, deflagration, detonation, diffusion flames, premixed flames, flammability, ignition and quenching will be discussed. Chemical processes that lead to various emissions and pollutant formation as wellas strategies for mitigation the pollutants produced from combustion process will be stressedat later part of this course. Students will also explore various practical aspects of combustion processes.

SEMM 4463 - Energy and Environment

Energy is the basic input to build, operate and maintain all kinds of engineering infrastructures and services. Energy is also appeared as a major actor for contemporary local and global-level environmental and societal challenges. Engineers, as being the major stockholders of energy, should have sufficient knowledge on how to protect the environment in building-up and maintaining of infrastructure for operating various engineering production, operation and services. This course provides training to the students in perceiving environmental and societal consequences causing from handling of energy in infrastructures, products, and services. The course also gives lessons to the engineering students on how to protect the environment through the stat-of-the art practices such as energy efficiency, alternative energy,emission accounting, emerging technologies etc. The course focuses on issues that are multidisciplinary in nature, and therefore, the course is well suited to the students of all branch of mechanical, electrical, chemical, and environmental engineering. After successful completion of this course, students would be able to apply the acquired knowledge to work out environmental implications in dealing with energy related services and play appropriate role to serve the environmental and societal interests by minimizing the negative impacts.

SEMM 4513 - Computer Aided Design

This course is designed for students to gain knowledge on what is going on behind the screen of Computer Aided Design Software. This understanding makes the learning curve of new CAD software shorter as the students may be using other CAD software later when they work. Furthermore, the course will also expose the students on the capability of the programming within CAD software. With the programming knowledge, students will be able to model as well as using the programming to integrate engineering knowledge to CAD.

BACHELOR OF MECHANICAL ENGINEERING (MATERIALS) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Mechanical Engineering (Materials) with Honours is offered on a full- time at the UTM Main Campus in Johor Bahru. The duration of study for the programme is subjected to the student's entryqualification and lasts between four (4) years and a maximum of six (6) years.

The programme is offered full-time and is divided into two semesters per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) and eighteen (18) credit hours per semester. Assessment is based on course works andfinal examinations given throughout the semester.

General Information

1.	**Awarding Institution**		Universiti Teknologi Malaysia
2.	**Teaching Institution**		Universiti Teknologi Malaysia
3.	**Programme Name**		Bachelor of Mechanical Engineering (Materials) with Honours
4.	**Final Award**		Bachelor of Mechanical Engineering (Materials) with Honours
5.	**Programme Code**		SEMBH
6.	**Professional or Statutory Body of Accreditation**		Engineering Accreditation Council (EAC)
7.	**Language(s) of Instruction**		Bahasa Melayu and English
8.	**Mode of Study (Conventional, distance learning, etc.)**		Conventional
9.	**Mode of Operation (Franchise, self-govern, etc.)**		Self-govern
10.	**Study Scheme (Full Time / Part Time)**		Full Time
11.	**Study Duration**		Minimum : 4 years Maximum : 6 years
Type of Semester		No of Semesters	No of Weeks/Semester
Normal		8	14
Short		1	8
12.	**Entry Requirements**		Matriculation / STPM / Diploma or equivalent

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.8%
ii.	Programme Core (including Mathematics and Electrical subject)	96	70.6%
iii.	Programme Electives	24	17.6%
	Total	**136**	**100%**
Classification of courses for engineering programme			
A	Engineering Courses (a) Lecture/Project/ Laboratory (b) Workshop/Field/Design Studio (c) Industrial Training (d) Final Year Project	 93 0 5 6	76.5%
	Total Credit Hours for Part A	**104**	
B	Non-Engineering (a) Applied Science/Mathematic/Computer (b) Management/Law/Humanities/Ethics/Economy (c) Language (d) Co-Curriculum	 16 8 6 2	23.5%
	Total Credit Hours for Part B	**32**	
Total credit hours for Part A and B		**136**	**100%**
Total Credit Hours to Graduate		**136 credit hours**	

AWARD REQUIREMENTS

To graduate, students must:

- Attain a total of not less than 136 credit hours 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 five (5) Professional Skills Certification (PSC) courses in UTM
- Other condition as specified

AREAS OF STUDY

For the first two years the students will be exposed to the basic mechanical engineering courses including the basic knowledge on materials science for both metal and non-metal engineering materials. Subsequently, they will be introduced to materials engineering related courses, focusing mainly on metallurgical study 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 Characterization

In understanding the materials behaviour, the main techniques used for analysing 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, atmosphereand 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 selectioncovers all aspects related to the concepts and methods of selecting suitable material fora 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 lectureswill 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 fora 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 engineeringmaterials (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 modellingboth 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.

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**	**CREDIT**	**PRE-REQUISITE**
SEMM 1203	Statics*	3	
SEMM 1503	Engineering Drawing	3	
SEMM 1911	Experimental Methods	1	
SEMM 1921	Introduction to Mechanical Engineering	1	
SSCE 1693	Engineering Mathematics 1	3	
SEEU 1002	Electrical Technology	2	
ULRS 1012	Value and Identity	2	
UHLB 1112	English Communication Skills	HL	Refer English courses requirement section
	Total	**15**	

YEAR 1: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	
SEMM 1113	Mechanics of Solid I*	3	SEMM 1203
SEMM 1213	Dynamics*	3	SEMM 1203
SEMM 1513	Introduction to Design	3	SEMM 1503
SSCE 1793	Differential Equations	3	SSCE 1693
UHMS 1182	Appreciation of Ethics and Civilizations	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLM 1012	Malay Language for communication 2 (for International Student only)		
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 2: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2123	Mechanics of Solids II*	3	SEMM 1113
SEMM 2313	Mechanics of Fluids I*	3	SEMM 1203, SEMM 1013**
SEMM 2413	Thermodynamics*	3	
SEMM 2921	Laboratory I	1	SEMM 1911
SSCE 1993	Engineering Mathematics II	3	SSCE 1693
SEEU 2012	Electronics	2	SEEU 1002
UKQF 2xx2	Service Learning and Community Engagement	2	
	Total	**17**	

YEAR 2: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2223	Mechanics of Machines and Vibration*	3	SEMM 1213
SEMM 2323	Mechanics of Fluids II*	3	SEMM 2313
SEMM 2433	Applied Thermodynamics and Heat Transfer*	3	SEMM 2413
SEMM 2613	Materials Science	3	
UHLB 2122	Professional Communication Skills 1	2	
UHIS 1022	Philosophy and Current Issue	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
	Total	**16**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 3: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMB 3613	Physical Metallurgy	3	SEMM 2613**
SEMM 3233	Control Engineering	3	SEMM 1213**, SSCE 1793**
SEMM 3523	Component Design	3	SEMM 2123**, SEMM 1513
SEMM 3813	Industrial Engineering	3	
SEMM 3931	Laboratory II	1	SEMM 2921
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
UHLX 1112	Foreign Language Elective	2	
	Total	**17**	

YEAR 3: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMB 3623	Mechanical Properties of Materials	3	SEMM 2613**
SEMM 3023	Applied Numerical Methods	3	SEMM 1013, SSCE 1793**
SEMM 3242	Instrumentation	2	SEEU 2012**
SEMM 3941	Laboratory III	1	SEMM 3931
SSCE 2193	Engineering Statistics	3	
ULRS 3032	Entrepreneurship and Innovation	2	
SEMM 2713	Manufacturing Processes	3	
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

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

Remarks:

Obtained minimum of 80 credits

YEAR 4: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMB 4613	Materials Characterization	3	SEMM 2613**
SEMB 4623	Corrosion and Corrosion Control	3	
SEMB 46x3	Elective I	3	
SEMB 5xx3	PRISMS Elective I		
SEMB 46x3	Elective II	3	
SEMB 5xx3	PRISMS Elective II		
SEMM 4533	System Design	3	SEMM 3523
SEMM 4912	Undergraduate Project I	2	SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2433**
	Total	**17**	

YEAR 4: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMB 4633	Materials Selection in Mechanical Design	3	
SEMM 4902	Engineering Professional Practice	2	Must be 3rd year
SEMM 4924	Undergraduate Project II	4	SEMM 4912
SEMM 3823	Engineering Management, Safety and Economics	3	
SEMX xxx3	Free Elective	3	
	Total	**15**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

ENGLISH COURSES REQUIREMENT

Students with English qualification shown in table below are exempted from Compulsory Attendance (HL) for UHLB 1112

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exempted

Elective Courses

Apart from the core course, students must also take 6 credits of 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

PRISMS ELECTIVE COURSES

For students who intend to enrol in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

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	
	SEMB 5xx3	PRISMS Elective I			
37	SEMB 46x3	Elective II	3	3	
	SEMB 5xx3	PRISMS Elective II			
TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (Faculty 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					
UNIVERSITY FREE ELECTIVE					
1	SXXX xxx3	Free Elective	3	3	
MALAYSIA CORE VALUE					
1	UHIS 1022	Philosophy and Current Issues	2	2	
2	UHMS 1182	Appreciation of Ethics and Civilizations	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			
VALUE AND IDENTITY					
1.	ULRS 1012	Value and Identity	2	2	
GLOBAL CITIZEN					
1	UKQF2XX2	Service Learning and Community Engagement	2	2	
COMMUNICATION SKILLS					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHLX 1112	Foreign Language for Communication	2	2	
ENTERPRISING SKILLS					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)			**19**	**19**	
TOTAL CREDIT TO GRADUATE (A + B + C + D)			**136**	**131**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATION (PCS) • Students are required to enrol and pass FIVE (5) PCS courses, in order to be eligible to graduate			
Compulsory PSC Courses			
1	GSPX XXXX	Design Thinking for Entrepreneur	
2	GSPX XXXX	Talent and Competency Management	
3	GSPX XXXX	English Communication Skills for Graduating Students (ECS)	
Elective PSC Courses (Choose 2 only)			
1	GSPX XXXX	Data Analytic for Organization	
2	GSPX XXXX	Quality Management for Built Environment and Engineering Professionals	
3	GSPX XXXX	Construction Measurement (Mechanical & Electrical)	
4	GSPX XXXX	Professional Ethics and Integrity	
5	GSPX XXXX	OSHE for Engineering Industry and Laboratory	
6	GSPX XXXX	OSHE for Construction Industry and Laboratory Works	
7	GSPX XXXX	Safety and Health Officer Introductory Course	

COURSE SYNOPSIS

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 conceptof 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 applythe 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 dueto 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 errorsand 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 MechanicalEngineering and a description of the mechanical engineer’s work and professional responsibilities. It discusses the education requirements for today’s mechanical engineers aswell 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 importanceof 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 failures 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 structuresin 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 buoyancyanalysis. 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 analyse 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 application. 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 flowof 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 powergeneration 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 principlesof 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, castingprocesses, 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 theparticular 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 casestudies in applied mechanics, strength of materials, thermal science, and fluid mechanics arepresented. 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 havethe 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 andtools 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 economicprinciples and methods of engineering economic analysis. At the end of the course, studentsshould 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. Students 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 groupedinto 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 identifyand apply appropriate methodologies in performing design tasks, recognize the fundamental principles of mechanical designs and practices, formulate and apply general problem-solvingstrategies 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 verbaland 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 aprofessional 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 applyengineering 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 analyse 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 providestudents 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 thevarious 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 shouldbe 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 providesstudents 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, theprobes needed, the mechanism to detect either surface or subsurface defects, the propertiesof materials to be tested, the test methods involved and the advantages and disadvantages ofeach 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 withinthe marine, oil and gas, aerospace and biomedical sectors. Emphasis will be placed on gainingsustainability 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 classesof 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 asshape 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 materialsfor 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 techniquesfor 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 suchas 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 materialproperties and behaviour 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 shouldbe able to construct simple numerical modelling both in atomistic, mesoscopic and microscopic scale.

BACHELOR OF MECHANICAL ENGINEERING (INDUSTRIALS) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Mechanical Engineering (Industrials) with Honours is offered on a full-time. The programme is offered only at the UTM Main Campus in Johor Bahru. The duration of study for the programme is subjected to the student's entryqualification and lasts between four (4) years and a maximum of six (6) years.

The programme is offered full-time and is divided into two semesters per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) and eighteen (18) credit hours per semester. Assessment is based on course works and final examinations given throughout the semester.

General Information

1.	**Awarding Institution**		Universiti Teknologi Malaysia
2.	**Teaching Institution**		Universiti Teknologi Malaysia
3.	**Programme Name**		Bachelor of Mechanical Engineering (Industrials) with Honours
4.	**Final Award**		Bachelor of Mechanical Engineering (Industrials) with Honours
5.	**Programme Code**		SEMIH
6.	**Professional or Statutory Body of Accreditation**		Engineering Accreditation Council (EAC)
7.	**Language(s) of Instruction**		Bahasa Melayu and English
8.	**Mode of Study (Conventional, distance learning, etc.)**		Conventional
9.	**Mode of Operation (Franchise, self-govern, etc.)**		Self-govern
10.	**Study Scheme (Full Time / Part Time)**		Full Time
11.	**Study Duration**		Minimum : 4 years Maximum : 6 years
Type of Semester		No of Semesters	No of Weeks/Semester
Normal		8	14
Short		1	8
12.	**Entry Requirements**		Matriculation / STPM / Diploma or equivalent

Course Classification

No	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.8%
ii.	Programme Core (including Mathematics and Electrical subject)	114	83.8%
iii.	Programme Electives	6	4.4%
	Total	**136**	**100%**
Classification of courses for engineering programme			
A	Engineering Courses (a) Lecture/Project/ Laboratory (b) Workshop/Field/Design Studio (c) Industrial Training (d) Final Year Project	 97 0 5 6	79.4%
	Total Credit Hours for Part A	**108**	
B	Non-Engineering (a) Applied Science/Mathematic/Computer (b) Management/Law/Humanities/Ethics/Economy (c) Language (d) Co-Curriculum	 12 8 6 2	20.6%
	Total Credit Hours for Part B	**28**	
Total credit hours for Part A and B		**136**	**100%**
Total Credit Hours to Graduate		**136 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 136 credit hours 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 five (5) Professional Skills Certification (PSC) courses in UTM
- Other condition as specified

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:
   (iv) Seminar, Conference or Paper Presentation
   (v) Cultural Exhibition and Conference
   (vi) 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**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	
SEMM 1203	Statics*	3	
SEMM 1503	Engineering Drawing	3	
SEMM 1911	Experimental Methods	1	
SEMM 1921	Introduction to Mechanical Engineering	1	
SSCE 1693	Engineering Mathematics I	3	
ULRS1012	Value and Identity	2	
UHLB 1112	English Communication Skills	HL	Refer English courses requirement section
	Total	**16**	

YEAR 1: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1113	Mechanics of Solids I*	3	SEMM 1203
SEMM 1213	Dynamics*	3	SEMM 1203
SEMM 1513	Introduction to Design	3	SEMM 1503
SSCE 1793	Differential Equations	3	SSCE 1693
UHMS 1182	Appreciation of Ethics and Civilisations	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLM 1012	Malay Language for Communication 2 (for International Students Only)		
SEMM 2921	Laboratory 1	1	SEMM 1911
SEEU 1002	Electrical Technology	2	
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 2: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2123	Mechanics of Solids II*	3	SEMM 1113
SEMM 2223	Mechanics of Machines and Vibration*	3	SEMM 1213
SEMM 2313	Mechanics of Fluids I*	3	SEMM 1203, SEMM 1013**
SEMM 2413	Thermodynamics*	3	
SEMM 2713	Manufacturing processes	3	
UKQF2XX2	Service Learning and Community Engagement	2	
	Total	17	

YEAR 2: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2323	Mechanics of Fluids II*	3	SEMM 2313
SEMM 2433	Applied Thermodynamics and Heat Transfer*	3	SEMM 2413
SSCE1993	Engineering Mathematics II	3	SSCE1693
SEMM 2613	Materials Science	3	
SEEU2012	Electronics	2	SEEU 1002
UHIS1022	Philosophy and Current Issues	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLB2122	Professional Communication Skills 1	2	
	Total	**18**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 3: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMI 3833	Production Planning and Control	3	
SEMM 3233	Control Engineering	3	SEMM 1213**, SSCE 1793**
SEMM 3931	Laboratory II	1	SEMM 2921
SEMI 3813	Work Design and Productivity	3	
SEMI 3823	Quality System	3	
UHLB3132	Professional Communication Skills 2	2	UHLB 2122
UHLX1112	Foreign Language Elective	2	
	Total	17	

YEAR 3: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3023	Applied Numerical Methods	3	SEMM 1013, SSCE 1793**
SEMM 3242	Instrumentation	2	SEEU 2012**
SEMM 3523	Component Design	3	SEMM 2123**, SEMM 1513
SEMM 3941	Laboratory III	1	SEMM 3931
SEMM4902	Engineering Professional Practice (Academic Service Learning)	2	Must be 3rd year
ULRS 3032	Entrepreneurship and Innovation	2	
SSCE2193	Engineering Statistics	3	
	Total	16	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

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

Remarks:

Obtained minimum of 80 credits

YEAR 4: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4533	System Design	3	SEMM 3523
SEMM 4912	Undergraduate Project I	2	SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2433**
SEMI 4813	Industrial System Simulation	3	
SEMI 4823	Operations Research	3	
SEMI 48x3	Industrial Engineering Elective	3	
SEMI 5xx3	PRISMS Elective		
SXXX xxx3	Free Elective	3	
	Total	17	

YEAR 4: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMI 3843	Engineering Economy and Accounting	3	
SEMM 4924	Undergraduate Project II	4	SEMM 4912
SEMI 4833	Safety and Engineering Management	3	
SEMI 4843	Facility Design	3	
	Total	13	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

ENGLISH COURSES REQUIREMENT

Students with English qualification shown in table below are exempted from Compulsory Attendance (HL) for UHLB 1112

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exempted

Elective Courses

List of Industrial Engineering Elective Courses (students may take ONE of the following courses)

1.	SEMI 4853	Quality Engineering
2.	SEMI 4863	Ergonomics and Occupational Safety
3.	SEMI 4873	Reliability and Maintenance
4.	SEMI 4883	Supply Chain Management and Sustainability

PRISMS ELECTIVE COURSES

For students who intend to enrol in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

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 3915	Industrial Training	5	HL	
23	SEMM 3931	Laboratory II	1	1	
24	SEMM 3941	Laboratory III	1	1	
25	SEMM 4533	System Design	3	3	
26	SEMM 4902	Engineering Professional Practice	2	2	
27	SEMM 4912	Undergraduate Project I	2	2	
28	SEMM 4924	Undergraduate Project II	4	4	
29	SEMI 3813	Work Design & Productivity	3	3	
30	SEMI 3823	Quality System	3	3	
31	SEMI 3833	Production Planning & Control	3	3	
32	SEMI 3843	Engineering Economy & Accounting	3	3	

33	SEMI 4813	Industrial System Simulation	3	3	
34	SEMI 4823	Operations Research	3	3	
35	SEMI 4833	Safety & Engineering Management	3	3	
36	SEMI 4843	Facility Design	3	3	
37	SEMI 48x3	Industrial Engineering Elective	3	3	
	SEMI 58x3	PRISMS Elective			
TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (Faculty 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					
UNIVERSITY FREE ELECTIVE					
1	SXXX xxx3	Free Elective	3	3	
MALAYSIA CORE VALUE					
1	UHIS 1022	Philosophy and Current Issues	2	2	
2	UHMS 1182	Appreciation of Ethics and Civilizations	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			
VALUE AND IDENTITY					
1	ULRS 1012	Value and Identity	2	2	
GLOBAL CITIZEN					
1	UKQF2XX2	Service Learning and Community Engagement	2	2	
COMMUNICATION SKILLS					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHLX 1112	Foreign Language for Communication	2	2	
ENTERPRISING SKILLS					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)			**16**	**16**	
TOTAL CREDIT TO GRADUATE (A + B + C + D)			**136**	**131**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATION (PCS) • **Students are required to enrol and pass FIVE (5) PCS courses, in order to be eligible to graduate**			
Compulsory PSC Courses			
1	GSPX XXXX	Design Thinking for Entrepreneur	
2	GSPX XXXX	Talent and Competency Management	
3	GSPX XXXX	English Communication Skills for Graduating Students (ECS)	
Elective PSC Courses (Choose 2 only)			
1	GSPX XXXX	Data Analytic for Organization	
2	GSPX XXXX	Quality Management for Built Environment and Engineering Professionals	
3	GSPX XXXX	Construction Measurement (Mechanical & Electrical)	
4	GSPX XXXX	Professional Ethics and Integrity	
5	GSPX XXXX	OSHE for Engineering Industry and Laboratory	
6	GSPX XXXX	OSHE for Construction Industry and Laboratory Works	
7	GSPX XXXX	Safety and Health Officer Introductory Course	

COURSE SYNOPSIS

CORE COURSE

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 conceptof 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 applythe 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 dueto 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 errorsand 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 MechanicalEngineering and a description of the mechanical engineer’s work and professional responsibilities. It discusses the education requirements for today’s mechanical engineers aswell 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 importanceof 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 structuresin 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 buoyancyanalysis. 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 application. 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 flowof 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 powergeneration 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 principlesof 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, castingprocesses, 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 theparticular 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 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 havethe capabilities to identify, analyse and design the machine elements in the perspective of static and fatigue failure aspect.

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 casestudies in applied mechanics, strength of materials, thermal science, and fluid mechanics arepresented. 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 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. Studenthave 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 identifyand apply appropriate methodologies in performing design tasks, recognize the fundamental principles of mechanical designs and practices, formulate and apply general problem-solvingstrategies 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 verbaland 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 aprofessional 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 applyengineering 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.

SEMI 3813 - Work Design and Productivity

This subject is designed to introduce students to techniques in designing work in manufacturing and service industries. It will emphasize on method study and work measurement. Other concepts and approach will also be introduced such as Productivity, Sustainability, Principles of Motion Economy, Design for Manufacture and Assembly (DFMA),Single Minute Exchange of Die (SMED) and Mistake Proofing (Poka Yoke). At the end of thecourse, students should be able to select the appropriate techniques, approaches and concepts in designing work that optimizes the use of resources such as man, machine, materials and time to improve productivity.

SEMI 3823 - Quality System

This course emphasizes on the importance of quality and productivity in industrial and operation systems. The principles of quality Improvement strategies and quality managementsystems such as Total Quality Management, Six Sigma, Lean Sigma, ISO 9000, ISO 14000 are highlighted. Statistical process control (SPC) techniques such as seven basic tools, variable and attribute control charts, process capability studies, acceptance sampling and reliability are covered. Students are required to work in groups to integrate the quality and statistical engineering tools in solving case studies problems.

SEMI 3833 - Production Planning and Control

This course is designed to expose students to the several theories and principles in Production Planning and Control (PPC) either in manufacturing or service sectors. It discusses issues on forecasting, capacity and aggregate planning, scheduling, inventory control and also computerized manufacturing system such as Manufacturing Requirement Planning (MRP), Demand Requirement Planning (DRP) and Enterprise Resources Planning(ERP). Besides that, it also introduces basic lean concept as part of the latest issues in manufacturing system. At the end of the course, students should be able to apply knowledgein production planning and control for managing all the resources such as man, machines, materials and time in an organization. This is to ensure the system becomes more productive,effective and efficient.

SEMI 3843 - Engineering Economy and Accounting

This course is designed to equip students to acquired engineering economy and accounting concepts, principles and methods. The focus of this course is to provide understanding on engineering economic principles and methods and to apply it in engineering field. The course

has two parts. Part 1 is designed to teach students to formulate cash-flow, perform analysis on engineering economic problems and evaluate between alternative of engineering investment/projects to make decision. Part 2 is designed to teach students to perform cost estimates using traditional and current costing techniques in production process, prepare simple financial statement and interpret financial performance of business firms for decision and control.

SEMI 4813 - Industrial System Simulation
This course is aimed to equip students with the knowledge on discrete-event simulation. A software will be utilized to model, build and run simulation models. The course cover topics on discrete-event approaches, representing uncertainty, trace driven simulation, input data analytics, modelling and building simulation models, verifying and validating simulation models, experimentation and running of simulation models, analysis of output results, etc

SEMI 4823 - Operation Research
This course provides students with the concepts and tools to model manufacturing or service systems efficiently using mainly Operations Research techniques. It focuses on formulating models based on deterministic and stochastic Operations Research techniques, applying these techniques for decision making and developing solutions from the models.

SEMI 4833 - Safety and Engineering Management
This course aims to prepare students with basic management knowledge and safety. The management part touches key issues in management and organization, management yesterday and today, strategic management, organizational structure and design, human resource management, motivating employees and leadership. In addition to these, project management aspects are included such as developing a project plan, managing risk, scheduling resources and costs, reducing project duration, and Progress and Performance Measurement. Major topic covers for safety are OSHA 1994, Factories and Machinery Act 1967, hazard identification, risk assessment and control, basic principles of accident prevention and occupational health. For Project Management, students will be exposed with some methods of doing network for project such as CPM and PERT, lagging activities and how to calculate cost for crash project. 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, managing a project using project management principles and techniques in planning, scheduling and controlling projects, and apply the principles of hazard identification, risk assessment/control; plan, design and implement an effective safety program.

SEMI 4843 - Facility Design
This course is designed to equip students with the basic knowledge of designing manufacturing layout facilities. Topics covered in this course include selection of the facility location, design layout procedures and algorithms, personnel requirements, line balancing, material handling and warehouse operations. At the end of the course, students should be able to design manufacturing plant layout by considering all engineering/manufacturing and supporting activities requirements, evaluate the best layout from the generated alternatives, select the best facility location, determine line balancing loss and select the best material

handling equipment for the manufacturing plant.

ELECTIVE COURSES

SEMI 4853 - Quality Engineering
This course covers process and product variation, Six Sigma, Quality Function Deployment, Failure Mode Effect Analysis, Gage Repeatability and Reproducibility, Short Run SPC and experimental methods such Taguchi Methods and Classical Experimental Designs. Students are required to work in groups to integrate these tools in solving case studies problems.

SEMI 4863 - Ergonomics and Occupational Safety
The course provides an introduction to ergonomics and occupational safety. In ergonomics, it concerns the study of human at work with the purpose of enhancing efficiency, productivity and comfort. It places human at the centre of reference with the components of machine, workspace and environment. In occupational safety, it introduces boiler, Unfired pressure vessel (UPV), hoisting machine and local exhaust ventilator (LEV) design. At the end of the course, students should be able to apply ergonomics and occupational safety principles and techniques in the design and analysis of workplace, processes and products.

SEMI 4873 - Reliability and Maintenance
This course introduces the reliability and maintenance concepts and tools. It gives an understanding about how to apply these concepts and tools at different phases of systems' and component life cycle. It covers maintenance and reliability models and to assist the decision maker in making cost effective decisions based on life cycle costing. At the system/equipment utilisation phase, it focuses on understanding how maintenance can improve the availability of processes, and how to reduce downtime through maintenance optimisation and total productive maintenance.

SEMI 4883 - Supply Chain Management and Sustainability
The course is designed for early exposure and understanding of the practical and theory in supply chain management and sustainability to the students. It guides students to develop an effective SCM strategy and its activities also the relationships that exist among a chain of firms that work together to provide a product or service. It shall cover the followings: Supply chain strategy, Sourcing strategy, logistic management, distribution management, measuringsupply chain performance, information technology in supply chain, coordination in supply chain, and sustainability. The learning process for this course will be conducted through lectures, case studies practices, discussion, audio-video presentation, group project and presentation.

BACHELOR OF MECHANICAL ENGINEERING (MANUFACTURING) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Mechanical Engineering (Manufacturing) is offered on a full-time at the UTM Main Campus in Johor Bahru. The duration of study for the programme is subjected to the student's entry qualification and lasts between four (4) years and a maximum of six (6) years.

The programme is offered full-time and is divided into two semesters per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) and eighteen (18) credit hours per semester. Assessment is based on course works andfinal examinations given throughout the semester.

General Information

1.	**Awarding Institution**		Universiti Teknologi Malaysia
2.	**Teaching Institution**		Universiti Teknologi Malaysia
3.	**Programme Name**		Bachelor of Mechanical Engineering (Manufacturing) with Honours
4.	**Final Award**		Bachelor of Mechanical Engineering (Manufacturing) with Honours
5.	**Programme Code**		SEMPH
6.	**Professional or Statutory Body of Accreditation**		Engineering Accreditation Council (EAC)
7.	**Language(s) of Instruction**		Bahasa Melayu and English
8.	**Mode of Study (Conventional, distance learning, etc.)**		Conventional
9.	**Mode of Operation (Franchise, self-govern, etc.)**		Self-govern
10.	**Study Scheme (Full Time / Part Time)**		Full Time
11.	**Study Duration**		Minimum : 4 years Maximum : 6 years
Type of Semester		No of Semesters	No of Weeks/Semester
Normal		8	14
Short		1	8
12.	**Entry Requirements**		Matriculation / STPM / Diploma or equivalent

Course Classification

No	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.8%
ii.	Programme Core (including Mathematics and Electrical subject)	99	72.8%
iii.	Programme Electives	21	15.4%
	Total	**136**	**100%**
Classification of courses for engineering programme			
A	Engineering Courses (a) Lecture/Project/ Laboratory (b) Workshop/Field/Design Studio (c) Industrial Training (d) Final Year Project	 97 0 5 6	79.4%
	Total Credit Hours for Part A	**108**	
B	Non-Engineering (a) Applied Science/Mathematic/Computer (b) Management/Law/Humanities/Ethics/Economy (c) Language (d) Co-Curriculum	 12 8 6 2	20.6%
	Total Credit Hours for Part B	**28**	
Total credit hours for Part A and B		**136**	**100%**
Total Credit Hours to Graduate		**136 credit hours**	

AWARD REQUIREMENTS

To graduate, students must:

- Attain a total of not less than 136 credit hours 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 five (5) Professional Skills Certification (PSC) courses in UTM
- Other condition as specified

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:
   (vii) Seminar, Conference or Paper Presentation
   (viii) Cultural Exhibition and Conference
   (ix) 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**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	
SEMM 1203	Statics*	3	
SEMM 1503	Engineering Drawing	3	
SEMM 1911	Experimental Methods	1	
SEMM 1921	Introduction to Mechanical Engineering	1	
SSCE 1693	Engineering Mathematics 1	3	
ULRS 1012	Value and Identity	2	
UHLB 1112	English Communication Skills	HL	Refer English courses requirement section
	Total	**16**	

YEAR 1: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1113	Mechanics of Solid I*	3	SEMM 1203
SEMM 1213	Dynamics*	3	SEMM 1203
SEMM 1513	Introduction to Design	3	SEMM 1503
SSCE 1793	Differential Equations	3	SSCE 1693
UHMS 1182	Appreciation of Ethics and Civilisations	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLM 1012	Malay Language for Communication 2 (for International Student Only)		
SEEU 1002	Electrical Technology	2	
SEMM 2921	Laboratory I	1	SEMM 1911
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 2: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2123	Mechanics of Solid II*	3	SEMM 1113
SEMM 2223	Mechanics of Machines and Vibration*	3	SEMM 1213
SEMM 2313	Mechanics of Fluid I*	3	SEMM 1203, SEMM 1013**
SEMM 2413	Thermodynamics*	3	
UKQF 2XX2	Service Learning and Community Engagement	2	
UHLX 1112	Foreign Language Communication Elective	2	
	Total	**16**	

YEAR 2: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2323	Mechanics of Fluid II*	3	SEMM 2313
SEMM 2433	Applied Thermodynamics & Heat Transfer	3	SEMM 2413
SEEU 2012	Electronics	2	SEEU 1002
UHLB 2122	Professional Communication Skills 1	2	
UHIS 1022	Philosophy and Current Issues	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
SEMM 2613	Materials Science	3	
SSCE 1993	Engineering Mathematics II	3	SSCE1693
	Total	**18**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 3: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3233	Control Engineering	3	SEMM 1213**, SSCE 1793**
SEMM 3623	Materials Engineering	3	SEMM 2613**
SEMM 3931	Laboratory II	1	SEMM 2921
SEMP 3713	CAD/CAM	3	
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
SEMM 3813	Industrial Engineering	3	
SXXX xxx3	Free Elective	3	
	Total	**18**	

YEAR 3: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3023	Applied Numerical Methods	3	SEMM 1213, SSCE 1793**
SEMM 3242	Instrumentation	2	SEEU 2012**
SEMM 3523	Component Design	3	SEMM 2123**, SEMM 1513
SEMM 3941	Laboratory III	1	SEMM 3931
SSCE 2193	Engineering Statistic	3	
SEMM 2713	Manufacturing Processes	3	
ULRS 3032	Entrepreneurship and Innovation	2	
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

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

Remarks:

Obtained minimum of 80 credits

YEAR 4: SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4533	System Design	3	SEMM 3523
SEMM 4912	Undergraduate Project I	2	SEMM 2123**, SEMM 2223**, SEMM2323**, SEMM 2433**
SEMP 4713	Design for Manufacture and Assembly	3	
SEMP 4723	Manufacturing Automation	3	
SEMP 4xx3	Elective I	3	
SEMP 5xx3	PRISMS Elective I		
	Total	**14**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 4: SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4902	Engineering Professional Practice	2	
SEMM 4924	Undergraduate Project II	4	SEMM 4912
SEMP 4733	Tooling for Production	3	
SEMP 4xx3	Elective 2	3	
SEMP 5xx3	PRISMS Elective 2		
SEMM 3823	Engineering Management, Safety & Economy	3	
	Total	**15**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

ENGLISH COURSES REQUIREMENT

Students with English qualification shown in table below are exempted from Compulsory Attendance (HL) for UHLB 1112

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exempted

Elective Courses

List of Manufacturing Engineering Elective Courses (students may take TWO of the-following courses)

1.	SEMP 4743	Plastic Technology
2.	SEMP 4753	Non-Traditional Machining
3.	SEMP 4763	Quality Engineering & Metrology
4.	SEMP 4773	Modern Manufacturing
5.	SEMP 4783	Casting Technology
6.	SEMP 4793	Product Design & Manufacture
7.	SEMP 4013	Additive Manufacturing
8.	SEMP 4023	Sustainable Manufacturing

9.	SEMP 4813	Engineering Economy & Accounting
10.	SEMP 4823	Quality Engineering
11.	SEMP 4833	Project Management & Maintenance

PRISMS ELECTIVE COURSES

For students who intend to enrol in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

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 3623	Materials Engineering	3	3	
23	SEMM 3813	Industrial Engineering	3	3	
24	SEMM 3823	Engineering Management, Safety & Economics	3	3	
25	SEMM 3915	Industrial Training	5	HL	

26	SEMM 3931	Laboratory II	1	1	
27	SEMM 3941	Laboratory III	1	1	
28	SEMM 4533	System Design	3	3	
29	SEMM 4902	Engineering Professional Practice	2	2	
30	SEMM 4912	Undergraduate Project I	2	2	
31	SEMM 4924	Undergraduate Project II	4	4	
32	SEMP 3713	CAD/CAM	3	3	
33	SEMP 4713	Design for Manufacture & Assembly	3	3	
34	SEMP 4723	Manufacturing Automation	3	3	
35	SEMP 4733	Tooling for Production	3	3	
36	SEMP 4xx3	Elective I	3	3	
	SEMP 5xx3	PRISMS Elective I			
37	SEMP 4xx3	Elective II	3	3	
	SEMP 5xx3	PRISMS Elective II			
TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (Faculty 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					
UNIVERSITY FREE ELECTIVE					
38	SXXX xxx3	Free Elective	3	3	
MALAYSIA CORE VALUE					
1	UHIS 1022	Philosophy and Current Issues	2	2	
2	UHMS 1182	Appreciation of Ethics and Civilizations	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			
VALUE AND IDENTITY					
1	ULRS 1012	Value and Identity	2	2	
GLOBAL CITIZEN					
1	UKQF2XX2	Service Learning and Community Engagement	2	2	
COMMUNICATION SKILLS					
1	UHLB 2122	Professional Communication	2	2	

		Skills 1			
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHLX 1112	Foreign Language for Communication	2	2	
ENTERPRISING SKILLS					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)			**19**	**19**	
TOTAL CREDIT TO GRADUATE (A + B + C + D)			**136**	**131**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATION (PCS)

- **Students are required to enrol and pass FIVE (5) PCS courses, in order to be eligible to graduate**

Compulsory PSC Courses			
1	GSPX XXXX	Design Thinking for Entrepreneur	
2	GSPX XXXX	Talent and Competency Management	
3	GSPX XXXX	English Communication Skills for Graduating Students (ECS)	
Elective PSC Courses (Choose 2 only)			
1	GSPX XXXX	Data Analytic for Organization	
2	GSPX XXXX	Quality Management for Built Environment and Engineering Professionals	
3	GSPX XXXX	Construction Measurement (Mechanical & Electrical)	
4	GSPX XXXX	Professional Ethics and Integrity	
5	GSPX XXXX	OSHE for Engineering Industry and Laboratory	
6	GSPX XXXX	OSHE for Construction Industry and Laboratory Works	
7	GSPX XXXX	Safety and Health Officer Introductory Course	

COURSE SYNOPSIS

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 conceptof 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 applythe 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 dueto 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 errorsand 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 MechanicalEngineering and a description of the mechanical engineer’s work and professional responsibilities. It discusses the education requirements for today’s mechanical engineers aswell 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 importanceof 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 failures 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 structuresin 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 buoyancyanalysis. 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 application. 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 flowof 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 powergeneration 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 principlesof 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, castingprocesses, 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 theparticular 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 casestudies in applied mechanics, strength of materials, thermal science, and fluid mechanics arepresented. 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 havethe 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 andtools 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 economicprinciples and methods of engineering economic analysis. At the end of the course, studentsshould 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. Studenthave 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 identifyand apply appropriate methodologies in performing design tasks, recognize the fundamental principles of mechanical designs and practices, formulate and apply general problem-solvingstrategies 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 verbaland 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 aprofessional 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 applyengineering 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 analyse results of the research clearly, effectively and confidently in both oral presentation and in dissertation.

SEMP 3713 - CAD/CAM

This course is designed to provide the fundamental concepts of Computer Aided Design and Manufacture (CAD/CAM) and their underlying mathematical principles. Topics include CAD/CAM architecture, geometric modelling, solid modelling, part programming, CNC fundamentals, data exchange as well as CAD standards. Students will able to incorporate hands-on experience using CAD/CAM software related with drafting, modelling, assembling

activities and additive manufacturing. Furthermore, students will utilize the CAD/CAM knowledge to complete a simple as well as complex design/manufacturing project throughout the course.

SMEP 4713 - Design for Manufacture and Assembly

This course aims to provide students with the necessary concepts and procedures tounderstand the integration of manufacturing criteria into the product design process. This course will explore Design for Manufacture and Assembly (DFMA) principles for design of reliable and easy-to- produce components having minimal cost. Design of machined, powder metallurgy/particulates and casting parts will be considered, along with design of assemblies.Materials selection and the benefits of DFMA in reduction in part and assembly costs will alsobe discussed.

SEMP 4723 - Manufacturing Automation

Manufacturing Automation is becoming more important in the near future to many organizations due to increasing global competition to produce products at the competitive priceand quality. Knowledge in automation for future engineers is vital for allowing them designinga competitive and productive system. In this course, the students are exposed to various lowcost automation control systems that are commonly used in industries such as pneumatic, electro pneumatic, hydraulic, electro hydraulic, electric motor controls and Programmable Logic Control (PLC), including introduction to Robotics and Internet of Things (IoTs). At the end of this course, the students will be able to design a simple control circuit for an automatedsystem.

SEMP 4733 - Tooling for Production

This course gives a brief but overall introduction to various types of production tooling typically used in manufacturing operations with special emphasize on jigs, fixtures, limit gauges and sheet metal press dies. Students are given comprehensive exercises and assignments on the design of jigs, fixtures and various categories of sheet metal stamping operations such as shearing, bending and deep drawing. The course will integrate various previous manufacturing basic knowledge such as manufacturing process, CAD/CAM/CAE, and DFMA.

ELECTIVE COURSES

SEMP 4013 - Additive Manufacturing

This course aims to prepare students with one of the pillar knowledges under industrial 4.0 industrial revolutions. Additive Manufacturing (AM), also known as 3D Printing Technology, is a group of manufacturing technologies that involves part creation by joining material together without part-specific tooling, driven by a computer. The technologies focus on prototypes and low-technology applications, AM service parts are being used in safety-critical fields including aerospace, automotive, biomedical, and services industries. The purpose of this course is to provide participants with knowledge and tools for informed decision making relative to integration of AM processes and parts into the industrial application. The coverage includes current AM practice for metals, polymers and ceramics; mechanical properties; AM processingfor production; and application inroads into industrial applications. At the end of the course, students should be able to describe fundamental aspects of Additive Manufacturing/3D

Printing Technology techniques and their application; finally, also perform engineering analysis to solve product manufacture problems and evaluate engineering investment/projectsby utilized this technique.

SEMP 4023 - Sustainable Manufacturing
This course introduces students to sustainability considerations in product design and manufacture. It is presenting the principles, methodology and case studies to develop an understanding of sustainable development that can reduce environmental impact and promotesustainable practice. Besides that, it is also introduced the new and innovative concept in sustainable development involving the transformation of 6Rs (reduce, reuse, recycle, recover,redesign, remanufacture) from the traditional 3Rs (reduce, reuse and recycle).

SEMP 4743 - Plastic Technology
This course provides a basic introduction but in-depth coverage of plastic mold design using CAD and CAE software, particularly for designing plastic injection mold. The CAD and simulation software used in the product and process design phases help the students to optimize the mold design. It is hoped that through this exposure the students will be able to further develop their design capability in actual working environment, thereby fill the presentlyserious gap of local engineering know how in this field.

SEMP 4753 - Non-Traditional Machining
This course introduces students to several methods of non-traditional machining. For each of the processes (i.e.: electro discharge machining, water jet machining, laser machining etc), it will examine the basic principles involved and machining parameters important to the process, as well as equipment, tooling and application issues. Where appropriate, theoretical or empirical models to estimate process attributes such as material removal rate will be described. Case studies will also be presented.

SEMP 4763 - Quality Engineering and Metrology
Product quality and the proper functioning of processes are among the important issues for any manufacturing and service organization. Manufacturing engineers play an important role in designing and performing experiments and subsequently analyzing the data collected to solve the problems on hand. This course emphasizes on the design and analysis of experiments, an important tool in industry as well as in research organization, for determiningthe effect of independent variables on the output of a system. In addition to the above, knowledge on measurement techniques is essential for manufacturing engineers. Product quality needs to be measured or inspected using the right techniques and the data collected need to be analysed correctly in order to ensure that decisions regarding production quality are made correctly.

SEMP 4773 - Modern manufacturing
This course introduces automation and advanced techniques used in the modern manufacturing. Types of automation systems, applications, advantages and disadvantages are discussed. It also includes discussion on the principle of CAD/CAM and other applicationsin various manufacturing automation systems such as GT, CNC, FMS and CIM. This coursewill also allow students to carry out small case studies in the real environments for exposing

them on certain issues related to manufacturing automation.

SEMP 4783 - Casting Technology
This course is designed to expose student to the primary elements of casting processes when producing a component. It covers in depth various issues in pattern and pattern making, the making of mould for various casting processes primarily the sand-based production, melting, melt treatment and the solidification phenomenon of metal. This course also emphasizes on gating and riser design, design for casting, typical casting defects and the quality control involved during processing and production. At the end of the course the student should be able to appraise the casting knowledge in deciding a suitable casting/moulding process to produce a casting component, estimate the riser requirements through calculation, use castingdesign principles in redesigning components to be reproduced using casting process, describe issues related to defects, quality control and inspection, gating, melt treatment and solidification.

SEMP 4793 - Product Design and Manufacture
This course introduces the students to the various stages of product design and development methods that can be put into immediate practice in developing products or projects. The development procedures blend the various perspective of marketing, design and manufacturing into a single approach to product development. Aspect of sustainable design and manufacturing will also be covered. The course also provide practice in carrying small project to expose the various stages of product development. It also includes the various prototyping and manufacturing systems strategies in developing product prototype.

SEMP 4813 - Engineering Economy and Accounting
This course is designed to equip students to acquired engineering economy and accounting concepts, principles and methods. The focus of this course is to provide understanding on engineering economic principles and methods and to apply it in engineering field. The course has two parts. Part 1 is designed to teach students to formulate cash-flow, perform analysis on engineering economic problems and evaluate between alternative of engineering investment/projects to make decision. Part 2 is designed to teach students to perform cost estimates using traditional and current costing techniques in production process, prepare simple financial statement and interpret financial performance of business firms for decision and control.

SEMP 4823 - Quality Engineering
This course covers process and product variation, Six Sigma, Quality Function Deployment, Failure Mode Effect Analysis, Gage Repeatability and Reproducibility, Short Run SPC and experimental methods such Taguchi Methods and Classical Experimental Designs. Students are required to work in groups to integrate these tools in solving case studies problems.

SEMP4833 - Project Management and Maintenance
This course is designed to expose students to project management and maintenance. In project management, the course emphasizes the general management of project as well as project scheduling and analysis. General management includes topics such as project manager, project planning, work breakdown structure (WBS) and negotiation and conflict

resolution. Whereas project scheduling addresses topic such as PERT, Critical Path Method (CPM), resource allocation, reducing project duration and project progress and performance measurement. Major topics covered under maintenance are maintenance engineering in general, preventive maintenance, total productive maintenance (TPM), six major losses, measuring overall equipment effectiveness (OEE), reliability and maintenance cost issues. Atthe end of the course, students should be able to apply knowledge in project management toplan, schedule and control projects as well as to apply basic maintenance concept and develop a total productive maintenance (TPM) program in a company.

BACHELOR OF MECHANICAL ENGINEERING (AERONAUTICS) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Mechanical Engineering (Aeronautics) with Honours is offered on a full-time basis at the UTM Main Campus in Johor Bahru. The duration of study for the programme is subjected to the student's entry qualification and lasts between four (4) years and a maximum of six (6) years.

The programme is offered on full-time basis and is divided into two semesters per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) and eighteen (18) credit hours per semester. Assessment is based on course work and final examinations given throughout the semester.

General Information

1.	**Awarding Institution**		Universiti Teknologi Malaysia
2.	**Teaching Institution**		Universiti Teknologi Malaysia
3.	**Programme Name**		Bachelor of Mechanical Engineering (Aeronautics) with Honours
4.	**Final Award**		Bachelor of Mechanical Engineering (Aeronautics) with Honours
5.	**Programme Code**		SEMTH
6.	**Professional or Statutory Body of Accreditation**		Engineering Accreditation Council (EAC)
7.	**Language(s) of Instruction**		Bahasa Melayu and English
8.	**Mode of Study (Conventional, distance learning, etc.)**		Conventional
9.	**Mode of Operation (Franchise, self-govern, etc.)**		Self-govern
10.	**Study Scheme (Full Time / Part Time)**		Full Time
11.	**Study Duration**		Minimum : 4 years Maximum : 6 years
Type of Semester		No of Semesters	No of Weeks/Semester
Normal		8	14
Short		1	8
12.	**Entry Requirements**		Matriculation / STPM / Diploma or equivalent

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.8%
ii.	Programme Core (including Mathematics and Electrical subject)	87	64.0%
iii.	Programme Electives	33	24.2%
	Total	**136**	**100%**
Classification of courses for engineering programme			
A	Engineering Courses (a) Lecture/Project/ Laboratory (b) Workshop/Field/Design Studio (c) Industrial Training (d) Final Year Project	 94 0 5 6	77.2%
	Total Credit Hours for Part A	**105**	
B	Non-Engineering (a) Applied Science/Mathematic/Computer (b) Management/Law/Humanities/Ethics/Economy (c) Language (d) Co-Curriculum	 12 11 6 2	22.8%
	Total Credit Hours for Part B	**31**	
Total credit hours for Part A and B		**136**	**100%**
Total Credit Hours to Graduate		**136 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 136 credit hours 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 five (5) Professional Skills Certification (PSC) courses in UTM
- Other condition as specified

AREAS OF STUDY

Aeronautical engineering encompasses all aspects of studies related to flying. In this aspect, flying includes aerospace flight. The areas of specialisation in Aeronautical Engineering can be divided into the following: -

(a) Aerodynamics

Aerodynamics is the relationship between air (wind) and the material (solid) that moves in it. Various principles of fluid Mechanics are considered in a flying problem. For example, an aerodynamic study will determine a suitable shape for an aircraft, missile, etc.

(b) Aircraft structure

This area will determine the integrity (strength) of a flying body such as an aircraft or a missile. Using dimensions and tolerances, strength of material, shear flow and theory of thin plate, the structure of an aircraft can be determined.

(c) Aircraft propulsion

Propulsion is a study of an aircraft powerplant. This study includes the design and selectionof an appropriate power plant for a particular aircraft. This field has developed vastly sincethe increase in the cost of petroleum. Engineers have been competing to invent lighter and more economical power plants.

(d) Aircraft instrumentation and Avionics

Avionics is the acronym for `Aviation Electronics' and together with aircraftinstrumentation they involve a wide range of studies. Flying has been facilitated by the use of various electronic devices. Electronic devices, which facilitate flying, such as radars, ILS (Instrument Landing System), ADF (Automatic Direction Finder), etc., were specifically invented by the Avionic/Aircraft Instrument Engineer. The Avionic/Aircraft Instrument Engineer will have to ensure that the instrument fitted on an aircraft will function satisfactorily and with a high degree of reliability.

(e) Management

The aircraft industry has expanded tremendously during this decade. The industry requires experts to manage and administer its operations smoothly. Regulations concerning the construction and operation of aircraft have been devised toavoid accidents and mistakes that may sacrifice lives.

(f) Transportation

Apart from transporting passengers an aircraft is also used a as cargo carriers, an ambulanceetc. Studying in this area trains transportation experts to modify flight schedules and loads sothat the aircraft can be used economically.

(g) Flight Regulations

To avoid accidents the flying fraternity has formulated special laws for flying. Briefly, the laws are divided into two, namely, military flight regulations and public flight regulations.

(h) Materials for Aircraft

This field focuses its study on selecting and determining metals, plastics, composites, etc. which are suitable for building an aircraft, rocket, etc.

(i) Flight Mechanics

Flight mechanics is an important aspect in the design and operation of an aircraft's flight mission. Research area includes aircraft performance (take-off, climbing, cruising, decent and landing) and aircraft static stability, and control in steady flight condition.

(j) Flight Dynamics and Control

The area is about the dynamics of rigid body aircraft and the application of control system theory to design simple stability augmentation systems to more complexautomatic flight control systems. This includes the application of modern multivariable control system design using state-space methods. The area includes the equation of motion of rigid body including translation aircraft longitude in a land lateral dynamic stability, flying and handling qualities, stability augmentation and automatic flight controlsystem, aerodynamics stability derivatives and multivariable state-space methods.

CAREER PROSPECTS

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

The Aeronautical Engineering programme at UTM is offered as a specialisation of mechanical engineering and covers five main areas namely aerodynamics, aircraft structure, flight dynamics and control, propulsion, and aircraft design. Thus, graduates of this programme satisfy the requirement to graduate as an engineer in Mechanical Engineering as well as in the field of specialisation in Aeronautics. Apart from TUDM, the Civil Aviation Department requires trained manpower to supervise flying activities in Malaysia. Other organisations that require graduates in the field of aeronautics include Malaysia Airline System, AirAsia, AIROD, GKN Aerospace, DRB-HICOM Defense Technologies, SME Aviation, Malaysia Helicopter Services (MHS), TLDM and PDRM Air Unit. Several other firms also have working opportunities in the airline industry.

In the field of academic and research opportunities is available for Aeronautical Engineers to serve in any institution that runs courses and research in the field of Aeronautics. Several other universities and institutions in Malaysia have started to offer programme in the field of Aeronautics too. Due to the rapid expansion in the airline industry, many airline companies, flying clubs, and firms are prepared to get actively involved in the airline industry in the countryby offering more job opportunities to UTM graduates.

MOBILITY PROGRAMME (OUTBOUND)

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

1. **Study Abroad / Student Exchange**
   The Study Abroad/Student Exchange programme is a programme that allows students to spend one or two semesters at universities abroad and take courses in regular semesters with credit transfer opportunites.

2. **Research Internship Abroad**
   A Research Internship is a programme that allows students to join research studies or internships under the supervision of an academic staff member at universities or industries abroad from all over the world.

3. **Global Outreach Programme (GOP)**
   GOP is a 7 to 14 days academic based programme to experience various cultures in othercountries. It includes immersion elements such as research & academic activities, social responsibility and cross-cultural activities.

4. **International Invitation Programme**
   Students participate in programme organised by international institutions/ organisationswith the following themes:
   (i) Seminar, Conference or Paper Presentation
   (ii) Cultural Exhibition and Conference
   (iii) Student Development Activity

5. **Summer School Abroad**
   The Summer School program is a programme which is designed to provide educational opportunities for 4 to 8 weeks during summer holiday abroad. It is related to environment, the 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**	**CREDIT**	**PRE-REQUISITE**
SEMM 1203	Statics*	3	
SEMM 1503	Engineering Drawing	3	
SEMM 1911	Experimental Methods	1	
SEMM 1921	Introduction to Mechanical Engineering	1	
SEEU 1002	Electrical Technology	2	
SSCE 1693	Engineering Mathematics I	3	
ULRS 1012	Value and Identity	2	
UHLB 1112	English Communication Skills	HL	Refer English courses requirement section
	Total	**15**	

YEAR 1 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	
SEMM 1113	Mechanics of Solids I*	3	SEMM 1203
SEMM 1213	Dynamics*	3	SEMM 1203
SEMM 1513	Introduction to Design	3	SEMM 1503
SSCE 1793	Differential Equations	3	SSCE 1693
UHMS 1182	Appreciation of Ethics and Civilizations	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLM 1012	Malay Language for Communication 2 (for International Students Only)		
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 2 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2123	Mechanics of Solids II*	3	SEMM 1113, SEMM 1203
SEMM 2313	Mechanics of Fluids I*	3	SEMM 1203, SEMM 1013**
SEMM 2413	Thermodynamics*	3	
SEMM 2921	Laboratory I	1	
SSCE 1993	Engineering Mathematics II	3	
UKQF 2XX2	Service Learning and Community Engagement	2	
UHLX 1112	Foreign Language Communication Elective	2	
	Total	**17**	

YEAR 2 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2223	Mechanics of Machines & Vibration*	3	SEMM 1213
SEMM 2323	Mechanics of Fluids II*	3	SEMM 2313
SEMM 2433	Applied Thermodynamics and Heat Transfer*	3	SEMM 2413
SEEU 2012	Electronics	2	SEEU 1002
SEMM 2613	Materials Science	3	
UHIS 1022	Philosophy and Global Issue	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLB 2122	Professional Communication Skill 1	2	
	Total	**18**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 3 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2713	Manufacturing Processes	3	
SEMM 3023	Applied Numerical Methods	3	SEMM 1013, SSCE 1793**
SEMM 3233	Control Engineering	3	SEMM 1213** SSCE 1793**
SEMM 3931	Laboratory II	1	SEMM 2921
SEMT 3333	Aerodynamics	3	SEMM 2323**
SEMT 3132	Aircraft Structure I	2	SEMM 2123*
UHLB 3132	Professional Communication Skill 2	2	UHLB 2122
	Total	**17**	

YEAR 3 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3033	Finite Element Methods	3	SEMM 1113**
SEMM 3941	Laboratory III	1	SEMM 3931
SEMT 3212	Flight Mechanics	2	SEMT 3333**
SEMT 3423	Aircraft Propulsion System	3	SEMM 2413
SEMT 3822	Aviation Management	2	
ULRS 3032	Entrepreneurship and Innovation	2	
SSCE 2193	Engineering Statistics	3	
	Total	**16**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

SHORT SEMESTER			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3915	Industrial Training	5	##, SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2423**
	Total	**5**	

Remarks:
Obtained minimum of 80 credits

YEAR 4 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4912	Undergraduate Project I	2	SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2423**
SEMM 3622	Material Technology	2	SEMM 2613
SEMT 4223	Flight Dynamics & Control	3	SEMT 3212**, SEMM 3233, SEMT 3333
SEMT 4513	Aircraft Design I	3	SEMM 1513, SEMT 3212
SEMT 4143	Aircraft Structure II	3	SEMT 3132
SXXX xxx3	Free Elective	3	
	Total	**16**	

Remarks:
i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).
ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.
iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.
iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).
v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 4 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4924	Undergraduate Project II	4	SEMM 4912
SEMM 4902	Engineering Professional Practice	2	Must be 3rd year
SEMT 4523	Aircraft Design II	3	SEMT 4513, SEMT 4143**
SEMT 4813	Aviation Economy	3	
SEMT 4253	Aircraft Instrumentation and Avionics	3	SEEU2012
	Total	**15**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

ENGLISH COURSES REQUIREMENT

Students with English qualification shown in table below are exempted from Compulsory Attendance (HL) for UHLB 1112

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exempted

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 3033	Finite Element Methods	3	3	
20	SEMM 3233	Control Engineering	3	3	
21	SEMM 3622	Materials Technology	2	2	
22	SEMM 3915	Industrial Training	5	HL	
23	SEMM 3931	Laboratory II	1	1	
24	SEMM 3941	Laboratory III	1	1	
25	SEMM 4902	Engineering Professional Practice	2	2	
26	SEMM 4912	Undergraduate Project I	2	2	
27	SEMM 4924	Undergraduate Project II	4	4	
28	SEMT 3132	Aircraft Structure I	2	2	
29	SEMT 3212	Flight Mechanics	2	2	
30	SEMT 3333	Aerodynamics	3	3	
31	SEMT 3423	Aircraft Propulsion System	3	3	
32	SEMT 3822	Aviation Management	2	2	
33	SEMT 4143	Aircraft Structure II	3	3	

34	SEMT 4223	Flight Dynamics & Control	3	3	
35	SEMT 4253	Aircraft Instrumentation & Avionics	3	3	
36	SEMT 4513	Aircraft Design I	3	3	
37	SEMT 4523	Aircraft Design II	3	3	
38	SEMT 4813	Aviation Economy	3	3	
TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (Faculty 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					
UNIVERSITY FREE ELECTIVE					
1	SXXX xxx3	Free Elective	3	3	
MALAYSIA CORE VALUE					
1	UHIS 1022	Philosophy and Current Issues	2	2	
2	UHMS 1182	Appreciation of Ethics and Civilizations	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			
VALUE AND IDENTITY					
1	ULRS 1012	Value and Identity	2	2	
GLOBAL CITIZEN					
1	UKQF2XX2	Service Learning and Community Engagement	2	2	
COMMUNICATION SKILLS					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHLX 1112	Foreign Language for Communication	2	2	
ENTERPRISING SKILLS					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	

TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)			**19**	**19**	
TOTAL CREDIT TO GRADUATE (A + B + C + D)			**136**	**131**	
OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATION (PCS) • **Students are required to enrol and pass FIVE (5) PCS courses, in order to be eligible to graduate**					
Compulsory PSC Courses					
1	GSPX XXXX	Design Thinking for Entrepreneur			
2	GSPX XXXX	Talent and Competency Management			
3	GSPX XXXX	English Communication Skills for Graduating Students (ECS)			
Elective PSC Courses (Choose 3 only)					
1	GSPX XXXX	Data Analytic for Organization			
2	GSPX XXXX	Quality Management for Built Environment and Engineering Professionals			
3	GSPX XXXX	Construction Measurement (Mechanical & Electrical)			
4	GSPX XXXX	Professional Ethics and Integrity			
5	GSPX XXXX	OSHE for Engineering Industry and Laboratory			
6	GSPX XXXX	OSHE for Construction Industry and Laboratory Works			
7	GSPX XXXX	Safety and Health Officer Introductory Course			

COURSE SYNOPSIS

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 ableto 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 determinateand 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 conceptof 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 applythe 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 dueto 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 errorsand 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 Profession

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 MechanicalEngineering and a description of the mechanical engineer’s work and professional responsibilities. It discusses the education requirements for today’s mechanical engineers aswell 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 importanceof 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 failures criteria 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 structuresin 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 buoyancyanalysis. Dynamic flow analysis inclusive of technique in solving flow problems is introduce specially to solve flow measurement, mass or volumetric flow rate, momentum in flow and lossin pipe network. Lastly, some basic dimensional analysis and similarities will be introduced. Atthe end of the course, the student should be able to demonstrate an ability to analyse 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 application. 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 flowof 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 powergeneration 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 principlesof 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, castingprocesses, 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 theparticular 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 casestudies in applied mechanics, strength of materials, thermal science, and fluid mechanics arepresented. 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 3033 - Finite Element Methods

This course gives students an exposure to the theoretical basis of the finite element method and its implementation principles and introduces the use of general-purpose finite element software for solving real-life engineering problems.

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 3622 - Materials Technology

This course introduces students to the basic concepts required to understand and describe the mechanical behaviour and failure mechanism of metals. It will emphasise on the concept of stress intensity factor and fracture mechanics to predict failure of materials and provide understanding on conditions under which fatigue, and creep occur. The course will also introduce students to the theory of electromechanical corrosion in metallic materials, estimatethe corrosion rate and understand the methods to control and manage corrosion. By the end of the course, students should be able to apply the criteria of failure to the design of materialsand conduct failure analysis of engineering components. This course also covers the properties, processing, and applications of non-metallic materials mainly polymer, ceramic and composite.

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. Students 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 groupedinto 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 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 aprofessional 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, a community service activity in a planned and structured manner. At the end of the course, students should be able to demonstrate and applyengineering 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). 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 analyse results of the research clearly, effectively and confidently in both oral presentation and in dissertation.

ELECTIVE COURSES

SEMT 3132 - Aircraft Structures I

The course will give the student an introduction to the various types of structural components used in aircraft, together with their functions and stress calculations under different types of loading. The lectures will include qualitative descriptions of methods of fabrication and provide a thorough introduction to quantitative methods of analysis. The first section covers the analysis of the statically determinate and indeterminate structure including the various type oftruss analysis. Next section covers the analysis of the opened, closed and thin wall beam structure peculiar to aircraft, features discussion on the effect of the various types of load exerted and an introduction to structural idealization. Finally, this section also investigates thestress analysis of the multi-cell structures due to the acting loads and its design characteristics.It is a blended course that combines traditional teaching methods to Problem-Based Learning(PBL) approach based on real problems of aircraft structures.

SEMT 3212 - Flight Mechanics

Flight mechanics is an important aspect in the design and operation of an aircraft. A flight mission can only be operated successfully and safely if proper efforts are given to this aspect. Therefore, in this course students will be equipped with the fundamental concept of aircraft performance calculation and static stability determination needed to analyse and design modern aircraft. Proper due shall be given to both aspects of performance and static stability.It is a blended course that combines traditional teaching methods to Problem-Based Learning(PBL) approach based on real problems in flight mechanics and industrial visit of related industries.

SEMT 3333 - Aerodynamics

The course gives an introduction to aerodynamics with specific emphasis to aircraft aerodynamics. The purpose is to instil understanding of the principle of aerodynamics and toprovide foundation of fundamental aerodynamics analysis. The contents include: Fluid flow equations (Continuity equation, Euler and Navier Stokes equations); Inviscid flow theory and Joukowski transformation; 2D aerofoil theory (Vortex law, Biot-Savart law, thin aerofoil theory,Fourier theory, thick and cambered aerofoil); Finite wing theory (Vortex system and horseshoevortex, downwash and lift distribution); Viscous Flow Theory and Boundary Layer; Introductionto industrial aerodynamics (vehicles and buildings).It is a blended course that combines traditional teaching methods to Problem-Based Learning (PBL) approach based on real problems of aerodynamics.

SEMT 3423 - Aerospace Propulsion System

An introduction to aircraft propulsion system including the historical background, review of thermodynamics and fluid mechanics; fundamental of gas dynamics; piston engines; shaft and thrust power; cycle analysis: air standard and cycle with friction; turbojet engine cycle; turbofan engine cycle; gas turbine engine components and their functions; compressor and turbine

velocity diagram analysis; turbine blades cooling techniques; gas turbine emissions; chemical rocket engines. It is a blended course that combines traditional teaching methods to Problem-Based Learning (PBL) approach based on real problems of aircraft propulsion system.

SEMT 3822 – Aviation Management
This course covers basic management concepts such as Planning, Organizing, Leading and Controlling; Management of the aviation industry; the process of airworthiness; airport operations; aviation organizations and rules; safety, liability and security in aviation industries;main activities of the aircraft manufacturer, main activities of the airline industry. It is a blendedcourse that combines traditional teaching methods to Problem-Based Learning (PBL) approach based on real problems in aviation and industrial visit of related industries.

SEMT 4143 - Aircraft Structures II
This course gives students an understanding of the basic principles in the analysis of aircraft structural components and the determination of their strengths under the various operational loading conditions. It covers the areas of thin plate analysis, analysis of structural instability, introduction to the analysis of unidirectional composites, introduction to aeroelasticity and fatigue of aircraft structures. It is a blended course that combines traditional teaching methodsto Problem-Based Learning (PBL) approach based on real problems of aircraft structures.

SEMT 4223 - Flight Dynamics and Control
This course is about the dynamics behaviour of rigid body aircraft and the application of control system theory to design simple stability augmentation systems to more complex automatic flight control systems. This includes the application of modern multivariable control system design using state-space methods. Topics include axes system and notation, equation of motion of rigid body including translation, aircraft longitudinal and lateral dynamic stability, flying and handling qualities, stability augmentation and automatic flight control system, aerodynamics stability derivatives and multivariable state-space methods. It is a blended course that combines traditional teaching methods to Problem-Based Learning (PBL) approach based on real problems in aircraft dynamics and control, which also comprising TheFourth Industrial Revolution (*IR 4.0*) element.

SEMT 4253 - Aircraft Instrumentation and Avionics
Aircraft Instrumentation and Avionics course provides the understanding of various basic instrument and electronics used in aircraft. The major topics cover includes an introduction to instrumentation system, component of instrumentation, air data, calibration equations, gyroscopes, indicators, signal conditioning, data acquisition system, transducers, Introductionto avionics, GPS application. The devices that will be thought are such as ADF, VOR, DME, LORAN C, ILS, RADAR Altimeter, GPS, and Primary RADAR. It is a blended course that combines traditional teaching methods to Problem-Based Learning (PBL) approach based on real problems in aircraft instrumentation and avionics, which also comprising The Fourth Industrial Revolution (*IR 4.0*) element.

SEMT 4513 - Aircraft Design I

The course will allow students to learn methodology and decision making in aircraft design process. This Integrated Design Project (IDP) offers a distinctive opportunity to use knowledge and skill from previous studies in aeronautics class to conduct a practical aircraft design project. Contents of learning include feasibility study, aircraft aerodynamics, aircraft performance & stability and component design.

SEMT 4523 - Aircraft Design II

This course gives students an exposure to the aircraft design process and methodology. Students are split into several groups to carry out aircraft components design and analyses. The progress of this Integrated Design Project (IDP) is closely monitored by the lecturers. Lectures are given to provide the student with information and guidance as project goes along.Group presentation and feedback from lecturers are regularly arranged for student evaluationand design improvement.

SEMT 4813 - Aviation Economy

This course aims to expose Aeronautical engineering students with fundamental elements of economics commonly used in engineering and aviation. The course begins by introducing key economic concepts such as the cash flow diagram and factors in engineering economy. These fundamental concepts are applied on various decision-making tools such as Net Present Value, Future Worth, Annual Worth, Rate of Return and Benefit/Cost Analysis to solve aviation economics related problems. It is a blended course that combines traditional teaching methods to Problem-Based Learning (PBL) approach based on real problems in aviation and industrial visit of related industries.

BACHELOR OF MECHANICAL ENGINEERING (AUTOMOTIVE) WITH HONOURS

PROGRAMME SPECIFICATION

The Bachelor of Mechanical Engineering (Automotive) with Honours is offered on a full-time basis at the UTM Main Campus in Johor Bahru. The duration of study for the programme is subjected to the student's entryqualification and lasts between four (4) years and a maximum of six (6) years.

The programme is offered on full-time basis and is divided into two semesters per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) and eighteen (18) credit hours per semester. Assessment is based on course works and final examinations given throughout the semester.

General Information

1.	**Awarding Institution**		Universiti Teknologi Malaysia
2.	**Teaching Institution**		Universiti Teknologi Malaysia
3.	**Programme Name**		Bachelor of Mechanical Engineering (Automotive) with Honours
4.	**Final Award**		Bachelor of Mechanical Engineering (Automotive) with Honours
5.	**Programme Code**		SEMVH
6.	**Professional or Statutory Body of Accreditation**		Engineering Accreditation Council (EAC)
7.	**Language(s) of Instruction**		Bahasa Melayu and English
8.	**Mode of Study (Conventional, distance learning, etc.)**		Conventional
9.	**Mode of Operation (Franchise, self-govern, etc.)**		Self-govern
10.	**Study Scheme (Full Time / Part Time)**		Full Time
11.	**Study Duration**		Minimum : 4 years Maximum : 6 years
Type of Semester		No of Semesters	No of Weeks/Semester
Normal		8	14
Short		1	8
12.	**Entry Requirements**		Matriculation / STPM / Diploma or equivalent

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.8%
ii.	Programme Core (including Mathematics and Electrical subject)	96	70.6%
iii.	Programme Electives	24	17.6%
	Total	**136**	**100%**
Classification of courses for engineering programme			
A	Engineering Courses (a) Lecture/Project/ Laboratory (b) Workshop/Field/Design Studio (c) Industrial Training (d) Final Year Project	 94 0 5 6	77.2%
	Total Credit Hours for Part A	**105**	
B	Non-Engineering (a) Applied Science/Mathematic/Computer (b) Management/Law/Humanities/Ethics/Economy (c) Language (d) Co-Curriculum	 12 11 6 2	22.8%
	Total Credit Hours for Part B	**35**	
Total credit hours for Part A and B		**136**	**100%**

AWARD REQUIREMENTS

To graduate, students must:

- Attain a total of not less than 136 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 five (5) Professional Skills Certification (PSC) courses in UTM
- Other condition as specified

AREAS OF STUDY

Students pursuing minor specialization in automotive will take specific automotive related courses in their 3rd and 4th year of the programme. The area of minor specialization will include:

(a) Automotive Technology

This area of study covers the fundamental technical know-how of the automotive main systems and sub-systems which constitute a car; such as the internal combustion engine (ICE), fuel injection, clutch, transmission, differential, steering, suspension and brake system.

(b) Vehicle Structure

Vehicle structure covers the constructions, classifications, and design of the vehicle chassis, taking into consideration its load path that will affect its structural rigidity with regards to bending, torsion and lateral loading.

(c) Vehicle Dynamic

Vehicle dynamic covers the fundamental concepts of vehicle dynamics, which consider the ride and comfort, handling, kinematics, and kinetics behaviours of its essential systems and subsystems.

(d) Vehicle Powertrain

Vehicle powertrain covers the engineering aspects of the vehicle powerplant (dominant by the internal combustion engines) and transmission (also known as drivetrain). It also covers the integration of the drivetrain with the powerplant to predict the essential vehicle performance such as maximum speed, acceleration, driveability and fuel consumption.

(e) Automotive Electrical and Instrumentation System

This area of study introduces and explains the fundamental behaviours and characteristics of the automotive electrical and electronic related systems in a vehicle. Some general electrical system diagnosis methods will also be exposed.

(f) Automotive Production Technology

Automotive production focuses on the fundamental aspects of automotive manufacturing processes, such as casting and forming, as well as difficult issues such as quality, lean manufacturing, and automation.

(g) Automotive Engineering Design

This area exposes students to automotive-related engineering design activities where real design project is to be undertaken in groups, which require creativity, commitment, leadership, and good public relations skills. Quality design tools such as QFD, DFM, and DFA will be highlighted.

(h) Engine Turbocharging

Engine turbocharging is one of the key technologies to improve the engine performance and increase efficiencies. This area includes analysis and evaluation of the parameters in turbocharger and supercharger engines. The study includes the processes in

turbocharger-engine matching to achieve better engine performances.

(i) Internal Combustion Engine

This area of study covers the fundamentals and applications of internal combustion engines, mainly in transportation. Projects in this field can vary from intake system configuration to combustion study and exhaust energy recovery. The area broadly aimsfor higher efficiency, lower fuel consumption, and lower exhaust emissions, through experimental and simulation investigations.

CAREER PROSPECTS

Graduates of this programme are essentially Mechanical Engineers with minor specialization in Automotive Engineering who can seek job opportunities in various mechanical and automotive sectors. Alternatively, they can also be known as Automotive Engineers dependingon their job placements in the industries, they are in.

Mechanical-Automotive graduates from UTM will be able to fulfill job requirements in the fields of research, design, development and production of various types of vehicles. In most cases, they will be working on the design and production of automotive components systems and sub-systems. They will make use of the knowledge learnt during their studies at UTM, such as those mentioned earlier. A Mechanical-Automotive Engineer will always perform design or production work in accordance with quality assurance practice to fulfil the requirementsof standards performance and safety.

Apart from passenger vehicles, Mechanical-Automotive graduates will also be able to find careers in the commercial vehicle industry or off-road vehicle companies such as MASTER BUILDERS and MALAYSIAN TRUCKS & BUS or even branch into locomotives companies. Furthermore, the advancement of motorsports-related industries has created a demand for technical expertise to support the industry; another exciting industry to which Mechanical-Automotive graduates can transition as their career. Malaysia has been producing cars for more than 30 years, with the growth of companies such as PROTON, PERODUA, MODENAS, and NAZA. The rapid growth in the Malaysian automotive industry, including component manufacturing and automotive-related companies has also provided many job opportunities for Mechanical-Automotive graduates.

UTM Mechanical-Automotive graduates are also capable of taking a position and advancing theircareer with international car manufacturers either locally or abroad. In short, UTM Mechanical-Automotive graduates have a wide career opportunity as they are all well trained to become competent engineers and managers, especially in the field of Mechanical-Automotive Engineering.

MOBILITY PROGRAMME (OUTBOUND)

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

1. **Study Abroad / Student Exchange**
   The study Abroad/Student Exchange programme is a programme that allows students to spend one or two semesters at universities abroad and take courses in regular semesters with credit transfer opportunities.

2. **Research Internship Abroad**
   A research Internship is a programme that allows students to join research studies or internships under the supervision of an academic staff member at universities or industries abroad from all over the world.

3. **Global Outreach Programme (GOP)**
   GOP is a 7 to 14 days academic based programme to experience various cultures in othercountries. It includes immersion elements such as research and academic activities, social responsibility, and cross-cultural activities.

4. **International Invitation Programme**
   The students participate in programme organised by international institutions/ organisationswith the following themes:
   (iv) Seminar, Conference or Paper Presentation
   (v) Cultural Exhibition and Conference
   (vi) Student Development Activity

5. **Summer School Abroad**
   The Summer School programme is a programme which is designed to provide educational opportunities for 4 to 8 weeks during the summer holiday abroad. It is related to environment, the 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**	**CREDIT**	**PRE-REQUISITE**
SEMM 1203	Statics*	3	
SEMM 1503	Engineering Drawing	3	
SEMM 1911	Experimental Methods	1	
SEMM 1921	Introduction to Mechanical Engineering	1	
SEEU1002	Electrical Technology	2	
SSCE 1693	Engineering Mathematics I	3	
ULRS 1012	Value and Identity	2	
UHLB 1112	English Communication Skills	HL	Refer English courses requirement section
	Total	**15**	

YEAR 1 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	
SEMM 1113	Mechanics of Solids I *	3	SEMM 1203
SEMM 1213	Dynamics*	3	SEMM 1203
SEMM 1513	Introduction to Design	3	SEMM 1503
SSCE 1793	Differential Equations	3	SSCE 1693
UHMS 1182	Appreciation of Ethics and Civilisations	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLM 1012	Malay Language for Communication 2 (for International Students Only)		
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 2 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2123	Mechanics of Solids II*	3	SEMM 1113
SEMM 2313	Mechanics of Fluids I*	3	SEMM 1203
SEMM 2413	Thermodynamics*	3	
SEMM 2921	Laboratory I	1	SEMM 1911
SSCE 1993	Engineering Mathematics II	3	SSCE 1693
UKQF 2XX2	Service Learning and Community Engagement	2	
UHLX 1112	Foreign Language Elective	2	
	Total	**17**	

YEAR 2 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2223	Mechanics of Machines and Vibration*	3	SEMM 1213
SEMM 2323	Mechanics of Fluids II*	3	SEMM 2313
SEMM 2433	Applied Thermodynamics and Heat Transfer*	3	SEMM 2413
SEMM 2613	Materials Science	3	
SEEU 2012	Electronics	2	SEEU 1002
UHLB 2122	Professional Communication Skills 1	2	
UHIS 1022	Philosophy and Current Issues	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
	Total	**18**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 3 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3023	Applied Numerical Methods	3	SEMM 1013, SSCE 1793**
SEMM 3233	Control Engineering	3	SEMM 1213**, SSCE 1793**
SEMM 3523	Components Design	3	SEMM 2123**, SEMM 1513
SEMM 3931	Laboratory II	1	SEMM 2921
SEMV 3012	Automotive Technology	2	
SEMV 3413	Internal Combustion Engines	3	SEMM 2413 SSCE 1793
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
	Total	**17**	

YEAR 3 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3033	Finite Element Methods	3	SEMM 1113**
SEMM 3183	Industrial Engineering	3	
SEMM 2713	Manufacturing processes	3	
SEMV 3512	Automotive Engineering Design I	2	
SEMV 3941	Laboratory III	1	SEMM 3931
ULRS 3032	Entrepreneurship and Innovation	2	
SSCE 2193	Engineering Statistics	3	
	Total	**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

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

Remarks:
Obtained minimum of 80 credits

YEAR 4 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3622	Materials Technology	2	SEMM 2613**
SEMM 3823	Engineering Management, Safety and Economics	3	
SEMM 4912	Undergraduate Project I	2	SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2433**
SEMV 4212	Automotive Electronics & Instrumentation	2	SEMV 3012,
SEMV 4523	Automotive Engineering Design II	3	SEMV 3512
SXXX xxx3	Free Elective	3	
	Total	**15**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 4 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4213	Vehicle Dynamics	3	
SEMM 4924	Undergraduate Project II	4	SEMM 4912
SEMV 4793	Automotive Production Technology	3	SEMV 3012, SEMM 2713
SEMX 4xx3	Elective	3	
SEMX 5xx3	PRISMS Elective		
SEMM 4902	Engineering Professional Practice	2	
	Total	**15**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

ENGLISH COURSES REQUIREMENT

Students with English qualification shown in table below are exempted from Compulsory Attendance (HL) for UHLB 1112

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exempted

ELECTIVE COURSES

Choose one (1) from the elective courses:

No.	Code	Courses
1	SEMV 4123	Vehicle Structure
2	SEMV 4413	Engine Turbocharging
3	SEMV 4423	Vehicle Powertrain

PRISMS ELECTIVE COURSES

For students who intend to enrol in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses on 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 courses 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 3033	Finite Element Methods	3	3	
20	SEMM 3233	Control Engineering	3	3	

21	SEMM 3523	Component Design	3	3	
22	SEMM 3622	Materials Technology	2	2	
23	SEMM 3813	Industrial Engineering	3	3	
24	SEMM 3823	Engineering Management, Safety & Economics	3	3	
25	SEMM 3915	Industrial Training	5	HL	
26	SEMM 3931	Laboratory II	1	1	
27	SEMM 4902	Engineering Professional Practice	2	2	
28	SEMM 4912	Undergraduate Project I	2	2	
29	SEMM 4924	Undergraduate Project II	4	4	
30	SEMV 3012	Automotive Technology	2	2	
31	SEMV 3413	Internal Combustion Engines	3	3	
32	SEMV 3512	Automotive Engineering Design I	2	2	
33	SEMV 3941	Laboratory III	1	1	
34	SEMV 4212	Automotive Electronics & Instrumentation	2	2	
35	SEMV 4213	Vehicle Dynamics	3	3	
36	SEMV 4523	Automotive Engineering Design II	3	3	
37	SEMV 4793	Automotive Production Technology	3	3	
38	SEMV 4xx3	Elective	3	3	
	SEMV 5xx3	PRISMS Elective			
TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (Faculty of Electrical Engineering)					
1	SEEU1002	Electrical Technology	2	2	
2	SEEU2012	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					
UNIVERSITY FREE ELECTIVE					
1	SXXX xxx3	Free Elective	3	3	
MALAYSIA CORE VALUE					
1	UHIS 1022	Philosophy and Current Issues	2	2	
2	UHMS 1182	Appreciation of Ethics and Civilizations	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			

VALUE AND IDENTITY					
1	ULRS 1012	Value and Identity	2	2	
GLOBAL CITIZEN					
1	UKQF2XX2	Service Learning and Community Engagement	2	2	
COMMUNICATION SKILLS					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHLX 1112	Foreign Language for Communi-cation	2	2	
ENTERPRISING SKILLS					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)			**19**	**19**	
TOTAL CREDIT TO GRADUATE (A + B + C + D)			**136**	**131**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATION (PCS)

- **Students are required to enrol and pass FIVE (5) PCS courses, in order to be eligible to graduate**

Compulsory PSC Courses			
1	GSPX XXXX	Design Thinking for Entrepreneur	
2	GSPX XXXX	Talent and Competency Management	
3	GSPX XXXX	English Communication Skills for Graduating Students (ECS)	
Elective PSC Courses (Choose 3 only)			
1	GSPX XXXX	Data Analytic for Organization	
2	GSPX XXXX	Quality Management for Built Environment and Engineering Professionals	
3	GSPX XXXX	Construction Measurement (Mechanical & Electrical)	
4	GSPX XXXX	Professional Ethics and Integrity	
5	GSPX XXXX	OSHE for Engineering Industry and Laboratory	
6	GSPX XXXX	OSHE for Construction Industry and Laboratory Works	
7	GSPX XXXX	Safety and Health Officer Introductory Course	

COURSE SYNOPSIS

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 conceptof 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 applythe 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 dueto 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 errorsand 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 Profession

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 MechanicalEngineering and a description of the mechanical engineer’s work and professional responsibilities. It discusses the education requirements for today’s mechanical engineers aswell 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 importanceof 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 failures 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 structuresin 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 buoyancyanalysis. Dynamic flow analysis inclusive of technique in solving flow problems is introduce specially to solve flow measurement, mass or volumetric flow rate, momentum in flow and lossin pipe network. Lastly, some basic dimensional analysis and similarities will be introduced. Atthe end of the course, the student should be able to demonstrate an ability to analyse 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 application. 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 flowof 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 2423 - Applied Thermodynamics

The aim of this course is to teach second-year mechanical engineering students on the application of thermodynamics principles to evaluate the performance criteria of various thermal systems. These include the reciprocating air-compressor, internal combustion engines, vapour power plants, gas turbine plants and refrigeration systems. Also, principles ofconservation of mass and energy are applied to various air-conditioning processes to assessthe properties changes and energy transfer during the 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 powergeneration 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 principlesof 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, castingprocesses, 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 theparticular 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 casestudies in applied mechanics, strength of materials, thermal science, and fluid mechanics arepresented. 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 3033 - Finite Element Methods

This course gives students an exposure to the theoretical basis of the finite element method and its implementation principles and introduces the use of general-purpose finite element software for solving real-life engineering problems.

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 havethe capabilities to identify, analyse and design the machine elements in the perspective of static and fatigue failure aspect.

SEMM 3622 - Materials Technology

This course introduces students to the basic concepts required to understand and describe the mechanical behaviour and failure mechanism of metals. It will emphasise on the concept of stress intensity factor and fracture mechanics to predict failure of materials and provide understanding on conditions under which fatigue, and creep occur. The course will also introduce students to the theory of electromechanical corrosion in metallic materials, estimatethe corrosion rate and understand the methods to control and manage corrosion. By the end of the course, students should be able to apply the criteria of failure to the design of materialsand conduct failure analysis of engineering components. This course also covers the properties, processing and applications of non-metallic materials mainly polymer, ceramic and composite.

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. Studenthave 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 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 aprofessional 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, a community service activity in a planned and structured manner. At the end of the course, students should be able to demonstrate and applyengineering 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). 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 analyse results of the research clearly, effectively and confidently in both oral presentation and in dissertation.

SEMV 3012 - Automotive Technology

This course introduces students the fundamental knowledge of automotive areas including different modern automotive system and components such as engine, transmission, differential, clutches, brakes, steering and suspension. Students will be exposed the principlefunction and working mechanism of the system. The new technology associated with differentsystems will also be introduced to enable student to identify the advancement in the technology. Students will also have some hands-on work to be done in automotive laboratorywhich will give them exposure to work on real automotive components and systems.

SEMV 3413 - Internal Combustion Engine

This course is intended to provide students an introduction, terminology, definition, and operating characteristics of internal combustion engines (ICE). It covers all topics needed fora basic engineering knowledge of the design, operation, analysis and performance of IC engines. Principles of all types of IC engines are covered including spark ignition (gasoline), compression ignition (diesels), four-stroke, and two-stroke engines. On top of that, students will be equipped with basic knowledge and understanding of engine heat transfer, frictions and lubrication. Moreover, an introduction on fuel-cell, hybrid and other alternative fuels are also covered.

SEMV 3512 - Automotive Engineering Design I

In this problem-based learning course, students will have to undertake (in group) one mechanical-automotive engineering design exercise which involves current trend in automotive technology. The main aim of this course is for the students to experience how to undertake real group design project which involves the latest automotive technology. Studentswill have to go through the process of applying various techniques and scientific principles (which they have learnt in this programme) in order to achieve their goals. Students will also be taught to be creative, brainstorm their ideas, discuss, design and analyse their developed design. Concurrently, students will also be given lectures related to mechanical engineering design process and engineering design method (technology-independent), based on relevantengineering design books.

SEMV 3941 - Laboratory III

This course is introduced in the third year of the study of Mechanical Engineering, three hours per week and experimental based course. It is divided into two parts; experimental work at Mechanics of Machine Laboratory and problem-based-learning (PBL) based laboratory (module). Students have to produce a short report for the experimental work as same to experimental work at year 2. But for the module, it is based on PBL concept. Students have to plan and design their experimental work from beginning until the end based on the title andobjective that have been given by the lecturer. Students will be grouped into 5 to 6 for each module. Generally, every group has 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.

SEMV 4212 - Automotive Electronics and Instrumentation

This course gives students an exposure to electronic and instrumentation systems typically used in automotive vehicles. It covers the basics of transducers and their uses in automotive instrumentation systems. The interface between transducers and microcontrollers are also covered for automotive applications. Major electronic systems in automotive vehicles (e.g. starting and charging system, electric, hybrid and autonomous vehicle systems) are also introduced and discussed in the course.

SEMV 4213 - Vehicle Dynamics

This course introduces students to the fundamentals of vehicle dynamics such as vehicle axis system, equation of motions, moments and products of inertia, body/chassis stiffness and vibrations. Students will be taught the knowledge to develop equation of motions of vehicle dynamics model and to analyse its performance in terms of ride, comfort & handling behaviour.

SEMV 4523 - Automotive Engineering Design II

In this problem-based learning course, students need to develop and fabricate (in group) one mechanical-automotive engineering system which involves both mechanical and electronic system integrations, which its specifications had been determined in Automotive Engineering Design 1. The main aim of this course is for the students to experience how to deliver an automotive system project involving the latest automotive technology, which emphasizes more on detailed engineering analysis and system fabrication. Students will have to go through the process of applying various techniques and scientific principles (which they have learnt in prerequisite subjects) in order to achieve their goals. At the end of the semester, the students

are required to produce one automotive system which comprises an integration between both mechanical and electronics systems.

SEMV 4793 - Automotive Production Technology
This course introduces students to the advances of manufacturing processes involved in the production of selected automotive parts. Further enhancement of basic manufacturing processes through analysis of selected critical parameters in stamping operation is also given.A brief overview on other processes such as joining, injection moulding, thermoforming, etc are highlighted. The course will also highlight some of the challenging issues such as Qualityimprovement implementation, Lean Manufacturing and Automation.

ELECTIVES

SEMV 4413 - Engine Turbocharging
This course is designed to deliver the principles of engine boosting and the its significant role towards engine downsizing. The course will emphasize on the engine air induction system, in particular the turbocharging and supercharging systems. Students will be introduced to the science governing the operation of turbochargers and superchargers – which covers aerodynamics, gas dynamics and thermodynamics. The syllabus will enable the students to have the view of a turbocharger designer, as well as enable them to recognize the common problems relating to turbocharging an internal combustion engine. Engine downsizing is one of the crucial steps undertaken by engine manufacturers towards carbon reduction and sustainable technology. However, it requires significant technology advancement in all aspects of engine sub-systems, to deliver the targeted performance. The specific contributionsof engine boosting to meet these targets will be discussed and elaborated as part of the course

SEMV 4123 - Vehicle Structure
This course is designed to expose students to the design of the modern passenger car structure. It will emphasize on the general architecture of the vehicle structure, design specifications for the body structure, methodology for evaluation of body structure performance.

SEMV 4423 - Vehicle Powertrain
This course introduces students to the fundamental of vehicle powertrain engineering systems. Students will be lectured on vehicle powertrain system that employs manual and automatic transmissions that uses either dry friction clutch or hydraulic torque converter and how to predict its performances. Students will be taught on how to match engine (internal combustion engine – ICE) and the different types of transmission systems in predicting the vehicle performances. The performances prediction that will be covered in this course are howto determine vehicle gradeability, top speed, acceleration and steady state fuel consumptions.In conjunction to these, students will be thought on how to determine top, bottom and intermediate gear ratios taking into consideration over gearing and under gearing conditions;and exploiting the current new continuously variable transmission (CVT) technology capabilityto achieve the above vehicle performances will be highlighted.

BACHELOR OF ENGINEERING (NAVAL ARCHITECTURE AND OFF-SHORE ENGINEERING) WITH HONOURS

PROGRAMME SPECIFICATION

The Bachelor of Naval Architecture & Offshore Engineering with Honours is offered on a full-time basis at the UTM Main Campus in Johor Bahru. The duration of study for the programme is subjected to the student's entry qualifications and is between four (4) years and a maximum of six (6) years.

The programme is offered full-time and is divided into two semesters per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) and eighteen (18) credit hoursper semester. Assessments are based on coursework, assignments, projects, and final examinations given throughout the semester. Description of the programme is provided below.

General Information

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

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

12.	**Entry Requirements**	Matriculation / STPM / Diploma or equivalent

Course Classification

No	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.8%
ii.	Programme Core (including Mathematics and Electrical subject)	115	84.6%
iii.	Programme elective	5	3.6%
	Total	**136**	**100%**
Classification of courses for engineering programme			
A	Engineering Courses (a) Lecture/Project/ Laboratory (b) Workshop/Field/Design Studio (c) Industrial Training (d) Final Year Project	 88 6 5 6	77.2%
	Total Credit Hours for Part A	**105**	
B	Non-Engineering a) Applied Science/Mathematic/Computer b) Management/Law/Humanities/Ethics/Economy c) Language d) Co-Curriculum	 12 11 6 2	22.8%
	Total Credit Hours for Part B	**31**	
Total credit hours for Part A and B		**136**	**100%**
Total Credit Hours to Graduate		**136 credit hours**	

AWARD REQUIREMENTS

To graduate, students must:

- Attain a total of not less than 136 credit hours 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 five (5) Professional Skills Certification (PSC) courses in UTM
- Other condition as specified

AREAS OF STUDY

Naval Architecture and Offshore Engineering are two important sectors in the maritime industry. The area of studies includes the design and system design, operations, performanceand dynamic behaviour of marine vehicles such as ships, and also other marine structures fixed or floating. The curriculum has about forty-five percent (45%) containing basic engineering courses such as Statics, Dynamics, Thermodynamics, Fluid Mechanics, and Mechanics of Materials. Naval architecture and offshore engineering related courses are about forty percent (40%). The courses are introduced as early as in the first semester and more courses are offered towards the end of the study period. The specialised courses for Naval Architecture and Offshore Engineering include: -

(a) Naval Architecture

Naval Architecture is a study that introduces students to basic naval architectural knowledge. It enables students to familiarise themselves with naval architectural terms, ship components and undertake simple hydrostatics and stability calculations. Tools and techniques that are required in future naval architecture work are introduced here. Students will be able to carry out calculations to determine ship stability in all conditions. The content covers the calculation of areas, moments and centroids, transversestability, longitudinal stability, large angle stability, damage stability, and launching.

(b) Marine Hydrodynamics

Basic knowledge of marine hydrodynamics theory and CFD software are introduced. Enhancement of knowledge in Mechanics of Fluids I started with some discussion on the motion of Viscous/Real fluid and Ideal fluid. Further discussion is also given in on surface waves and the hydrodynamic of slender bodies.

(c) Ship and Offshore Structures

Ship and Offshore Structures are concerned with the loading and stresses ofships and offshore structures. It begins with the components and functions of ships and offshore structures. The floating hull loading, shear forces and bending moments will be discussed in detail. Following that, the importance of structural strength analysis for ships and offshore structures will be highlighted on bending and buckling afterward.

(d) Ship and Offshore Production Technology

Ship and Offshore Production Technology study is important because it provides the student with the fundamental knowledge and exposure on the construction of ship & offshore structures. This course covers the hardware and software aspects of ship and offshoreproduction technology. It begins with the introduction to the ship building industry, its importance and development in world economics and in Malaysia, ship and offshore/production construction process flow chart and activities. Production/construction yard's location, layout, and facilities. Material treatment includes surface preparation, cutting, welding, and painting processed that are involved in the construction process. It is followed by the subassembly, block assembly, and erection processesof offshore structures. Upon completion, the launching, transporting, and upsetting processwill also be discussed. On the soft engineering side, quality control and productionsystems will also be taught. Apart from normal lecture hours, the students are expected to carry out class assignments, field surveys or site visits to ships and offshore production yards,

and technical writing. Therefore, the course is expected to develop and enhance the students' ability to discuss and explain the related knowledge, to work in a team effectively, to have long life learning and communication skills.

(e) Integrated Ship and Offshore Design Project

The course first explains the concepts of engineering design and later relates them tothe processes and procedures in ship and offshore design. An emphasis is made on preliminary design calculations to satisfy the owner's requirements and related legislations. The hands-on part will deal with design tasks, including hull form design (manually and computer aided), hydrostatics calculation and general Arrangement.

In terms of design, the students will be given areal design job and working as consultant group to closely replicates the real ship and offshore design practice. Designing ship hull forms and its related general arrangement to serve its functions done previously, this course also continuing the necessary design tasks including Stability Calculation and Assessment, Scantling Calculation and Strength Assessment, and Shell Expansion & material take off. This course emphasis is hands on design project works (in group) with continuous monitoring from the lecturer. Apart from providing the necessary technical knowledge and skills, the course also aimed at developing the necessary generic skills such as team working, oral and written presentation skills, project management skills, etc. The contents and conduct of the design project are as close to industry design practice as possible.

(f) Marine and Offshore Engineering Systems

The course covers the main engineering systems of the ship and offshore structure machinery. This includes the propulsion and auxiliary systems. Selected analysis of the thermodynamic processes of the system, description of the plant's main components, operating principles and plant performance will be studied. This includes the marine diesel engine and steam turbine power plant, electric and hydraulic power systems. Other important support systems such as air conditioning, fire, condition and performance monitoring systems will also be covered.

(g) Marine Transport Economic

The course focuses on delivering knowledge to students on two aspects of maritime transport and economics. Firstly, it is on the basic definitions and processes for the efficientoperation of global port and shipping operations. Secondly, is on the basic definition of the economics of port and shipping operations up to the concepts for appraising investment and financial performance. Additional knowledge is also given to students on the current issues influencing the world maritime scenario. The topics selected are globalization, technology and knowledge while addressing environmental issues.

(h) Marine Management, Environment and Safety

This course aims to prepare students with knowledge on basic principles of management, project management, marine environment and safety. The managementpart will examine key issues in management and organization, past and present

management, strategic management, organizational structure and design, human resource management, motivating employees and leadership. Project management shall cover network analysis, resources constrained project, crash time and project performance and risk assessment. Main topics covered under environment and safetywill be IMO, MARPOL, SOLAS and the like. OSHA1994, Factories and Machinery Act 1967 shall also be mentioned. Safety topics cover hazard identification, risk assessment and control, basic principles of accident prevention and occupational health. 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.

(i) Ship Resistance and Propulsion

This course introduces students to ship hydrodynamics, dimensional analysis, fundamental of ship resistance and its components, fundamental of ship model testingand extrapolation methods and marine propulsors. The course also includes propeller theories, methods of propeller design and the study of cavitation phenomena together with the analysis of propeller-engine matching.

CAREER PROSPECTS

Graduates of this programme are essentially Naval Architects, but with applied knowledge on offshore engineering. They could be registered with the Board of Engineers Malaysia (BEM) under the category of Naval Architect and join the Institute of Engineers Malaysia (IEM).

The Maritime Industry encompasses all forms of maritime activity and can be divided into several segments namely, Shipbuilding & Ship Repair, Offshore Structure and Vessels Fabrication, Ocean & Coastal Shipping Port Services, Marine Professional Services, MaritimeDefence and Law Enforcement, Government Authorities & Marine/Maritime Associations, Marine and Inland Fishing, Marine Tourism, Marine Mining, Marine Environment and Marine Products & Services.

There are excellent employment opportunities in all these segments of the maritimeindustry.

Naval Architects have a wide range of employment opportunities, not limited to areas such as Ship and Offshore Vessel Design, Construction and Repair, Consultancy, Marketing and Sales, Operations, Regulation, Surveying and Overseeing, Research and Development and in the Education and Training sector.

Naval Architects and Offshore Engineers play a vital role in the delivery of the many complex and challenging projects being developed. This is possible since they have the ability to model and solve a problem, describe and deliver an economical solution and then supervise and manage the work through to completion. The end product needs to be feasible, economical, safe, delivered on time, as well as respectful to the environment. All of these require a special combination of aptitude, vision and commitment.

Each type of work has its own distinctive character and offers opportunities for initiative and imagination in a wide variety of technical and managerial posts as well as opportunities for foreign travel. The workplace may be a large company, a small group, a consultancy or a government department.

Programme Educational Objectives (PEO)

Code	Intended Educational Objectives
PEO1	Demonstrate academic and technological excellence professionally and globally, particularly in areas related to naval architecture and offshore 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 their work and society.
PEO4	Adapt and communicate effectively and be successful working with multi-disciplinary teams.

Programme Learning Outcomes (PLO)

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

Code	Intended Learning Outcomes
PO1	Ability to acquire and apply fundamental knowledge of mathematics, science and engineering principles to solve complex naval architecture and offshore engineering problems; Keywords: **Engineering Knowledge**
PO2	Ability to identify, formulate and analyse complex naval architecture and offshore engineering problems; Keywords: **Problem Analysis**
PO3	Design solutions for complex naval architecture and offshore engineering problems that fulfil health, safety, societal, cultural and environmental needs; Keywords: **Design/Development of Solutions**
PO4	Investigate complex naval architecture and offshore engineering problemsusing research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**
PO5	Use modern engineering and information technology (IT) tools in complex naval architecture and offshore engineering activities, with an understanding oflimitations; Keywords: **Modern Tools Usage**
PO6	Apply professional engineering practice and solutions to complex naval architecture and offshore engineering problems related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**
PO7	Evaluate the sustainability and impact of professional engineering work in the

	solutions of complex naval architecture and offshore engineering problems in societal and environmental contexts; Keywords: **Environment and Sustainability**
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**
PO9	Work productively as an individual, and as a member or leader in a team that may involve multi- disciplinary settings; Keywords: **Team Working**
PO10	Communicate effectively on complex naval architecture and offshore engineering activities both orally and in writing; Keywords: **Communication**
PO11	Demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**
PO12	Undertake lifelong learning and manage information including conducting literature study; Keywords: **Lifelong Learning**

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 programme is a programme 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**	**CREDIT**	**PRE-REQUISITE**
SEMM 1203	Statics*	3	
SEMO 1503	Ship Engineering Drawing	3	
SEMM 1911	Experimental Methods	1	
SEMO 1922	Introduction to Naval Architecture and Offshore Engineering	2	
SEEU 1002	Electrical Technology	2	
SSCE 1693	Engineering Mathematics I	3	
ULRS 1012	Value and Identity	2	
UHLB 1112	English Communication Skills	HL	Refer English courses requirement section
Total		**16**	

YEAR 1 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	
SEMM 1113	Mechanics of Solids I*	3	SEMM 1203
SEMM 1213	Dynamics*	3	SEMM 1203
SEMO 1332	Naval Architecture I	2	SEMO 1503
SSCE 1793	Differential Equations	3	SSCE 1693
SEMM2921	Laboratory I	1	SEMM 1911
UHMS 1182	Appreciation of Ethics and Civilisations	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
UHLM 1012	Malay Language for Communication 2 (for International Students Only)		
Total		**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 2 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2313	Mechanics of Fluids I*	3	SEMM 1203
SEMM 2413	Thermodynamics*	3	
SEMM 2613	Materials Science	3	
SSCE 1993	Engineering Mathematics II	3	SSCE 1693
UKQF 2XX2	Service Learning and Community Engagement	2	
UHLX 1112	Foreign Language Communication Elective	2	
Total		**16**	

YEAR 2 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2223	Mechanics of Machines and Vibration*	3	SEMM 1213
SEMO 2123	Ship and Offshore Structures I	3	SEMM 1113
SEMO 2323	Marine Hydrodynamics	3	SEMM 2313
SEEU 2012	Electronics	2	SEEU 1002
SSCE 2193	Engineering Statistics	3	
UHLB 2122	Professional Communication Skills 1	2	
UHIS 1022	Philosophy and Current Issues	2	(International students can choose either UHMS 1182 or UHIS 1022 but UHLM1012 is compulsory)
Total		**18**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 3 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3023	Applied Numerical Methods	3	SEMM 1013, SSCE 1793**
SEMO 2713	Ship and Offshore Production Technology	3	
SEMO 3512	Ship and Offshore Design	2	SEMO 1332
SEMO 3333	Naval Architecture II	3	SEMO 1332
SEMO 3353	Ship Resistance and Propulsion	3	
UHLB 3132	Professional Communication Skills 2	2	
Total		**16**	

YEAR 3 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE- REQUISITE**
SEMO 3033	Computational Methods in Ocean Engineering	3	SEMO 2123** SEMO 2323**
SEMM 3242	Instrumentation	2	SEEU 2012**
SEMM 3623	Materials Engineering	3	SEMM 2613
SEMO 3133	Ship and Offshore Structure II	3	SEMO 2123**
SEMO 3523	Integrated Ship & Offshore Design Project I	3	SEMO 3512
SEMO 3931	Marine Laboratory I	1	SEMM 2921
ULRS 3032	Entrepreneurship and Innovation	2	
Total		**17**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

SHORT SEMESTER			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMO 3915	Industrial Training		##, SEMO 2123**, SEMM 2223**
Total		**5**	

Remarks:

Obtained minimum of 80 credits

YEAR 4 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMO 4233	Dynamics of Marine Vehicles	3	SEMM 2223, SEMO 2323
SEMO 4423	Marine and Offshore Engineering System	3	SEMM 2413
SEMO 4533	Integrated Ship & Offshore Design Project II	3	SEMO 3523
SEMO 4912	Undergraduate Project I	2	SEMM 2223**, SEMO 2123**
SEMO 4262	Risers & Mooring Dynamics	2	
SXXX xxx3	Free Elective	3	
Total		**16**	

Remarks:

i) *Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).

ii) For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.

iii) **Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.

iv) For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).

v) Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.

YEAR 4 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4902	Engineering Professional Practice	2	Must be 3rd year
SEMO 4924	Undergraduate Project II	4	SEMO 4912
SEMO 4823	Marine Management, Finance and Safety	3	
SEMO 4951	Marine Laboratory II	1	
SEMO 4xx2	Marine and Offshore Elective	2	
SEMO 3813	Marine Transport and Economics	3	
Total		**15**	

Remarks:

i) ***Core Courses – passing grade is C (50%). Passing grade for other courses is D+ (40%).**

ii) **For courses with pre-requisite(s), students MUST OBTAIN the passing grade for the pre-requisite course(s) unless stated otherwise.**

iii) ****Students MUST OBTAIN minimum grade D- (30%) for the pre-requisite course.**

iv) **For courses with pre-requisite(s) in sequence, students MUST ALSO FULFIL all the preceding pre-requisite(s).**

v) **Students MUST OBTAIN at least 20% of total marks in any mechanical engineering courses final examination.**

ENGLISH COURSES REQUIREMENT

Students with English qualification shown in table below are exempted from Compulsory Attendance (HL) for UHLB 1112

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exempted

MARINE AND OFFSHORE ELECTIVE COURSES

Choose one (1) from Elective

SEMO 4012 Marine Environment

SEMO 4132 Marine Control Engineering

SEMO 4142 Reliability of Ship and Offshore Structures

SEMO 4152 Platform, Pipeline and Sub-Sea Technology

SEMO 4452 Marine Engineering System Project

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	SEMO 1503	Ship Engineering Drawing	3	3	
6	SEMO 1332	Naval Architecture I	2	2	
7	SEMM 1911	Experimental Methods	1	1	
8	SEMO 1922	Introduction to Naval Architecture and Offshore Engineering	2	2	
8	SEMM 2223	Mechanics of Machines & Vibration	3	3	
9	SEMM 2313	Mechanics of Fluids I	3	3	
10	SEMM 2413	Thermodynamics	3	3	
11	SEMM 2613	Materials Science	3	3	
12	SEMM 2921	Laboratory I	1	1	
13	SEMM 3023	Applied Numerical Methods	3	3	
14	SEMO 3033	Computational Methods in Ocean Engineering	3	3	
15	SEMM 3242	Instrumentation	2	2	
16	SEMM 3623	Materials Engineering	3	3	
17	SEMM 3931	Laboratory II	1	1	
18	SEMM 4902	Engineering Professional Practice	2	2	
19					
20	SEMO 2123	Ship & Offshore Structures I	3	3	
21	SEMO 2713	Ship & Offshore Production Technology	3	3	
22	SEMO 2323	Marine Hydrodynamics	3	3	
23	SEMO 3512	Ship & Offshore Design	2	2	
24	SEMO 3333	Naval Architecture II	3	3	
25	SEMO 3353	Ship Resistance & Propulsion	3	3	
26	SEMO 3133	Ship & Offshore Structures II	3	3	
27	SEMO 3523	Integrated Ship & Offshore Design Project I	3	3	
28	SEMO 3813	Marine Transport & Economics	3	3	
29	SEMO 3915	Industrial Training	5	HL	
30	SEMO 4233	Dynamics of Marine Vehicles	3	3	
31	SEMO 4423	Marine & Offshore Engineering System	3	3	

32	SEMO 4533	Integrated Ship & Offshore Design Project II	3	3	
33	SEMO 4823	Marine Management, Finance & Safety	3	3	
34	SEMO 4912	Undergraduate Project I	2	2	
35	SEMO 4924	Undergraduate Project II	4	4	
36	SEMO 4941	Marine Laboratory	1	1	
37	SEMO 4262	Risers & Mooring Dynamics	2	2	
38	SEMO 4xx2	Marine & Offshore Elective	2	2	
TOTAL CREDIT FOR ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (Faculty 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					
UNIVERSITY FREE ELECTIVE					
1	SXXX xxx3	Free Elective	3	3	
MALAYSIA CORE VALUE					
1	UHIS 1022	Philosophy and Current Issues	2	2	
2	UHMS 1182	Appreciation of Ethics and Civilizations	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			
VALUE AND IDENTITY					
1	ULRS 1012	Value and Identity	2	2	
GLOBAL CITIZEN					
1	UKQF2XX2	Service Learning and Community Engagement	2	2	
COMMUNICATION SKILLS					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHLX 1112	Foreign Language for Communication	2	2	
ENTERPRISING SKILLS					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)			**19**	**19**	
TOTAL CREDIT TO GRADUATE (A + B + C + D)			**136**	**131**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATION (PCS) • Students are required to enrol and pass FIVE (5) PCS courses, in order to be eligible to graduate			
Compulsory PSC Courses			
1	GSPX XXXX	Design Thinking for Entrepreneur	
2	GSPX XXXX	Talent and Competency Management	
3	GSPX XXXX	English Communication Skills for Graduating Students (ECS)	
Elective PSC Courses (Choose 3 only)			
1	GSPX XXXX	Data Analytic for Organization	
2	GSPX XXXX	Quality Management for Built Environment and Engineering Professionals	
3	GSPX XXXX	Construction Measurement (Mechanical & Electrical)	
4	GSPX XXXX	Professional Ethics and Integrity	
5	GSPX XXXX	OSHE for Engineering Industry and Laboratory	
6	GSPX XXXX	OSHE for Construction Industry and Laboratory Works	
7	GSPX XXXX	Safety and Health Officer Introductory Course	

COURSE SYNOPSIS

CORE MECHANICAL 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 conceptof 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 applythe 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 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 errorsand 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 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 buoyancyanalysis. Dynamic flow analysis inclusive of technique in solving flow problems is introduce specially to solve flow measurement, mass or volumetric flow rate, momentum in flow and lossin pipe network. Lastly, some basic dimensional analysis and similarities will be introduced. Atthe end of the course, the student should be able to demonstrate an ability to analyse whether statically, dynamically or kinematically problems related directly to 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 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 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 theparticular 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 casestudies in applied mechanics, strength of materials, thermal science, and fluid mechanics arepresented. 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 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 3623 - Materials Engineering

This course is designed to introduce students to the concept of fracture mechanics and how engineering materials respond to mechanical loads. The failure behaviour of engineering materials will cover fracture, fatigue, creep, wear and corrosion. The course will also provide students with knowledge of how to conduct failure analysis and determine the root cause of failure under different mechanical loading. The mechanical behaviour of polymeric materials,ceramics and composites will also be covered examples of case studies as well of selecting engineering materials for specific product designs.

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 aprofessional 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, a community service activity in a planned and structured manner. At the end of the course, students should be able to demonstrate and applyengineering professional ethics in their career as an engineer.

PROGRAMME CORE COURSE

SEMO 1503 - Ship Engineering Drawing

This course introduces students to the basic of ships and engineering drawing knowledge. It enables students to apply their skills and knowledge of engineering drawing to understand any design via geometric drawing, orthographic projection, isometric and production drawing. Meanwhile, in ship drawing parts, the student will be able to interpret a hull formation through lines plan drawing which consists of body, half breadth and sheer plan projection. Basic terminologies which related to naval architecture and ship drawing will be highlighted in this course.

SEMO 1332 - Naval Architecture I

In this course, students will continue to learn basic naval architecture knowledge. For this subject, students are exposed on how to use the ship particulars and lines plan data in calculating the hydrostatic particulars of a ship. Students are introduced to the methods of hydrostatics and stability calculations. Students are then introduced to design concept as theyare required to use their naval architecture knowledge to design an object for floating structuredesign competition. The subject contents also include the introduction to ship general arrangement. The course includes hands-on individual and group projects

SEMO 1922 - Introduction to Naval Architecture and Offshore Engineering

The course comprises two parts intended to introduce students to the field of naval architecture and offshore engineering. The first part raises the students' awareness on the importance and necessity in developing systematic approach for solving naval architecture and offshore engineering problems. It introduces the importance of some generic skills to naval architects and offshore engineers. It also provides students an overview of the differentfields within naval architecture and offshore engineering and a description of the naval architects and offshore engineer's work and professional responsibilities. The second part aims to expose students to the hands-on nature of basic engineering workshop skills.

SEMO 2123 - Ship and Offshore Structure I

This course is concerned with the knowledge on loading and stresses of ship and offshore structure. It begins with the components and functions on ship and offshore structures. The floating hull loading, shear forces and bending moments are then in detail discussed. The important structural strength analysis for ship and offshore structures will be highlighted on bending and buckling afterward.

SEMO 2713 - Ship & Offshore Production Technology

This course is essential as it prepare the student with the basic knowledge and exposure on construction process of ship & offshore structures. This course covers the hardware and software aspects of ship and offshore production technology. It begins with the introduction toshipbuilding industry, its importance and development in world economics and in Malaysia. Ship and offshore /production construction process flow chart and activities.Production/construction yards location, layout and facilities. Material treatment including surface preparation, cutting process, welding, painting process etc. that involve in the construction process. It followed by sub assembly, block assembly and erection process of offshore structures. Upon completion, Launching, transporting and upsetting process will alsobe discussed. On the soft engineering side, the quality control and production system will alsobe taught. Apart from normal lecture

hours, the student is expected to carry out class assignment, field survey or site visits to ship and offshore production yards and technical writing. Therefore, the course is expected to develop and enhance the student ability to discuss and explain the related knowledge, to work in team effectively, long life learning and communication skills.

SEMO 2343 - Marine Hydrodynamics

This course starts with enhance the knowledge in fluid mechanic with discussion on the motion of Real fluid and Ideal fluid. Basic knowledge of marine hydrodynamics theory and general concept of numerical approach in simulate the flow around floating body are introduced in this course. Further discussions are also given in surface waves and various hydrodynamic problems. The hydrodynamic coefficients such as added mass coefficient, damping coefficientand wave loading are defined. Brief discussion is also given on the motion of floating body inregular wave by related to the hydrodynamic coefficients of the floating body.

SEMO 3133 - Ship and Offshore Structure II

This course is divided into three main areas, namely ship/platform topside vibration, finite element methods and underwater structural failure. In the vibration it starts with introduction to the structural vibration, free vibration and forced vibration. It is then followed by the vibration calculation in ships and platform topside structure. Method of determining vibration characteristics and reducing vibration are given for design practices. FEM covers the analysisof statically indeterminate structure by the direct stiffness method of truss, beam and plane frames. The students are also required to carry out building frame project using FEM software.In the underwater structural failure, it reviews the various modes of structural failure and highlights the importance of fracture induced failure and contrasts it with the limited coveragegiven to fracture mechanics in underwater. This section will discuss some examples of well- known failures/accidents attributed to cracking. Then, using a simple example we shall compare the failure load predicted from linear elastic fracture mechanics with the one predicted by classical strength of material. The ability to learn independently, working in teamand interpret the results objectively will also be emphasized in this course.

SEMO 3033 - Computational Methods in Ocean Engineering

This course is designed to enhance the students' computational knowledge in simulating fluid flow and strength of floating structure. In the first half semester, the fundamental knowledge on computational fluid dynamic will be introduced to students. The course will enhance the basic knowledge that has been developed in the Marine Hydrodynamics and expose the students in analysing hydrodynamically the flow field. It will emphasize on the analysis and the importance of boundary layer, ideal and compressible flow in a practical engineering application. The course will also provide the knowledge on analysis of flow through marine vehicle and structure. In the second half semester, the course will be focused in the computational solution to analysis the strength of floating structure. It starts with discuss the external loading to the floating structure such as the effect of flow and wave to the stress on the floating structure. After that, the course gives students an exposure to the theoretical basisof the finite element method and its implementation principles. The students will be applied the finite element method to develop the governing equation and solve the equation for the giving simple engineering problem. Besides, this part of the course also introduces the use ofgeneral-purpose finite element software for solving real-life engineering problems. At the endof the course,

students should be able to demonstrate and apply the theory to solve problem related to marine hydrodynamics.

SEMO 3333 - Naval Architecture II

This course introduces students to further naval architectural knowledge. It enables students to familiarise themselves with naval architectural terms ship components and undertakes hydrostatics and stability calculations. Students will be able to carry out calculations to determine ship stability in all conditions. The content covers calculation of areas, moments and centroids, transverse stability, longitudinal stability, large angle stability, damage stabilityand launching.

SEMO 3512 - Ship and Offshore Design

This course introduces the students to Ship and Offshore Design. It starts with the definition of design and spiral nature of ship design process. Four different stages of ship design will be discussed briefly but focusing more on basic ship design covering conceptual design and some of preliminary design stage. The contents of the course mainly cover the theory and governing principles used in basic ship design starting from understanding mission and owners requirement, followed by preliminary estimation of main dimensions, hull form properties and generation process, preliminary calculation of hydrostatics and stability and preliminary general arrangement of the ship. Some of the statutory requirements in design will also be discussed and finally method of estimating first cost of the ship will be introduced.Apart from the theoretical background, the student will also require carrying out hands on project (in group) to determine the main dimension and conceptual sketch of general arrangement of a ship based on the given design/owners' requirements. This will provide them with the initial exposure and experience of applying the knowledge learned in theory tosolve the real problem given.

SEMO 3523 - Integrated Ship & Offshore Design Project I

Integrated Ship and Offshore Design Project consists of two Parts run in two consecutive semesters (6 & 7 Sem). This course is the first parts of the IDP that requiring the students to carry out several basic ship design tasks. It covers the Hull form development of the ship based on the design requirements and main dimensions of the ship, General Arrangement design & Capacity calculation and Hydrostatics calculation and Stability Assessment. The result of the design works of this course will be used for following design tasks in the following semesters. The students working in group of three are expected to propose the ships and its main systems that able to deliver the intended design requirements (problem). The design tasks and the quality of the solution should reflect the real design works in industry. In carrying out the design task effectively, the students are expected to apply and integrate the knowledge learnt in the core courses and acquiring new knowledge on their own in order to solve the design problem correctly. Hence the PoPBL (Project Oriented Problem Based Learning) approach is adopted in this course. Apart from technical knowledge and design skills, the students will also be exposed to several generic skills such as team working and leadership skills, communication skills, project management.

SEMO 3353 - Ship Resistance & Propulsion

This course introduces students to ship hydrodynamics, dimensional analysis, fundamentals of ship resistance, ship resistance and its components and methods of determining ship total

resistance. The course then introduces the fundamentals of ship model testing and extrapolation methods to full scale ships. The course discusses various marine propulsors andspecifically the marine propeller. The course also includes the description of propeller geometrical features and its effect on propeller performance. Propeller theories, methods of propeller design and the study of cavitation phenomena together with the analysis of propeller-engine matching also discussed.

SEMO 3813 - Marine Transport & Economic

This course focuses on delivering knowledge to students on two aspects of maritime transport and economics. Firstly, is on the basic definitions and process for the efficient operation of global port and shipping operations. Secondly is on the basic definition for the economics of port and shipping operations up to the concepts for appraising investment and financial performance. Additional knowledge is also given to students on the current issues influencingthe world maritime scenario. The topics selected are globalization, technology and knowledgewhile addressing environmental issues.

SEMO3931 - Marine Laboratory 1

This course is introduced in the third year of the program, involving two hours session per week and experimental based courses. It consists of four experiments; Inclining Test, Roll Decay Test, Calm Water Resistance Test, and Open Water Test. Students will be grouped into 5 to 6 for each experiment. It is based on the theory learned in the Naval Architecture and Offshore Engineering courses at the previous semesters. In general, every student has to carry out a total of twelve experiments. This course is designed to enable students to apply knowledge of ship resistance, stability, open water test and roll motions in their laboratory works. This course will also train students to plan and manage their work within a given timeline. It also develops student's capability to discuss and analyze experimental results clearly, effectively and confidently through written laboratory reports. At the end of the session, students have to submit a report for each experiment

SEMO 3915 - Industrial Trainin

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 which requires the students to learn the process and able to apply their knowledge acquired in class into actual industrial setting. The knowledge acquire during practical training may be used later in final year class as well as to equip them with sufficient knowledge for job interviews.

SEMO 4233 - Dynamics of Marine Vehicles

Marine vehicles and floating structures are built for transportation and to perform various marine activities such as fishing and offshore drilling. This course provides the knowledge of the characteristics of vessels/structures and the effect of the environment on their behaviour.The course begins with the introduction to effects of waves on vessels and structures. Since ocean waves are complex in nature, by incorporating linear wave theory, statistical methods can be adopted to study the irregular behaviour of waves and relate to vessels/structures motions characteristics. Some of the topics include; Introduction to seakeeping and solving seakeeping in waves using strip theory. Introduction to manoeuvrability of vessels that are motions in the horizontal plane so that they can proceed on a straight path, turn or take otheravoiding actions

in calm water as well as in waves, wind and current. This course emphasiseson the student's ability to identify and solve the behaviour marine vehicles/structures problemsby carrying the necessary calculation and analysis.

SEMO 4423 - Marine and Offshore Engineering System

The course covers the main engineering systems of the ship and offshore structure machinery. This includes the propulsion and auxiliary systems. Selected analyses of the thermodynamic processes of the system, description of the plant main components, operating principle and performances will be studied. This includes the marine diesel engine and steam turbine power plant, electric, drilling and hydraulic power system. Other important support system such as air conditioning, fire, condition and performance monitoring system will also be covered.

SEMO 4533 - Integrated Ship and Offshore Design II

This is the second part of Integrated Ship & Offshore Design Project, continuation from the first part SEMO 3513. The students working in the same group as in part I are expected to continue the ship design tasks by performing structural design and strength assessment and addressing the sustainability aspect of the design in order to complete most of the tasks in preliminary design process. The design work continues with the Offshore Structures design which could be chosen between Semi-Submersible, TLP, FPSO etc. depending on the availability of data. The design task focuses on structures configuration, Hydrostatics Calculation, Stability Assessment based on MODU, Seakeeping and Mooring Analysis and Structural Strength Assessment of the selected offshore structures. The design tasks and thequality of the solution should reflect the real design works in industry. In carrying out the design task effectively, the students are expected to apply and integrate the knowledge learntin the core courses and acquiring new knowledge on their own in order to solve the design problem correctly. Hence the PoPBL (Project Oriented Problem Based Learning) approach is adopted in this course. Apart from technical knowledge and design skills, the students willalso be exposed to several generic skills such as team working and leadership skills, communication skills and project management.

SEMO 4262 - Risers & Mooring Dynamics

This course provides the design and installation operations of riser and mooring systems. Emphasis is made on design of deep-water moorings and riser system by the accepted industry practices and design codes and criteria. It starts with the types and layout of risers, layout and geometry of mooring and line types. Then the riser and mooring line design cycle is introduced and in this section the students calculate the environmental loads, pretension and static equilibrium, and vortex-induced-vibration (VIV), and analyse the static and dynamicperformances including floater. The students also solve the dynamic performances of riser/mooring lines using simulation software (e.g. MOSES) and analyse the fatigue of riser and mooring chains.

SEMO 4823 - Engineering Management Environment & Safety

This course aims to prepare students with knowledge on basic principles of management, project management, marine environment and safety. 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. Project management shall cover network analysis, resources constrained project,

crash time and project performance and risk assessment. Main topics covered under environment and safety will be IMO, MARPOL, SOLAS and the like. OSHA 1994, Factories and Machinery Act 1967 shall also be mentioned. Safety topics cover hazard identification, risk assessment and control, basic principles of accident prevention and occupational health.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.

SEMO 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 student 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 theirresearch proposal to be assessed by their supervisors and panel of assessors.

SEMO 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 analyse results of the research clearly, effectively and confidently in both oral presentation and in dissertation.

SEMO 4951 - Marine Laboratory 2

This course is designed to enable the students to apply knowledge of seakeeping & motions in waves, manoeuvring, offshore structure tests in the laboratory works. The students need to seek information and prepare marine model experiments protocol and procedure. This course will train the students to prepare the experimental set up and conduct the marine model experiments. They are instructed to analyse the experimental result and deduce the appropriate conclusion. The students need to adopt team work to solve seakeeping & motions, manoeuvring, and self-propulsion tests. This course also develops the students' capability to present, discuss and analyse experimental results clearly, effectively and confidently in the oral presentations as well as in the written laboratory reports.

ELECTIVE COURSES:

Elective courses are offered to provide a wider area of study. Students can choose the courses according to their interest.

SEMO 4012 - Marine Environment

This course gives an introduction to the courses of oceanography and marine meteorology. It explains the fluid physical characteristics and movement on the earth surface. As such, the student will have a clear understanding of the weather which results from the interaction between the atmosphere and the sea surface.

SEMO 4132 - Marine Control Engineering
The course encompasses control engineering analysis and the vessel's auxiliary systems. This includes marine control engineering systems, hydraulic and electrical system. The students are expected to solve control engineering problems, analyse the performance and operation of marine control systems

SEMO 4142 - Reliability of Ship and Offshore Structures
This course provides reliability of ship and offshore structure as the complement of the failure probability for a rational measure of safety in structural design. The course applies the reliability method which deals with the uncertain nature of loads, resistance, etc. and leads to assessment of the reliability. The reliability method is based on analysis models for the structure in conjunction with available information about loads and resistances and their associated uncertainties. These are introduced to the analysis models that are usually imperfect, and the information about loads and resistances is usually incomplete. At the end of the course, students should be able to calculate the reliability as assessed by reliability method that is generally not a purely physical property of the structure but rather a nominal measure of safety of the structure given a certain analysis model and a certain amount and quality of information.

SEMO 4152 - Platform Pipeline and Sub-Sea-Technology
This course provides the concepts of offshore platform, submarine pipeline and subsea- technology, basic calculation on strength and fatigue, safety on fatigue life, reliability assessment, design issues, fabrication, installation and operations of offshore platform, submarine pipelines and risers, and also understanding of the equipment used in subsea developments.

SEMO 4452 - Marine Engineering System Project
Marine Engineering System Project is designed for final year students to perform marine systems design. Students are required to specifically design a typical marine engineering system for a chosen ship or offshore vehicles. Students are then required to integrate these systems together to form a workable compromise and fulfil the vessel's intended function. Thestudents are expected to understand the design processes, operations and selection of the auxiliary systems. For this subject, students are required to have numerous discussions and presentations to complete the design. Implementation of this course is via group project.

INTEGRATED BACHELOR-MASTER PROGRAMME (PRISMS) ELECTIVE COURSES

LIST of PRISMS ELECTIVE COURSES

1. **MASTER OF SCIENCE (MECHANICAL ENGINEERING)**
    - SEMM 5023 - Product Innovation and development
    - SEMM 5113 - Advanced Mechanics of Composite Structures
    - SEMM 5223 - Advanced Industrial Automation
    - SEMM 5273 - Vibration measurement and control
    - SEMM 5343 - Friction, wear and lubrication
    - SEMM 5413 - Energy Management

- SEMB 5613 - Advanced Materials Processing
- SEMB 5623 - Smart Materials
- SEMB 5633 - Assets Integrity and Management
- SEMB 5643 - Structural composites
- SEMP 5713 - Statistical Quality Engineering
- SEMP 5723 - Green Manufacturing Technology
- SEMP 5733 - Digital Manufacturing
- SEMV 5313 - Advanced Vehicle Dynamics
- SEMV 5403 - Internal Combustion Engine & Boosting system
- SEMV 5503 - Advanced Vehicle Powertrain

2. MASTER OF SCIENCE (INDUSTRIAL ENGINEERING)

- SEMI 5813 - Statistical Quality Engineering
- SEMI 5823 - Supply Chain and Logistics
- SEMI 5833 - Work System and Ergonomics
- SEMP 5713 - Statistical Quality Engineering
- SEMP 5723 - Green Manufacturing Technology
- SEMP 5733 - Digital Manufacturing

PRISMS ELECTIVE COURSE SYNOPSIS

MASTER OF SCIENCE (MECHANICAL ENGINEERING)

SEMM 5023 - Product Innovation and Development

This course introduces the students to the various stages of product design and development methods that can be put into immediate practice in developing products or projects. The development procedures blend the various perspective of marketing, design and manufacturing into a single approach to product development. Aspect of sustainable design and manufacturing will also be covered. The course also provide practice in carrying small project to expose the various stages of product development. It also includes the various prototyping and manufacturing systems strategies in developing product prototype.

SEMM5113 - Advanced Mechanics of Composite Materials

This course introduces students to some major views and theories in the area of composite materials especially in the polymer based composite learning with emphasis on the types of materials, production methods, failure analysis and the mechanics of laminated composites. It will examine some key issues in the mechanics of laminated composites with special focus on the stress-strain relationship and interaction to the extensional, coupling and bending stiffness matrices in promoting learning. Sandwich structures and interlaminar fracture toughness will also be included in this syllabus. The course will also provide a visit to industries dealing with polymer based composite materials in order the students to understand more regarding the practical sides of the subject.

SEMM 5223 - Advanced Industrial Automation

The course is an elective for students seeking a specialty in mechanical engineering. It shall introduce students to the methods, tools, and technologies used to automate a product or a plant. Primary automation technologies include sensors, actuators, signal conditioners, microprocessor/microcontroller, programmable logic controllers (PLCs), ON/OFF and automatic control, and PC-based control are covered within this course. Students will also experience development of automated product/plant through hardware programming and interfacing implementation.

SEMM 5273 - Vibration Measurement and Control

The course relates to practical aspects of vibration measurements and the control of vibration in mechanical and engineering systems. Cause and effects of vibration related failures are presented that highlight the importance of measurements, diagnosis, assessment and control of vibration in the industry. A review of vibration basics from a measurement perspective is presented. Important aspects of vibration data acquisition, signal processing and data interpretation are covered. Topics in vibration fault analysis, avoidance of vibration induced failures, and reduction of vibration and design of control solutions are covered. The course involves measurements and design exercises to demonstrate and to apply knowledge in vibration instrumentation and control.

SEMM 5343 - Friction, Wear and Lubrication

This course covers basic knowledge on tribological contact in mechanical systems in relative

motion. The course presents the importance, role and properties of contact surfaces, materials and surroundings. Furthermore, the influence of the components of a tribological system and contact conditions on the properties of friction and tear is explained. The course covers the types and the role of lubricants, as well as their influence on the quality of lubrication, friction, and on various friction and wear mechanics. In relation to these topics, the analyticaltechniques available for the analysis of surface properties, lubricants, tribological behaviour and wider systems are presented.

SEMM 5413 - Energy Management

Energy management is meant for guiding energy-sector activities to conserve energy and enhance energy supply and security. Energy management includes four main functions: analysis of historical data, energy audit and accounting, engineering analysis of systems, andenergy economics. This course covers contemporary energy management topics such as energy sector challenges, energy policy and regulations, energy management system, energyaudit, energy economics, and emerging energy technologies. This course also provides training in gathering updated energy related information to apply in real-life applications. The course is multidisciplinary in nature and students will be required to look at the energy sectorproblems from a holistic point of views. After successful completion of this course, the studentswould comprehend the energy management knowledge to play their role in conserving and efficient use of energy in building and industry.

SEMB 5613 - Advanced Materials Processing

This course introduces students to the manufacturing methods of materials engineering into the desired shapes. It starts with the basic concepts of manufacturing and processing and their applications to materials engineering 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. In addition to the advanced processes of traditional materials, the course also covers the advanced process for semiconductor materials and optical fibre, the thin film deposition process on nanoscale application, and Layer-Based Additive Manufacturing Technologies.

SEMB 5623 - Smart Materials

This course introduces students to the recent developments on the various classes of smart materials or functional materials used in applications such as aerospace, automotive, biomedical and electronic industries. It will emphasize on the important properties exhibited by smart materials that make them selected for high-end and advanced applications. The physical and mechanical properties of the various classes of smart materials will be detailed as well as the unique processing techniques associated with producing these materials. The course will also cover shape memory alloys, self-healing materials, materials for sensor and actuator, and sustainable materials. The students are enabled to describe structural setup andfunction 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 5633 - Asset Integrity and Management

This course is introducing the students to the Asset Integrity Management (AIM) system especially for an aging offshore oil field infrastructure. The platforms, pipelines and onshore facilities were aged and needed some extensive refurbishment and a new inspection and integrity regime put in place. The course also provides a comprehensive coverage of the various non-destructure techniques (NDT) used to assess the intergrity of engineering components. The concepts and techniques used in assessing assets through risk based assessement (RBI) be covered.

SEMB 5643 - Structural Composites

Advanced composite materials are used in many industries including aerospace, marine, automotive, medical, energy, and recreation. Striking examples of the expanding use of composites are the Boeing 787 and Airbus A350, as these materials improve performance and save weight. To better prepare engineers in applying these new material technologies tothe design and manufacturing of composite structures. This subject provides an introduction to structural composites, starting with the "trinity" - the interaction between shape design, basematerial and manufacturing. The course covers the design principles of composites structure;durability and fatigue; testing; manufacturing methods and mechanics. The main focus is on composites structures made with polymer matrices but use of metals and ceramics as matrices will be addressed as well. By the end of this course students will be able to know what design choices they have to make for different requirements. Also, the student will be able to identify the unique characteristics of composites and apply the fundamental and practical knowledge necessary to build and maintain composite structures.

SEMP 5713 - Statistical Quality Engineering

This course is designed to provide the students with sound understanding to statistical methods in quality improvement. It encompasses various statistical process control problem-solving tools. For control charts, emphasis was given on additional control charts not coveredpreviously at the undergraduate level. Advanced tools and techniques such as Gauge Repeatability and Reproducibility (GR & R), Quality Function Deployment (QFD), Failure ModeEffect Analysis (FMEA) and experimental design methodology were also covered.

SEMP 5723 - Green Manufacturing Technology

This course introduces students to green manufacturing technology and sustainability considerations in product design and manufacture. It is present the principles, methodology and case studies to develop an understanding of sustainable development that can reduce environmental impact and promote green technology for sustainable practice. Besides that, itis also introducing the Life Cycle Assessment consists of four main phases, goal and scope definition, inventory, impact assessment, and interpretation. Analysis of use valid life cycle assessment method to collect and process data of the product's life cycle orthe manufacturing processes consumption or declaring the total emissions from the manufacturing.

SEMP 5733 - Digital Manufacturing

This course aims to prepare students with one of the pillar knowledge under industrial 4.0 industrial revolutions. Digital Manufacturing (DM), also known as 3D Printing Technology, is a group of manufacturing technologies that involves part creation by joining material together without part-specific tooling, driven by a computer. The technologies focus on prototypes and

low-technology applications, DM service parts are being used in safety-critical fields including aerospace, automotive, biomedical, and services industries. The purpose of this course is to provide participants with knowledge and tools for informed decision making relative to integration of DM processes and parts into the industrial application. The coverage includes current DM practice for metals, polymers and ceramics; mechanical properties; DM processingfor production; and application inroads into industrial applications. At the end of the course, students should be able to describe fundamental aspects of Additive Manufacturing/3D Printing Technology techniques and their application; finally, also perform engineering analysis to solve product manufacture problems and evaluate engineering investment/projects by utilised this technique.

SEMV 5313 - Advanced Vehicle Dynamics

This course discusses vehicle dynamics in general which covers the vehicle's ride and handling behaviours. The systems which contribute to a better vehicle dynamic performance in modern passenger vehicle will be covered in this course. This includes the semi-active and active suspension systems, roll control systems, electronic brake force distribution (EBD) system, anti-lock braking system (ABS) and active steering system. The importance of vehicledynamics for automated vehicle will also be covered in this course. This includes handling modelling and control system of an automated vehicle which utilises sensors data to maneuver. All of the mentioned systems will be introduced theoretically followed by the development of the systems' simulation model using MATLAB/SIMULINK. At the end of the course, the students are able to develop modern vehicle dynamics'-controlled systems whichare typically used for an outstanding dynamics performance for a vehicle.

SEMV 5403 - Internal Combustion Engine & Boosting Systems

This course is designed to deliver the principles of internal combustion engine and boosting systems. The subject covers the types of internal combustion engines and its operations. Furthermore, the latest technologies that make internal combustion engine to be more efficientand less polluting are also covered in this subject. Additionally, the course emphasizes on theengine air induction system, in particular the turbocharging and supercharging methods. It covers the science governing the operation of turbochargers and superchargers – which include aerodynamics, gas dynamics and thermodynamics. Upon completion of this course, students will have advanced understanding of how internal combustion engine with boosting system can meet the strict emission and energy efficiency targets.

SEMV 5503 - Advanced Vehicle Powertrain

This course covers principle knowledge of conventional and alternative powertrain systems for automotive applications. It includes main components in the powertrain systems namely powerplant (internal combustion engine/electric motor), transmissions and power storage (battery). At the end of the course, students should be able to propose powertrain system for passenger vehicles.

MASTER OF SCIENCE (INDUSTRIAL ENGINEERING)

SEMI 5813 - Statistical Quality Engineering

This course is designed to provide the students with sound understanding to statistical methods in quality improvement. It encompasses various statistical process control problem-solving tools. For control charts, emphasis was given on additional control charts not coveredpreviously at the undergraduate level. Advanced tools and techniques such as Gauge Repeatability and Reproducibility (GR & R), Quality Function Deployment (QFD), Failure ModeEffect Analysis (FMEA) and experimental design methodology were also covered.

SEMI 5823 - Supply Chain and Logistics

This course is identifying strategic importance of good supply chain and logistics design and management on the competitive position for each supply chain members. The main goal of this course is to understand the fundamental of supply chain and logistics including logistics vs supply chain, supply chain drivers, metrics and performance, distribution and network designs, 3PL, 4PL, transportation, procurement and sourcing and the logistics and supply chain in the future in order to satisfy end customers. This course also concerns about techniques for designing transportation networks, distribution issues, logistics management, integration issues and performance measurement.

SEMI 5833 - Work System and Ergonomics

This subject aims to provide students with fundamental knowledge of ergonomics (also known as human factors engineering) relevant for industry. This includes fundamental concepts and analysis of industrial problems in ergonomics such as practice of ergonomics principles and methodology, solving industrial problems related to ergonomics, information input and design, human physical work capacity, job design and task analysis including Ergonomics Risk Assessment (ERA).

ACADEMIC ADVISING

ACADEMIC ADVISING

Universiti Teknologi Malaysia in general and Faculty of Mechanical Engineering specifically practice academic advising where each student is placed under the guidance of an Academic Advisor who is appointed among the academic staff in the faculty.

The academic advising is aimed to assist students to get used to the University education system which is very different from the school education system, to help students in solving problems related to academic matters such as study load, aim and objective of programmes, or problems related to appropriate studying techniques, and to help students in getting the maximum benefit from the semester system.

Academic Advisor will aid to solve the mentioned above problems faced by students under his/her supervision. Undergraduate students are required to discuss with his/her Academic Advisor in deciding on the courses to be taken before registering for a particular semester.

AIMS AND OBJECTIVES

Generally, emphasis are given on advices relating to academic matters and improvement of the student performance:

i. Guiding and assisting students to familiarise themselves with learning based on the semester system.
ii. Acting as an advisor to students especially in the academic field Guiding students to work in a team
iii. Assisting any student who faces difficulties especially in the academic field
iv. Acting as a link between students and staff (academic and general) with FKM
v. Nurturing a balance attitude and assisting in personality development of students in line with the need of the nation.

Academic advisor	Roles of students
1. Improving students' academic performance and self-confidence 2. Selection of course and field of specialization 3. Intellectual development 4. Improving relationship between students and academic staff 5. Encouraging co-curricular activities 6. Student registration 7. Assisting students in overcoming problems in their course 8. Consulting on career 9. Identifying students who require counseling 10. Preparing academic report and letter of recommendation to former students under his/her advice	1. Meeting the Academic Advisor during the first week to receive general briefing on the semester system and other matters related to studies. 2. Obtaining endorsement of course and examination registrations. 3. Seeking advice from the Academic Advisor on preparation of study programme in the aspects of course selection, total credit hours to register and duration of study. 4. Obtaining endorsement for application to withdraw course 5. Seeking advice on the effects of registration and withdrawal of courses. 6. Informing and discussing with the Academic Advisor on academic performance and on any problem encountered throughout each semester

ACADEMIC STAFF

DEPARTMENT OF APPLIED MECHANICS & DESIGN

Director of Department

Dr.-Ing. Zair Asrar bin Ahmad
BEng (Mech-Aero), UTM
MSc (Mech. Eng), UTM
PhD (Mech. Eng.), Otto-von-Guericke Universität, Germany
Room : C23-318
Email : zair@utm.my
zair@mail.fkm.utm.my

Professors

Ir. Dr. Leong Yew Mun @ Mohd. Salman
BSc (Hons) (Mech. Eng.), Heriot-Watt, UK
PhD (Rotordynamics), Heriot-Watt, UK
PEng, M.I.E.M
Room : C24-336
Email : salman.kl@utm.my
salman@ic.fkm.utm.my

Dr. Mohd. Nasir bin Tamin
BSc (Mech. Eng.), Northrop
MSc (Mech. Eng.), Washington State,USA
PhD (Mech. Eng. & App. Mechs.), Univ. of Rhode Island, USA
Room : C23-328
Email : taminmn@utm.my
taminmn@fkm.utm.my

Dr. Mohamed bin Hussein
BEng (Mech.),UTM
MSc (Adv, Mfg Sys. & Tech.), University of Liverpool, UK
PhD (Mechatronics), De Montfort University, UK
Room : C24 - 217
Email : mohamed@utm.my
mohamed@mail.fkm.utm.my

Dr. Mohd. Yazid bin Yahya
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Mech. Eng.), University of Liverpool, UK
Room : C25 – 410
Email : yazidyahya@utm.my
yazid@mail.fkm.utm.my

Dr. Intan Zaurah bt Mat Darus
BEng. (Hons.) (Mech. Eng.), Univ. of Wales, Cardiff, UK
PhD (Automatic Control & Sys. Eng.), University of Sheffield, UK
Room : C24 - 336
Email : intan@utm.my
intan@mail.fkm.utm.my

Associate Professors

Dr. Amran bin Alias
BSc (Mech. Eng.), Texas, USA
MSc (Eng. Solid Mechs.), UMIST, UK
PhD (Mech. Eng.), University of Liverpool, UK
Room : C24-214
Email : amran_al@utm.my
amran_al@mail.fkm.utm.my

Dr. Ardiyanshah Syahrom
BEng (Mech. Eng.), Indonesia
MEng (Mech.), UTM
PhD (Mech. Eng.), UTM
Room : C23 – 410
Email : ardi@utm.my
ardi@mail.fkm.utm.my

Dr. Muhamad Noor bin Harun
Bachelor Mech. Eng., UiTM
MSc (Mech. Eng.), Loughborough University, UK
PhD (Mech. Eng), University of Leeds, UK
Room : C23 – 224
Email : mnoorharun@utm.my
mnoor@mail.fkm.utm.my

Dr. Mohamed Ruslan bin Abdullah
BEng (Mech.), UTM
MSc (Mfg. Sys. Eng.), University of Warwick, UK
PhD (Impact Properties of Composite Materials), University of Liverpool, UK
Room : C23 - 218
Email : ruslanabdullah@utm.my
ruslan@mail.fkm.utm.my

Dr. Shukur bin Abu Hassan
BEng (Mech.), UTM
MSc (Mfg. Sys. Eng.), University of Warwick, UK
PhD (Mech. Eng.), UTM
Room : P23 - 303 - 01
Email : shukur@fkm.utm.my
shukur@mail.fkm.utm.my

Ir. Dr. Mohd. Zarhamdy bin Md. Zain
BEng (Mech.), UTM
MSc (Mech. Eng.), University of Sheffield, UK
PhD (Mech. Eng.), University of Sheffield, UK
Room : C24 – 218
Email : zarhamdy@utm.my
zarhamdy@mail.fkm.utm.my

Ir. Ts. Dr. Zaini bin Ahmad
BEng (Mech.),UTM
MSc (Structures, Impact & Crashworthiness), Cranfield University, UK
PhD (Structural Impact), QUT, Australia
Room : E07-04.03.09 Tel : +607-5534567Room : C23 - 312
Email : azaini@utm.my
azaini@mail.fkm.utm.my

Dr.-Ing. Zair Asrar bin Ahmad
BEng (Mech-Aero), UTM
MSc (Mech. Eng), UTM
PhD (Eng.), Otto-von-Guericke Universität, Germany
Room : C23-318
Email : zair@utm.my
zair@mail.fkm.utm.my

Senior Lecturers

Dr. Amir Putra bin Md Saad
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Mech. Eng.), UTM
Room :
Email : amirputra@utm.my
amirputra @mail.fkm.utm.my

Dr. Mohd. Ayub bin Sulong
BEng (Mech. Eng), UTM
MEng (Mech. Eng), UTM
PhD (Mech. Eng), Newcastle, Australia
Room : C23 – 424
Email : mayub@utm.my
mayub@mail.fkm.utm.my

Hairul Anuar bin Abdullah
BSc (Mech. Eng.), Evansville, USA
MSc (Eng. Design), Loughborough, UK
Room : C23 – 221
Email : hairul@utm.my
hairul@mail.fkm.utm.my

Dr. Jamaludin bin Hj. Mohd. Taib
BSc (Mech. Eng.), Texas, USA
MPhil (Mech. Eng.), Heriot-Watt, UK
PhD (Computer Aided Eng.), Dundee, UK
Room : C23 – 225
Email : jamalt@utm.my
jamalt@mail.fkm.utm.my

Dr. Nor Fasiha bt Mohd. Yusof
BSc of Eng., Saitama, Japan
MEng (Mech.), UTM
PhD (Mech. Design), Kobe, Japan
Room : C23 – 226
Email : fasiha@fkm.utm.my
fasiha@mail.fkm.utm.my

Dr. Nur Safwati bt Mohd. Noor
BEng (Mechatronics), UIA
MEng (Mech. Eng.), UTM
PhD (Mech. Eng), Shibaura Institute of Technology, Japan
Room : C23-416
Email : safwati@utm.my
safwati@mail.fkm.utm.my

Khairul Anwar bin Hanafiah
BEng (Mech.), UTM
MEng (Mech.), UTM
Room : C23 – 425
Email : khairul@utm.my
khairul@mail.fkm.utm.my

Dr. Maziah bt Mohamad
BEng (Mech. Auto), UTM
MEng (Mech.), UTM
PhD (System and Control Eng), University of Sheffield, UK
Room : C23 - 419
Email : maziah@utm.my
maziah@mail.fkm.utm.my

Dr. Mohd. Foad bin Abdul Hamid
BSc (Mech. Eng.), Arizona, USA
MSc (Mech. Eng.), Arizona, USA
PhD (Mech. Eng.), New York, USA
Room : C25 – 334
Email : mfah@utm.my
mfah@mail.fkm.utm.my

Dr. Kamarulafizam bin Ismail
BSc (Computer), UTM
MEng (Electrical), UTM
PhD (Med. Eng.), UTM
Room : C25 – 412
Email : kamarulafizam@utm.my
kamarulafizam@mail.fkm.utm.my

Dr. Shaharil bin Mad Saad
BSc (Elec. Eng.), UTM
MSc (Mech. Electronic & Electric.), UTM
PhD (Mechatronics Eng.), UniMAP
Room : C24-213
Email : shaharil@utm.my
shaharil@mail.fkm.utm.my

Dr. Tang Howe Hing
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Electrical Eng/Biomedical), UNSW , Australia
Room: C23 - 220
Email : tanghh@utm.my
tanghh@mail.fkm.utm.my

Dr. Wong King Jye
BEng (Mech. Eng.), UTM
MEng (Mech. Eng), UTM
PhD (Mechanics), ISAT, France
Room : C23-322
Ext : 34637
Email : kjwong@utm.my
kjwong@mail.fkm.utm.my

Dr. Wan Aliff bin Abdul Saad
BEng (Hons) (Mech. Eng.), UTM
Ph.D. (Mech. Eng.), UTM
Room : C24-318
Email : w.aliff@mail.fkm.utm.my
wan.aliff@utm.my

Dr. Zainab bt Asus
B.Eng. (Mech.), UTM
Master (Automotive Eng.), ISAT, France
PhD (Mech Automobile), ISAT, France
Room : C23-210
Email : zainabasus@utm.my
zainab@mail.fkm.utm.my

Dr. Ahmad Humaizi bin Rozaini
BSc (Hons) (Mech. Eng.), UNITEN
MSc (Product Design & Management),
University of Liverpool, UK
PhD (Mech Eng.), UTM
Room : C23 - 412
Email : humaizi@utm.my
humaizi@mail.fkm.utm.my

Dr. Afandi bin Dzakaria
BEng (Mech.), UTM
MSc (Mech. Eng.), Coventry University, UK
PhD (Mech Eng.), UTM
Room : C23 - 222
Email : dafandi@fkm.utm.my

Dr. Mat Hussin bin Ab Talib
BSc (Mech-Auto. Eng.), UTM
PhD (Mech. Eng.), UTM
Room : C23-315
Email : mathussin@utm.my
mathussin@mail.fkm.utm.my

Dr. Mohd Syahril Ramadhan bin Mohd Saufi
BEng (Mech.), UTM
PhD (Mech Eng.), UTM
Room: C23-312
Email : mohdsyahrilramadhan@utm.my
syahrilramadhan@mail.fkm.utm.my

Dr. Muhammad Firdaus bin Isham
MEng (Mech. Eng.), UNMC
PhD (Mech. Eng.), UTM
Room : C23-410
Email : muhammadfirdausisham@utm.my
muhammadfirdaus@mail.fkm.utm.my

Dr. Muhammad Asyraf bin Muhammad Rizal
BEng (Mech. Eng.), UPM
Ph.D. (Material Eng.), UPM
Room : C25-322
Email : m.asyraf@mail.fkm.utm.my
muhammadasyraf.mr@utm.my

Dr. Muhammad Danial bin Abu Hasan
BEng (Mech.), UTM
PhD (Mech. Eng.), UTM
Room : C23-2XX
Email : danial@utm.my
muhammaddanial.ah@mail.fkm.utm.my

DEPARTMENT OF THERMOFLUIDS

Director of Department

Dr. Aminuddin bin Saat
BEng (Mech.), UTM
MSc (Mech. Eng.), Coventry University, UK
PhD (Mech. Eng.),University of Leeds, UK
Room : C23 – 216
Email : aminudin@utm.my
amins@mail.fkm.utm.my

Professors

Dr. Mazlan bin Abdul Wahid
BSc (Aero. Eng.), Embry-Riddle Aeronautical Univ., USA
MSc (Combustion & Energy), University of Leeds, UK
PhD (Mech. Eng.), State Univ. of New York, USA
Room : E07 - 04.03.18/C24 – 434
Email : mazlan@utm.my
mazlan@mail.fkm.utm.my

Dr. Normah bt Mohd. Ghazali
BSc (Nuclear Eng.), University of Wisconsin-Madison, USA
MSc (Science Eng.), UM
PhD (Mech. Eng.), University of New Hampshire, USA
Room : C24 – 329
Ext : 34577
Email : normahghazali@utm.my
normah@mail.fkm.utm.my

Dr. Syahrullail bin Samion
BSc (Mech. Eng.), Kagoshima University, Japan
MSc (Eng.), Kagoshima University, Japan
PhD (Mech. Eng.), Kagoshima University, Japan
Room : C23 – 434
Email : syahruls@utm.my
syahruls@mail.fkm.utm.my

Associate Professors

Dr. Aminuddin bin Saat
BEng (Mech.), UTM
MSc (Mech. Eng.), Coventry University, UK
PhD (Mech. Eng.),University of Leeds, UK
Room : C23 – 216
Email : aminudin@utm.my
amins@mail.fkm.utm.my

Dr. Haslinda bt Mohamed Kamar
BEng (Hons.) (Mech. Eng.), University of Glasgow, UK
MEng (Mech.), UTM
PhD (Mech. Eng.), UTM
Room : C25 – 416
Email : haslinda@utm.my
haslinda@mail.fkm.utm.my

Senior Lecturers

Dr. Fazila bt Mohd. Zawawi
BEng (Mech.), UTM
MEng (Aerospace Mechanics & Atomic), ISAE, France
PhD (Aeroelaslicity), ISAE, France
Room : C23 - 424
Email : fazilamz@utm.my
fazila@mail.fkm.utm.my

Mohamad Nor bin Musa
BSc (Mech. Eng.), Korea
MSc (Thermofluids), Korea
Room : C24 – 311
Email : mnormusa@utm.my
mnormusa@mail.fkm.utm.my

Dr. Mohd. Fairus bin Mohd. Yasin
BSc (Mech. Eng.), University of Wisconsin-Madison, USA
PhD (Combustion), University of Cambridge, UK
Room : C24 - 309
Email : mohdfairuz@utm.my
mohdfairuz@mail.fkm.utm.my

Mohd. Ibthisham bin Ardani
BEng (Automotive), UTM
MEng (Mech. Eng.), UTM
PhD (Mech.), Imperial College London, UK
Room: C23 - 316
Email : ibthisham@utm.my
ibthisham@mail.fkm.utm.my

Dr. Mohd. Faizal bin Hassan
BEng (Mech.), Kitami Institute of Technology, Japan
MEng (Mech.), UTM
PhD (Mech. Eng.), Keio University, Japan
Room : C24 -212
Email : mfaizal@utm.my
mfaizal@mail.fkm.utm.my

Dr. Muhammad Hasbullah bin Padzillah
BEng (Mech.), UTM
PhD (Mech. Eng.), Imperial Collage London, UK
Room : C25 - 320
Email : mhasbullah@utm.my
hasbullah@mail.fkm.utm.my

Dr. Muhammad Noor Afiq Witri bin Muhammad Yazid
BEng (Mech.), UTM
MSc (Mech. Eng.), UTM
PhD (Mech. Eng.), UTM
Room : C25-335
Email : mnafiqwitri@utm.my
afiqwitri@mail.fkm.utm.my

Dr. Natrah bt Kamaruzaman
BEng (Mech. System), University of the Ryukyus, Japan
MEng (Mech. Eng), UTM
PhD (Mech. Eng.), UTM
Room : C23 – 215
Email : natrahk@utm.my
natrah@mail.fkm.utm.my

Ts Dr. Zulhanafi bin Paiman
BEng (Mech. Eng.), UiTM
MSc (Mech. Eng.), UTM
PhD (Mech. Eng.), UTM
Room : C25-328
Email : zulhanafi.paiman@utm.my
zulhanafi@mail.fkm.utm.my

Ir. Ts. Dr. Mohamad Nur Hidayat bin Mat
B.Eng. (Mech. Eng.), UTP
Ph.D. (Mech. Eng.), UTHM
Room : C24-313
Email : mn.hidayat@utm.my
hidayat@mail.fkm.utm.my

Dr. Ummikalsom binti Abidin
BEng (Hons.) (Mech. Eng.), UNITEN
MEng (Mech.) UTM
PhD (Micro Eng.), UKM
Room : C23 - 211
Email : ummi@utm.my
ummi@mail.fkm.utm.my

Dr. Zulkarnain bin Abdul Latiff
BSc (Mech. Eng.), Univ. of Glasgow, UK
MEng (Mech.), UTM
PhD (Mech. Eng.), UTM
Room : C25 – 411
Email : zkarnain@utm.my
zkarnain@mail.fkm.utm.my

Dr. Muhammad Faiz Hilmi bin Rani
B.Eng. (Hons) (Mech. Eng.), UniMAP
Ph.D. (Mech. Eng.), UniMAP
Room : C24-318
Email : muhammadfaizhilmi@utm.my
faizhilmi@mail.fkm.utm.my

DEPARTMENT OF MATERIALS, MANUFACTURING & INDUSTRIAL ENGINEERING

Director of Department

Dr. Azanizawati bt Ma'aram
BEng (Mech-Industry), UTM
MEng (Mech.), UTM
PhD (Management), Univ. of Liverpool, UK
Room : C23 - 411
Email : niza@utm.my
niza@mail.fkm.utm.my

Professors

Dr. Safian bin Sharif
Dip. (Mech. Eng.), Ngee Ann Polytechnic, Singapore
BEng (Mech.), UTM
MSc (Adv. Mnfg. Tech.), UMIST, UK
PhD (Machining), Coventry University, UK
Room : C25 - 315
Email : safian@utm.my
safian@mail.fkm.utm.my

Dr. Izman bin Sudin
BEng (Mech.), UTM
MSc (Mnfg. Sys. Eng.), Univ. of Warwick, UK
PhD (Mech. Eng.), UTM
Room : E07 - 04.03.01/C25 - 313
Email : izman@utm.my
izman@mail.fkm.utm.my

Dr. Mohd. Hasbullah bin Hj. Idris
BEng (Mech. Prod.), UTM
Mphil (Investment Casting), Univ. of Loughborough, UK
PhD (Mech. Eng.), UTM
Room : E07 - 04.03.07/C25 - 316
Email : hasbullah@utm.my
hsbullah@mail.fkm.utm.my

Dr. Muhamad Zameri bin Mat Saman
BEng (Mech.), UTM
MSc (Adv. Mnfg. Sys. Eng.), Coventry University, UK
PhD (Mech. Eng.), Coventry University, UK
Room : C23 - 426
Email : zameri@utm.my
zameri@mail.fkm.utm.my

Dr. Wong Kuan Yew
BEng (Mech-Ind.), UTM
MEng (Eng. Management), UTM
PhD (Mech. Eng.), Univ. of Birmingham, UK
Room : E07 - 04.02.05/C24 - 320
Email : m-wongky@fkm.utm.my
wongky@fkm.utm.my

Associate Professor

Dr. Aini Zuhra bt Abdul Kadir
BEng (CAD/CAM), UM
MEng (Manufacturing), UM
PhD (Mech. Eng.), Univ. of Auckland, New Zealand
Room : C24 - 215
Email : ainizuhra@utm.my
aini@mail.fkm.utm.my

Dr. Azanizawati bt Ma'aram
BEng (Mech-Industry), UTM
MEng (Mech.), UTM
PhD (Management), Univ. of Liverpool, UK
Room : C23 - 411
Email : niza@utm.my
niza@mail.fkm.utm.my

Dr. Jafri bin Mohd. Rohani
BSc (Mathematics – Statistics), New Mexico State University, USA
BSc (Ind. Eng.), New Mexico State University, USA
MSc (Ind. & System Eng.), Ohio University, USA
PhD (Mech. Eng.) UTM
Room : C24 - 325
Email : jafrimr@utm.my
jafri@mail.fkm.utm.my

Dr. Muhamad Azizi bin Mat Yajid
BEng (Hons)(Materials Eng.), USM
MSc (Nanoscale Science and Technology), Univ. of Leeds, UK
PhD (Materials Engineering), Univ. of Sheffield, UK
Room : E07-04.03.08
Email : azizi@utm.my
azizi_my@mail.fkm.utm.my

Dr. Norhayati bt Ahmad
BSc (Hons) (Physics), UKM
MEng (Materials Eng.), USM
PhD (Materials Eng.), Kagoshima University, Japan
Room : C23 - 409
Email : nhayatiahmad@utm.my
nhayati@mail.fkm.utm.my

Dr. Syed Ahmad Helmi bin Syed Hassan
BSc (Mech. Eng.), Univ. of Alabama, USA
BSc (Ind. Eng), Clemson University, USA
MEng (Advance Manufacturing Technology), UTM
PhD (Eng. Education), UTM
Room : C24 - 323
Email : helmi@utm.my
helmi@mail.fkm.utm.my

Dr. Tuty Asma bt Abu Bakar
BEng (Materials Eng.), USM
MEng (Materials Eng.), USM
PhD (Surface Eng.), Dublin City University, Ireland
Room : C23 - 422
Email : tuty@utm.my
tuty@mail.fkm.utm.my

Senior Lecturers

Dr. Engku Mohammad Nazim bin Engku Abu Bakar
BSc (Metallurgy), Seoul, Korea
MSc (Properties & Applications of Eng. Materials), Univ. of Strathclyde, UK
PhD (Mech. Eng.) UTM
Room : C23 – 217
Email : nazim@utm.my
nazim@mail.fkm.utm.my

Dr. Foo Jin Hoe
BEng (Mnfg. Sys. Eng.), Coventry University, UK
MSc (Manufacturing Eng.) Coventry University, UK
PhD (Nanocoating), Shibaura Univ. of Tech., Japan
Room : C23 - 408
Email : jinhoe@utm.my
jinhoe@mail.fkm.utm.my

Dr. Mohd. Azlan bin Suhaimi
BEng (Manuf.), UTM
MEng (Mech. Eng), UTM
PhD (Mech. Eng.-Industry), Chonbuk National University, Korea
Room : C23-321
Email : azlansuhaimi@fkm.utm.my
azlan@mail.fkm.utm.my

Dr. Mohd. Firdaus bin Mohd. Taib
BEng (Ind.), UTM
MEng (Eng. Management), UPM
PhD (Mech. Eng.-Industry), Seoul National University, Korea
Room : C25-311
Email : firdaustaib@utm.my
firdaus@mail.fkm.utm.my

Wan Nazdah bt Wan Hussin
BSc (Hons.) (Mnfg. Sys. Eng.), Univ. of Leeds, UK
MSc (Adv. Mnfg. Sys. Eng.), Coventry University, UK
Room : C23 - 213
Email : wnazdah@utm.my
wnazdah@mail.fkm.utm.my

Dr. Wan Fahmin Faiz bin Wan Ali
BEng (Materials Eng.), USM
MEng (Materials Eng.), USM
PhD (Surface Eng.), Dublin City University, Ireland
Room : C23 - 321
Email : fahmin_faiz@utm.my
fahminfaiz@mail.fkm.utm.my

Dr. Nor Akmal bt Fadil
BEng (Mech. Materials), UTM
PhD (Regional Environment System), Shibaura Inst. of Tech., Japan
Room : C23 - 415
Email : norakmal@utm.my
akmal@mail.fkm.utm.my

Ir. Ts. Dr. Nor Hasrul Akhmal bin Ngadiman
BEng (Mech. Eng.), UTM
PhD (Mech. Eng.), UTM
Room : C23 - 331
Email : norhasrul@utm.my
norhasrul@mail.fkm.utm.my

Dr. Norizah bt Hj. Redzuan
BEng (Hons.) (Mech. Eng.- Computer Integration),Univ. of Glasgow, UK
MEng (Mech.), UTM
PhD (Mech.Eng.), University of Glasgow, UK
Room : C24 - 234
Email : norizah@utm.my
norizah@mail.fkm.utm.my

Rozaimi bin Mohd. Saad
BEng (Mech. Prod.), UTM
MEng (Adv. Mnfg. Tech.), UTM
Room : C25 - 327
Email : rozaimi@utm.my
rozaimi@mail.fkm.utm.my

Dr. Uday M. Basheer Al-Naib Bakar
BEng (Chemical), Baghdad Univ., Iraq
MEng (Chemical), University of Iraq, Iraq
PhD (Computer Sc.), USM
Room : C23 - 413
Email : uday@utm.my
ummb2008@gmail.com

Dr. Abdul Hakim bin Md Yusop
BEng (Mech.), UTM
MSc (Biomedical. Eng.), UTM
PhD (Biomedical Eng.), UTM
Room : C25-323
Email: abdul.hakim@utm.my
a.hakim@mail.fkm.utm.my

Ts. Dr. Muhd Ikmal Isyraf Bin Mohd Maulana
Diploma in Mechanical Engineering with Education, KUiT-THO
BEng. (Mechanical) with Honours, KUiTTHO
PhD (Manufacturing), Cranfield University, UK
Room : C23-411
Email : muhdikmalisyraf@utm.my
ikmalisyraf@mail.fkm.utm.my

Zulkepli bin Hj. Muhamad
BEng (Mech.), UTM
MEng (Mech.), UTM
Room : C25 - 331
Email : zulkeplim@utm.my
zulkepli@mail.fkm.utm.my

Khidzir bin Zakaria
BEng (Hons.) (Mech. Eng.), Univ. of Portsmouth, UK
MSc (Adv. Mnfg. Tech.), Univ. of Portsmouth, UK
Room : C23 - 413
Email : khidzir@utm.my
khidzir@mail.fkm.utm.my

Dr. Mohd. Faridh bin Ahmad Zaharuddin
BEng. (Mnfg. Sys. Eng.), Univ. of Portsmouth, UK
MSc (Adv. Mnfg. Tech.), Univ.of Portsmouth, UK
PhD (Manufacturing), Hanyang University, Korea
Room : C24-324
Email : faridh@utm.my
faridh@mail.fkm.utm.my

Dr. Rozlina bt Md. Sirat
BEng (Mech. Prod.), UTM
Advanced Diploma in Education (Mech.), UTM
MEng (Mech.), UTM
PhD (Mech. Eng), UTM
Room : C23 - 227
Email : rozlina@utm.my
rozlina@mail.fkm.utm.my

Dr. Najlaa Nazihah binti Mas'ood
Dip. (Mech. Eng.), UiTM
BEng (Manufacturing) (Hons), UiTM
MEng (Industrial Engineering), UTM
PhD (Mechanical & Materials Engineering), UKM
Room no: C25-325
Email: najlaanazihah@utm.my
najlaa@mail.fkm.utm.my

DEPARTMENT OF AERONAUTICS, AUTOMOTIVE & OCEAN ENGINEERING

Director of department

Dr. Haris Ahmad bin Israr Ahmad
BEng (Mech. Aero), UTM
MSc (Aerospace Mechanics & Avionics), ISAE, France
PhD (Mechanics and Materials), Univ. of Toulouse, France
Room : C25 - 319
Email : harisahmad@utm.my
haris@mail.fkm.utm.my

Professors

Dr. Mohammad Nazri bin Mohd. Ja'afar
BSc (Aero Eng.), Wichita Univ., USA
MSc (Aero Eng.), Wichita Univ, USA
PhD (Combustion), Univ. of Leeds, UK
Room : C25 - 308
Email : nazrijaafar@utm.my
nazri@mail.fkm.utm.my

Ir. Dr. Ab Saman bin Abd Kader
B.Eng (Marine Eng.),Indonesia Marine Academy, Jakarta
M.Sc. (Shipping and Maritime Studies), Liverpool Polytechnics, UK
PhD. (Marine Transport System),Liverpool John Moores University, UK
Room: C23-335
Email: abdsaman@mail.fkm.utm.my
abdsaman@utm.my

Dr. Adi Maimun bin Abdul Malik
MRINA BSc (Hons) (Naval Arch.), Strathclyde Univ., UK
MSc (Marine Tech.), Strathclyde Univ., UK
PhD (Marine Technology), Strathclyde Univ., UK

Room : C25 - 309
Email : adi@utm.my
adi@mail.fkm.utm.my

Dr. Omar bin Yaakob, MRINA
BSc (Hons) (Marine Eng.), Newcastle Cert.
Naval Arch
MSc (Marine Tech.), Newcastle Univ.,UK
PhD (Marine Tech.), Newcastle Univ., UK
Room : C23 - 428
Email : omar@utm.my
omar@mail.fkm.utm.my

Dr. Srithar A/L Rajoo
BEng (Mech. Material), UTM
MEng (Eng. Mngt.), UTM
PhD (Mech.), Imperial College, UK
Room : C24 - 317
Email : srithar@utm.my
srithar@mail.fkm.utm.my

Associate professor

Dr. Mohd. Farid bin Muhamad Said
Dip. Mech. Eng., UTM
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Mech.), Univ. of Leicester, UK
Room : C23 - 212
Email : mdfarid@utm.my
mfarid@mail.fkm.utm.my

Ir. Dr. Shabudin bin Mat, CEng
BEng (Mech. Aero), UTM
Master (Aeronautical Maintenance & Prod.), ENSICA, France
PhD (Aero), Univ. of Glasgow, UK
Room : C24 - 310
Email : shabudin@utm.my
shabudin@mail.fkm.utm.my

Ir. Dr. William Chong Woei Fong
BEng (Mech Eng.), UTM
Msc. (Automotive Product Eng.), Cranfield University, UK
PhD (Adhesive and Molecular Friction in Tribological Conjunctions), Cranfield University, UK
Room : C23 - 436
Email : william@utm.my
william@mail.fkm.utm.my

Senior Lecturer

Dr. Abd. Rahim bin Abu Bakar
BEng (Mech.), UTM
MSc (Automotive Eng.), Univ. of Leeds, UK
PhD (Mech. Eng.), Univ. of Liverpool, UK
Room : C24 – 312
Email : arahim@utm.my
arahim@mail.fkm.utm.my

Dr. Chiong Meng Soon
BEng (Mech – Automotive), UTM
PhD (Mech.), UTM
Room : C24 – 328
Email : chiongms@utm.my

Dr. Izhari Izmi Bin Mazali
Dipl. -Ing. Hochschule RheinMain, Germany,
PhD (Mech. Eng.), UTM
Room : C23-420
Email : izhariizmi@utm.my
izhari@mail.fkm.utm.my

Dr. Farah Ellyza binti Hashim
Beng (Mech – Marine Tech), UTM
PhD (Mech. Eng.), UTM
Room : C24 – 332
Email : farahellyza@utm.my
ellyza@mail.fkm.utm.my

Dr. Haris Ahmad bin Israr Ahmad
Beng (Mech. Aero), UTM
MSc (Aerospace Mechanics & Avionics), ISAE, France
PhD (Mechanics and Materials), Univ. of Toulouse, France
Room : C25 - 319
Email : harisahmad@utm.my
haris@mail.fkm.utm.my

Dr. Iskandar Shah bin Ishak
BEng (Mech. Aero), UTM
Master (Technique of Aeronautics & Space),
ENSAE, France
PhD (Mech. Eng.) , UTM
Room : C25-409
Email : shah@utm.my
shah@mail.fkm.utm.my

Dr. Kang Hooi Siang
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Mech.), Texas Agri. & Mech. Uni. College
Station, USA
Room : C23 – 324
Email : kanghs@utm.my
kanghs@mail.fkm.utm.my

Dr. Mastura bt Ab. Wahid
BEng (Mech.Aero), UTM
MSc (Aeronautical and Space Systems), ISAE, France
PhD (Guidance Control and Navigation), ENAC, France
Room : C23 – 323
Email : masturawahid@utm.my
mastura@mail.fkm.utm.my

Dr. Nik Ahmad Ridhwan bin Nik Mohd
BEng (Mech. Aero), UTM
MEng (Mech.), UTM
PhD (Helicopter), Univ. of Liverpool
Room : C23 - 209
Email : ridhwan@utm.my
ridhwan@mail.fkm.utm.my

Ir. Dr.-Ing. Mohd. Nazri bin Mohd. Nasir
BSc (Aero Eng.), The Univ. of Manchester, UK
MSc (Aero Eng.), Tech. Univ. of Delft, Netherland
PhD (Aero Eng.), Tech. Univ. of Darmstadt, , Germany
Room : C25 – 329
Email : mnazrimnasir@utm.my
mnazri@mail.fkm.utm.my

Dr. Md. Nizam bin Dahalan
Beng (Mech. Aero), UTM
Meng (Mech.), UTM
PhD. (Mech.) UTM
Room : C23 – 232
Email : nizamdahlan@utm.my
nizam@mail.fkm.utm.my

Ir. Dr. Mohd Azman bin Abas
B.Eng (Automotive), University of Hertfordshire, UK
PhD (Mech. Eng.-Automotive), UTM
Room : C24 – 326
Email : azman.abas@utm.my
azmanabas@mail.fkm.utm.my

Dr. Mohd. Kameil bin Abdul Hamid
BSc (Mech. Eng.), SUNNY Buffalo, US
MSc (Automotive Eng.), Uni. Of Leeds, UK
PhD (Automotive Tribology), Univ. of Western Australia
Room : C23 – 417
Email : kameil@utm.my
kameil@mail.fkm.utm.my

Dr. Desmond Daniel Chin Vui Sheng
Dip (Mech. Eng.), UTHM
B.Eng. (Hons) (Mech. Eng.), UTHM
PhD (Mech. Eng.), UTHM
Room : C24-337
Email : daniel.chin@utm.my
desmond@mail.fkm.utm.my

Dr. Muhammad Faruq Foong bin Mohamad Faiz Foong
BSc (Aerospace. Eng.), Monash , Australia
PhD (Mech. Eng.), Heriot Watt , Malaysia.
Room : C23-311
Email : faruqfoong@utm.my
faruqfoong@mail.fkm.utm.my

Dr. Arifah binti Ali
BEng (Mech –Marine Technology.), UTM
PhD (Mech.Eng.), UTM
Room : C23-321
Email : arifahali@utm.my
arifah@mail.fkm.utm.my

Dr. Muhammed Amirul Asyraf bin Hasnan
BEng (Mech –Marine Technology.), UTM
MSc (Ship and Offshore Eng.), UTM
PhD (Marine Transportation & Environmental Syst.), Hiro-
shima Univ., Japan
Room : C23-421
Email : muhammedamirulasyraf@utm.my
amirul@mail.fkm.utm.my

Dr. Nik Mohd Ridzuan bin Shaharuddin
Beng (Mech –Marine Technology.), UTM
PhD (Mech.Eng.), UTM
Room : C23 -423
Email : nmridzuan@utm.my
ridzuan@mail.fkm.utm.my

Dr. Norazila binti Othman
Beng (Mech. Aero), UTM
Meng (Mech.), UTM
PhD (Aerospace Eng.), Tokyo Metropolitan University, Japan
Room : C23 – 309
Email : norazilao@utm.my
norazila@mail.fkm.utm.my

Dr. Mohd Fairuz bin Shamsudin
Meng. (Aerospace Eng.), Manchester Univ., UK
PhD (Mechanical Eng.) Brunel Univ. UK
Room: C24-316
Email: mohd_fairuz@mail.fkm.utm.my
mohdfairuz@utm.my

Dr. Saiful Anuar bin Abu Bakar
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Interdisciplinary Eng.), Tokai Univ., Japan
PhD (Mech.), UTM
Room : C25 - 330
Email : saifulanuar@utm.my
saiful@mail.fkm.utm.my

Dr. Siow Chee Loon
BEng (Mech –Marine Technology.), UTM
PhD (Mech.Eng.), UTM
Room : C25-410
Email : scheeloon@utm.my
scloon@mail.fkm.utm.my

Dr. Nur Izwanne binti Mahyon
BEng (Chem. Eng.), UTM
MSc (Msc. Safety, Health and Environment), UTM
Ph.D (Chem. Eng.), Imperial College, UK
Room : C25 - 307
Email : izwanne@utm.my
izwanne@mail.fkm.utm.m

Dr. Mohd. Hazmil Syahidy bin Abdol Azis
BEng (Mech.), UTM
MSc (Mech. Eng), UTM
PhD (Mech. Eng.), Imperial College,UK
Room : C25-314
Email : hazmil@utm.my
hazmil@mail.fkm.utm.my

ACKNOWLEDGEMENT

THE FACULTY'S ADMINISTRATION WOULD LIKE
TO THANK ALL THOSE INVOLVED IN THE PUBLICATION OF THIS
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