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UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Faculty of Mechanical Engineering

UNDERGRADUATE HANDBOOK

Session 2017/2018

BACHELOR DEGREE PROGRAMME

The content of this book is true and accurate at the time of publication.
The Faculty of Mechanical Engineering UTM reserves the right to change any information contained herewith
Please forward any enquiries to:-

The Dean
Faculty of Mechanical Engineering
Universiti Teknologi Malaysia
81310 UTM Johor Bahru
Johor Darul Ta'zim

E-mail : dekan@mail.fkm.utm.my
Telephone : 07-5534567
Fax : 07-5566159

Or

Deputy Registrar
Academic Affairs Office
Faculty of Mechanical Engineering
81310 UTM Johor Bahru
Johor Darul Ta'zim

Email : tpfkm@mail.fkm.utm.my
Telephone : 07-5557073
Fax : 07-5557097

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FOREWARD BY THE DEAN

Assalamu'alaikum and Greetings

I am grateful to the Almighty Allah S.W.T for enabling me to pen a few words in this Undergraduate Handbook 2017/2018.

Welcome to Faculty of Mechanical Engineering, Universiti Teknologi Malaysia(UTM). I would like to congratulate all new students for being admitted to the various degree programs offered by the faculty. I hope the opportunity given will be used wisely and you will do your utmost to acquire the knowledge, experience and exposure necessary to be a successful Engineer.

The Undergraduate Handbook contains brief information on the curriculum and syllabus of programs offered by the faculty which is applicable to the students of the 2017/2018 session intake. It also serves as your main source of reference related to your academic affairs and provides the required information for the students especially on the faculty's administration implementation of programmes and courses offered. This handbook can be used by the students to plan their studies as well as a reference for the programme structure offered by the faculty. Additionally a special topic on Academic Advising is included so that both students and academic advisors can play their roles effectively.

We hope all new students will utilize the information provided in this handbook so that you can benefit from all the services provided thus enhancing your educational experience and create many valuable memories. All users of this handbook are invited to submit comments and recommendations for changes to the Academic Office of the faculty. Additionally, deletions and changes to this handbook may occur throughout the year. So please be on the lookout for notices informing of the changes.

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 the new students all the best in their studies at the faculty and we hope this handbook will be useful to all. The faculty and staff are very interested in your success even though much of your success is dependent on you.

Thank you.

Wassalam.

Best wishes,

PROFESSOR DR. MOHD. HASBULLAH BIN HJ. IDRIS
Dean
Faculty of Mechanical Engineering
Universiti Teknologi Malaysia

PHILOSOPHY, VISION & MISSION OF THE UNIVERSITY,

VISION, MISSION, OBJECTIVES & CLIENT'S CHARTER OF THE FACULTY

PHILOSOPHY OF THE UNIVERSITY

The divine law of Allah is the foundation for science and technology. Universiti Teknologi Malaysia strives with total and unified effort to develop excellence in science and technology for universal peace and prosperity in accordance with His Will.

VISION OF THE UNIVERSITY

To be recognized as a world class centre of academic and technological excellence

MISSION OF THE UNIVERSITY

To be a leader in the development of human capital and innovative technologies that will contribute to the nation's wealth creation

VISION OF THE FACULTY

To become a world-class Mechanical Engineering Faculty

MISSION OF THE FACULTY

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

OBJECTIVES OF THE FACULTY

- To develop quality human resource at undergraduate and post-graduate levels
- To assist the industry through basic and applied research
- To forge cooperative network with the industry in areas of mutual benefit
- To disseminate knowledge through the publication of research papers, journals, books and reports
- To develop its staff

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

ACADEMIC CALENDAR
FOR 2017/2018 SESSION

ACADEMIC SESSION

The University Academic Session is divided into two regular semesters namely, Semester I and Semester II. Each semester consists of at least 19 weeks of lectures, mid semester break, revision and final examination. Apart from the regular semesters, the University also runs a short semester, which is held during the vacation period at the end of an academic year. This semester is not taken into account in the maximum study duration stipulated for a particular programme.

The academic session is shown in Table1.

Table 1: Academic Session (*Subject to amendments)

SEMESTER I	
Lectures	14 weeks
Mid Semester Break	1 week
Revision Week	1 week
Final Examination	3 weeks
TOTAL	**19 weeks**
Semester I Vacation	4 weeks
SEMESTER II	
Lectures	14 weeks
Mid Semester Break	1 week
Revision week	1 week
Final Examination	3 weeks
TOTAL	**19 weeks**
Semester II Vacation	10 weeks
GRAND TOTAL	52 weeks
SHORTSEMESTER (During Semester II Vacation)	
Lectures & Examination	8 weeks

ACADEMIC CALENDAR
FOR 2017/2018 SESSION

4 Sept 2017	Registration of New Students
5 – 8 Sept 2017	Student Orientation Week
6 Sept 2017	*Senate Meeting
6 & 7 Sept 2017	Course Registration for Semester I, 2017/2018

SEMESTER I
10 September 2017 – 8 February 2018
(22 weeks)

10 Sept – 12 Oct 2017	Lectures Semester I (First Half) (5 Weeks)
4 Oct 2017	*Senate Meeting
15 – 19 Oct 2017	Mid – Semester Break for Semester I (1 week)
22 Oct – 21 Dec 2017	Lectures Semester I (Second Half) (9 weeks)
28 – 31 Oct 2017	*UTM 59th Convocation Ceremony
1 Nov 2017	*Senate Meeting
6 Dec 2017	*Senate Meeting
10 – 21 Dec 2017	Course Pre – Registration for Semester II, 2017/2018
24 – 28 Dec 2017	Revision Period for Semester I (1 week)
2 – 18 Jan 2018	Final Examination for Semester I, 2017/2018 (3 weeks)
3 Jan 2018	*Senate Meeting
21 Jan – 8 Feb 2018	Final Break for Semester I, 2017/2018
7 Feb 2018	*Senate Meeting
19 Feb – 1 March 2018	Special Examination for Semester I, 2017/2018
7 – 8 Feb 2018	Registration of New Students for Semester II, 2017/2018
7 – 8 Feb 2018	Course Registration for Semester II, 2017/2018

SEMESTER II
11 February 2018 – 30 August 2018
(29 weeks)

11 Feb – 29 March 2018	Lectures Semester II (First Half) (7 weeks)
7 March 2018	*Senate Meeting
1 – 5 April 2018	Mid – Semester Break for Semester II (1 week)
4 April 2018	*Senate Meeting
8 April 2018	Lectures Semester II (Second Half) (7 weeks)
28 – 29 Apr 2018	*UTM 60th Convocation Ceremony
9 May 2018	*Senate Meeting
13 – 24 May 2018	Course Pre – Registration for Semester I, 2018/2019
25 – 29 May 2018	Revision Period for Semester II (1 week)
30 May – 14 June 2018	Final Examination for Semester II, 2017/2018
6 June 2018	*Senate Meeting
17 June – 30 Aug 2018	Final Semester Long Vacation (11 weeks)
4 July 2018	*Senate Meeting
15 – 26 July 2018	Special Examination for Semester II, 2018/2019
8 August 2018	*Senate Meeting
29 – 30 Aug 2018	Course Registration for Semester I, 2018/2019

SHORT SEMESTER
17June 2018 – 23 August 2018
(10 weeks)

17 – 21 June 2018	Break for Short Semester (1 week)
20 & 21 June 2018	Course Registration for Short Semester, 2017/2018
24 June – 16 Aug 2018	Lectures Short Semester (8 weeks)
19 – 23 Aug 2018	Final Break for Short Semester (1 week)

PUBLIC HOLIDAY

31 August 2017	National Day
16 September 2017	Malaysia Day
22 September 2017	Maal Hijrah 1439
18 October 2017	Deepavali Day
26 October 2017	Hol Almarhum Sultan Iskandar (Johor only)
1 December 2017	Birthday of Prophet Muhamad S.A.W.
25 December 2017	Christmas Day
31 January 2018	Thaipusam
16 & 17 February 2018	Chinese New Year
23 March 2018	Birthday of His Majesty the Sultan of Johor (Johor only)
1 May 2018	Labour Day
17 May 2018	First Day of Ramadhan (Johor only)
29 May 2018	Wesak
2 June 2018	Birthday of His Majesty Seri Paduka Baginda Yang Di – Pertuan Agong
15 & 16 June 2018	Eid Al – Fitri
31 August 2018	National Day

ENTRY REQUIREMENT

ENTRY REQUIREMENTS FOR THE FOLLOWING PROGRAMMES:

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

A. MINIMUM ENTRY REQUIREMENTS FOR STPMHOLDERS

1. University General Requirements

   1.1 Passed Sijil Pelajaran Malaysia (SPM) or equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July Paper.

   1.2 Passed Sijil Tinggi Persekolahan Malaysia (STPM) with at least
   i. **C Grade (2.00)** in General Studies/General Paper **and**
   ii. **C Grade (2.00)** in two (2) other courses

   1.3 Obtained at least a **Band 1** in Malaysian University English Test(MUET)

2. Programme Specific Requirements

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

   2.2 Passed with at least a **CGPA 2.80** at STPM level

   2.3 Passed with at least **a B- Grade (2.67)** at STPM level in Additional Mathematics.

   2.4 Passed with at least a **CGPA 2.67** at STPM level in Physics or Chemistry

   2.5 Do not have any health problems that may affect their studies

B. MINIMUM ENTRY REQUIREMENTS FOR THOSE WHO HAVE COMPLETED THE MINISTRY OF EDUCATION MALAYSIA MATRICULATION/UM SCIENCE FOUNDATION/UiTM FOUNDATION PROGRAMME

1. University General Requirements

   1.1 Passed Sijil Pelajaran Malaysia (SPM) or equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July paper.

   1.2 Passed Ministry of Education Matriculation/UM Science Foundation/UiTM Foundation with at least a **CGPA2.00**.

   1.3 Obtained at least a **Band 1** in Malaysian University English Test(MUET)

2. Programme Specific Requirements

   2.1 Passed with a **C Grade** in Mathematics and Physics at SPM level or equivalent

   2.2 Obtained **at least a CGPA 2.80** at Matriculation/Foundation level

   2.3 Passed with at least a **B- Grade (2.67)** in Mathematics/Engineering Mathematics.

   2.4 Passed with at least **a B- Grade (2.67)** in Physics/Engineering Physics or Chemistry/Engineering Chemistry

   2.5 Do not have any health problems that may affect their studies

C. MINIMUM ENTRY REQUIREMENT FOR DIPLOMA HOLDERS/EQUIVALENT

1. University General Requirements

   1.1 Passed SPM or equivalent with a credit in Bahasa Melayu/Bahasa Malaysia or a credit in Bahasa Melayu/Bahasa Malaysia, July paper.

   1.2 Obtained a Diploma or equivalent qualification recognised by the Malaysian Government and approved by the Senate:

or

13 Passed STPM examination in 2009 or before and obtained at least:

i) C Grade (2.00) in General paper and
ii) C Grade (2.00) in two (2) other courses

or

14 Passed Matriculation examination in 2015 or before and obtained at least CGPA2.00

15 Obtained at least a **Band 1** in Malaysian University English test(MUET)

2. Programme Specific Requirements

2.1 Obtained a Diploma in Mechanical Engineering from UTM or equivalent **with at least a CGPA 2.75**.

or

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

or

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

or

2.4 Meet the minimum entry requirements as required for those who have completed the Ministry of Education Malaysia Matriculation/UM Science Foundation/UiTM Foundation Programme.

and

2.5 Obtained at least a credit in Mathematics and Physics at SPM level.

or

2.6 Obtained at least a C Grade (2.0) in any one of the Mathematics courses at Diploma level.

and

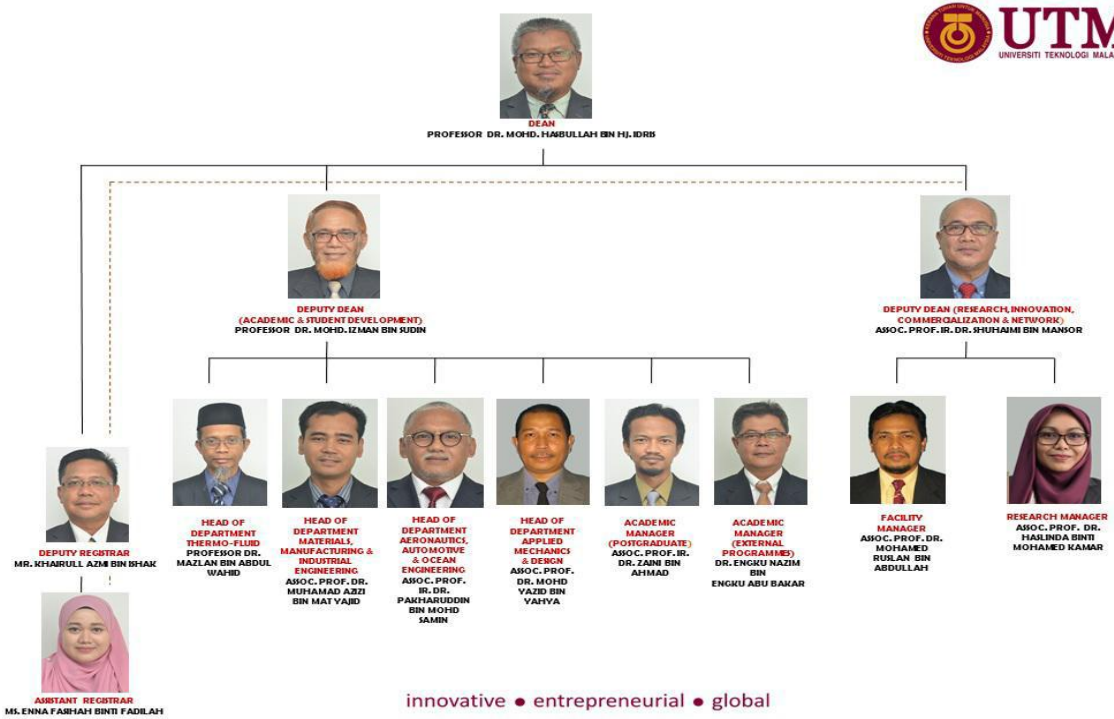
2.6.1 Do not have any healthy problems that may affect their studies.

Note:

Candidates are required to submit to UTM, a detailed transcript of the examination results during the course of their Diploma study (from the first semester to the final semester). They are also required to submit a copy of their Diploma certificate or a letter verifying completion of their study.

The actual year of entry and duration of study are subjected to credit exemptions approved by UTM.

ORGANISATIONAL STRUCTURE



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FACULTY BACKGROUND
& PROGRAMMES OFFERED

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 totalling 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 enrolled in the programme. During the 1981/1982 session, another new programmes were offered by the Faculty, namely, Diploma and Bachelor Degree in Ocean Engineering. A total of 29 students enrolled 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 Engineeringwas 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 (Academics& Student Development) and Deputy Dean (Research, Innovation, Communities and Networking). A Deputy Registrar with the assistance of an 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 Laboratory Manager. Currently, the Faculty has FOUR (4) academic departments, each headed by a Head 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 Engineering (Mechanical)
2. Bachelor of Engineering (Mechanical – Materials)
3. Bachelor of Engineering (Mechanical – Industrial)
4. Bachelor of Engineering (Mechanical – Manufacturing)
5. Bachelor of Engineering (Mechanical – Aeronautics)
6. Bachelor of Engineering (Mechanical – Automotive)
7. Bachelor of Engineering (Naval Architecture and Offshore Engineering)

Postgraduate Programmes :

Master programmes taught by course:

1. Master of Science (Mechanical Engineering)
2. Master of Science (Industrial Engineering)
3. Master of Science (Materials Engineering)
4. Master of Science (Advanced Manufacturing Technology)
5. Master of Science (Ship and Offshore Engineering)
6. Master of Science (Aeronautical Engineering)
7. Master of Science (Automotive Engineering)

Master of Philosophy/Doctor of Philosophy (Field of Research) :

1. Mechanical Engineering
2. Marine Technology

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 activities, laboratories and workshops are available and headed by a Laboratory 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

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 licenced 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 softwares 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 is 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 http://mech.utm.my

ADMINISTRATIVE STAFF

Dean

Professor Dr. Mohd. Hasbullah bin Hj. Idris
BEng (Mech. Prod.), UTM
MPhil (Investment Casting), L'borough
PhD (Mech. Eng.), UTM
Room : E07-04.03.09
Ext : 34567
E-mail : hasbullah@utm.my
hsbullah@mail.fkm.utm.my

Deputy Dean (Academics & Student Development)

Professor Dr. Izman Sudin
BEng (Mech.Ind.),UTM
MSc (Mnfg. Sys. Eng.), Warwick
PhD (Mech. Eng.),UTM
Room : E07-04.03.07
Ext : 57051
Email : izman@utm.my
izman@mail.fkm.utm.my

Deputy Dean (Research, Innovation, Communities & Networking)

Professor Dr. Mohd. Nasir binTamin
BSc (Mech. Eng.),Northrop
MSc (Mech. Eng.), Washington State
PhD (Mech. Eng. & App. Mechs.), Univ. of Rhode Island
Room : E07-04.03.08/C23 -328
Ext : 57048/34622
Email : nasirtamin@utm.my

Head of Department Aeronautics, Automotive & Ocean Engineering

Associate Professor Ir. Dr. Shuhaimi bin Mansor
BSc (Aero. Eng.),Glasgow
MSc (Flight Dynamics), Cranfield
PhD(Aero), L'borough
Peng. MIEM
Room : E07- 04.03.06
Ext : 57043
Email : shuhaimi@utm.my
shuhaimi@mail.fkm.utm.my

Head of Department Thermo-Fluids

Professor Dr. Mazlan bin Abdul Wahid
BSc (Aero. Eng.),Embry-Riddle Florida
MSc (Combustion & Energy), Leeds
PhD (Mech. Eng.),State Univ. Of New York
Room : E07-04.03.18
Ext : 57036
Email : mazlan@utm.my
mazlan@mail.fkm.utm.my

Head of Department
Applied Mechanics
& Design

Associate Professor Dr.Intan Zaurah bt Mat Darus
BEng. (Hons.)(Mech. Eng.), Univ. Of Wales Cardiff
PhD (Automatic Control & Sys. Eng.), Sheffield
Room : E07-04.03.15
Ext : 57044
Email : intan@utm.my
intan@mail.fkm.utm.my

Head of Department
Materials,
Manufacturing
& Industrial
Engineering

Associate Professor Dr. Muhamad Azizi bin Mat Yajid
BEng (Hons)(Materials Eng.), USM
MSc(Mech. Eng.), Leeds
PhD(Nanotechnology) The Univ.of Sheffield, UK
Room : E07-04.02.17
Ext : 57038
Email : azizi@utm.my
azizi_my@mail.fkm.utm.my

Academic Manager
(Post Graduate)

Associate Professor Ir. Dr. Zaini bin Ahmad
BEng (Mech.),UTM
MSc (Structures & Energy Studies),Leeds
PhD (Built Environment and Eng.), Australia
Room : E07-04.02.01
Ext : 57072
Email : azaini@utm.my
azaini@mail.fkm.utm.my

Research Manager

Professor Dr. Wong Kuan Yew
BEng (Mech. Ind.),UTM
MEng (Eng. Mngt),UTM
PhD (Mech. Eng.), Birmingham
Room : E07-04.02.05
Ext : 57062
Email : m-wongky@fkm.utm.my
wongky@fkm.utm.my

Academic Manager
(External Program)

Dr. Engku Mohammad Nazim bin Engku Abu Bakar
BSc (Metallurgy), Seoul,
MSc (Properties & Applications of Eng. Materials), Strathclyde
PhD (Mech. Eng.) UTM
Room : C24-114-02
Ext : 34861
Email : nazim@utm.my
nazim@mail.fkm.utm.my

Facility Manager

Dr. Mohamed Ruslan bin Abdullah
BEng (Mech.), UTM
MSc (Mfg. Sys. Eng.), Warwick
PhD (Impact Properties of Composite Materials), Liverpool
Room : C23-318
Ext : 34707
Email : ruslanabdullah@utm.my
ruslan@mail.fkm.utm.my

Deputy Registrar

Khairull Azmi bin Ishak
Bachelor of Arts (Geography) USM
Master of Management (Technology)
Room : E07–04.02.14
Ext : 57073
E-mail : khairull@utm.my
tpfkm@mail.fkm.utm.my

Assistant Registrar

Enna Fasihah binti Fadilah
Bachelor of Business Administration(BBA), UiTM
Room : E07 –04.03.12
Ext : 57063
Email : ennafasihah@utm.my
ennafasihah@mail.fkm.utm.my

PROGRAMME SPECIFICATIONS AREAS OF STUDY, CAREER PROSPECTS AND CURRICULUM

BACHELOR OF ENGINEERING (MECHANICAL)
PROGRAMME SPECIFICATIONS

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

12. Programme Objectives (PEO)

To Produce graduates who are able to:

(i) demonstrate their academic and technological excellence professionally and globally, particularly in areas related to mechanical engineering practices and contribute innovatively to the nation's wealth creation.

(ii) advance their careers by assuming increasing levels of responsibility, leadership and acquiring professional and advanced academic qualifications.

(iii) recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of their work and society.

(iv) adapt and communicate effectively and be successful working with multi disciplinary teams.

13. Programme Learning Outcomes (PO)

(a) Technical Knowledge and Competencies

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

PO4		
Ability to investigate complex mechanical engineering problems using research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
(b) Generic Skills		
Intended Learning Outcomes	**Teaching and Learning Methods**	**Assessment**
PO5		
Ability to use modern engineering and information technology (IT) tools in complex mechanical engineering activities, with an understanding of limitations; Keywords: **Modern Tools Usage**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO6		
Ability to apply professional engineering practice related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Ability to identify the impact of mechanical engineering solutions on sustainability and demonstrate the needs for sustainable development in societal and environmental contexts. Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.
PO8		
Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Ability to communicate effectively on complex mechanical engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Ability to work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

PO11		
Ability to undertake life long learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO12		
Ability to demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses

No.	Classification	Credit Hours	Percentage
i.	Programme Core	79	57
ii.	Programme Elective	38	28
iii.	Compulsory University Courses	20	15
Total		**137**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	85
	Total credit hours for Part A	**117**	
B	Non – Engineering Courses	20	15
	Total credit hours for Part B	**20**	
Total credit hours for Part A and B		**137**	**100**
15. Total Credit Hours to Graduate		**137**	

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 in studying 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:

- Turbo-Machinery
- 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 as well as project-oriented skills from both technical and non-technical consideration. Students are 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 design communication.

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 equipments, machineries and tools in all branches of industry including automotive, aerospace, marine/shipbuilding, manufacturing, processing and those involving heavy machineries. Graduates in this area are capable of fulfilling 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.

CURRICULUM

FIRST YEAR

SEMESTER I

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1013	Programming for Engineers	3	0	3	3	
SKMM 1203	Static*	3	1	0	3	
SKMM 1503	Engineering Drawing	1	0	6	3	
SKMM 1922	Introduction to Mechanical Engineering	0	0	3	2	
SSCE1693	Engineering Mathematics I	3	1	0	3	
ULAB1122	Academic English Skills	3	0	0	2	
		Total			**16**	

SEMESTER II

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1113	Mechanics of Solids I*	3	1	0	3	SKMM 1203
SKMM 1213	Dynamics*	3	1	0	3	SKMM 1203
SKMM 1512	Introduction to Design	1	0	3	2	SKMM 1503
SKMM 1912	Experimental Methods	2	0	3	2	
SKEU 1002	Electrical Technology	2	1	0	2	
SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
UICI 1012/ ULAM 1012	Islamic and Asian Civilization/ Malay Language for Communication 2#	2	0	0	2	
		Total			**17**	

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

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

SECOND YEAR

SEMESTER III

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2123	Mechanics of Solids II*	3	1	0	3	SKMM 1113
SKMM 2223	Mechanics of Machines & Vibration*	3	1	0	3	SKMM 1213
SKMM 2313	Mechanics of Fluids I*	3	1	0	3	SKMM 1203
SKMM 2413	Thermodynamics*	3	1	0	3	
SKMM 2921	Laboratory I	0	0	2	1	SKMM 1912
ULAB 2122	Advanced Academic English Skills	3	0	0	2	ULAB 1122
UHAS 1172/ UHAK 1022	Malaysian Dynamics/ Malaysian Studies 3#	2	0	0	2	
		Total			**17**	

SEMESTER IV

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2323	Mechanics of Fluids II*	3	1	0	3	SKMM 2313
SKMM 2423	Applied Thermodynamics*	3	1	0	3	SKMM 2413
SKMM 2613	Materials Science	3	1	0	3	
SKEU 2012	Electronics	2	0	0	2	SKEU 1002
SSCE 1993	Engineering Mathematics II	3	1	0	3	SSCE 1693
SSCE 2193	Engineering Statistics	3	1	0	3	
		Total			**17**	

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

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

THIRD YEAR

SEMESTER V

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2713	Manufacturing Processes	3	1	0	3	
SKMM 3023	Applied Numerical Methods	3	0	0	3	SKMM 1013, SSCE 1793
SKMM 3233	Control Engineering	3	0	0	3	SKMM 1213**, SSCE 1793**
SKMM 3242	Instrumentation	2	0	0	2	SKEU 2012**
SKMM 3931	Laboratory II	0	0	3	1	SKMM 2921
UHAK 1012	Graduate Success Attributes	2	0	0	2	
UHAK 1032	Introduction to Entrepreneurship	2	0	0	2	
		Total			**16**	

SEMESTER VI

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3033	Finite Element Methods	3	0	0	3	SKMM 1113**
SKMM 3252	Mechatronics	2	0	0	2	SKMM 1013**, SKEU 2012**
SKMM 3443	Heat Transfer	3	0	0	3	SKMM 2413**, SSCE 1793**
SKMM 3523	Component Design	2	0	3	3	SKMM 2123**, SKMM 1512
SKMM 3813	Industrial Engineering	3	1	0	3	
SKMM 3941	Laboratory III	0	0	3	1	SKMM 3931
ULAB 3162	English for Professional Purposes	3	0	2	2	ULAB 1122, ULAB 2122
		Total			**17**	

SHORT SEMESTER

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3915	Industrial Training				5	##, SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2423**
		Total			**5**	

** Minimum grade D- (30%) in the pre-requisite courses
Obtained minimum of 80 credits
Notes: L – Lecture, T – Tutorial, P/S – Practical/Studio

FOURTH YEAR

SEMESTER VII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 4533	System Design	2	0	3	3	SKMM 3523
SKMM 4823	Engineering Management, Safety and Economics	3	0	0	3	
SKMM 4912	Undergraduate Project I	0	0	6	2	SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2423**
SKMX 4xx3	Elective I	3	0	0	3	
SKMX 4xx3	Elective II	3	0	0	3	
UICL 2302	Thinking of Science and Technology	2	0	0	2	
		Total			**16**	

SEMESTER VIII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 4902	Engineering Professional Practice	0	0	2	2	Must be 3rd year
SKMM 4924	Undergraduate Project II	0	0	12	4	SKMM 4912
SKMX 4xx3	Elective III	3	0	0	3	
SKMX 4xx3	Elective IV	3	0	0	3	
ULAX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQX xxx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			**16**	

** Minimum grade D- (30%) in the pre-requisite courses

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

ELECTIVE COURSES

Students may take up any FOUR (4) of the following elective courses (for SKMX 4xx3) in any area of study subject to them being offered in the respective semesters.

	CODE	COURSE
AREA 1: MECHANICAL	SKMM 4113	Plasticity and Application
	SKMM 4123	Structural Analysis
	SKMM 4133	Failure of Engineering Components and Structures
	SKMM 4143	Mechanics of Composite Materials
	SKMM 4153	Applied Stress Analysis
	SKMM 4163	Surface Mount Technology
	SKMM 4213	Mechanical Vibration
	SKMM 4233	Mechanisms and Linkage
	SKMM 4243	Advanced Control
	SKMM 4253	Industrial Automation
	SKMM 4273	Robotics
	SKMM 4293	Noise
	SKMM 4313	Turbo-Machinery
	SKMM 4323	Fluid Power
	SKMM 4333	Computational Fluid Dynamics
	SKMM 4343	Hydraulic Machine and Pipe System
	SKMM 4353	Lubrications
	SKMM 4413	Internal Combustion Engine
	SKMM 4423	Power Plant Engineering
	SKMM 4433	Refrigeration and Air Conditioning
	SKMM 4443	Thermal Fluid System Design
	SKMM 4453	Combustion
	SKMM 4513	Computer Aided Design
AREA 2: MATERIALS	SKMB 4603	Non Destructive Testing
	SKMB 4613	Corrosion and Corrosion Control
	SKMB 4623	Materials Selection
	SKMB 4013	Modern Materials
	SKMB 4663	Materials Processing
	SKMB 4673	Surface Engineering
	SKMB 4683	Nanomaterials
	SKMB 4693	Modelling in Materials Engineering
AREA 3: MANUFACTURING	SKMP 4703	Design for Manufacture and Assembly
	SKMP 4723	Tooling for Production
	SKMP 4733	Product Design and Development
	SKMP 4753	Modern Machining
	SKMP 4793	CAD/CAM
AREA 4: INDUSTRIAL	SKMI 4803	Production Planning and Control
	SKMI 4813	Quality Engineering
	SKMI 4833	Facility Design
	SKMI 4843	Industrial System Simulation
	SKMI 4873	Project Management and Maintenance
	SKMI 4883	Operation Research
	SKMI 4893	Work Design

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 into clusters according to the skillset required by specific industries. Students will also experience industrial training with industries related to the respective cluster they had chosen. Consequently, Mechanical Engineering students can experience the working world while they are 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.

BACHELOR OF ENGINEERING (MECHANICAL – MATERIALS)
PROGRAMME SPECIFICATIONS

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

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

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

12. Programme Objectives (PEO)

To Produce graduates who are able to:

(i) demonstrate their academic and technological excellence professionally and globally, particularly in areas related to mechanical engineering practices and contribute innovatively to the nation's wealth creation.

(ii) advance their careers by assuming increasing levels of responsibility, leadership and acquiring professional and advanced academic qualifications.

(iii) recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of their work and society.

(iv) adapt and communicate effectively and be successful working with multi disciplinary teams.

13. Programme Learning Outcomes (PO)

(a) Technical Knowledge and Competencies

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

PO4		
Ability to investigate complex mechanical and materials engineering problems using research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
(b) Generic Skills		
Intended Learning Outcomes	**Teaching and Learning Methods**	**Assessment**
PO5		
Ability to use modern engineering and information technology (IT) tools in complex mechanical and materials engineering activities, with an understanding of limitations; Keywords: **Modern Tools Usage**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO6		
Ability to apply professional engineering practice related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Ability to identify the impact of mechanical and materials engineering solutions on sustainability and demonstrate the needs for sustainable development in societal and environmental contexts. Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.
PO8		
Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Ability to communicate effectively on complex mechanical and materials engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Ability to work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

PO11		
Ability to undertake life long learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO12		
Ability to demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses

No.	Classification	Credit Hours	Percentage
i.	Programme Core	80	58
ii.	Programme Elective	37	27
iii.	Compulsory University Courses	20	15
Total		**137**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	85
	Total credit hours for Part A	**117**	
B	Non – Engineering Courses	20	15
	Total credit hours for Part B	**20**	
Total credit hours for Part A and B		**137**	**100**
15.	**Total Credit Hours to Graduate**	**137**	

AREAS OF STUDY

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

a) Physical Metallurgy

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

b) Mechanical Properties of Materials

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

c) Materials Characterisation

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

d) Advanced Materials

This course covers advances in structures, properties, processes and applications of engineering materials through advanced technology. Students will be exposed to the latest technological innovations of advanced materials, processes, processing techniques as well as areas of applications and use.

e) Materials Processing

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

f) Corrosion and Corrosion Control

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

g) Materials Selection

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

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.

CURRICULUM

FIRST YEAR

SEMESTER I

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1203	Static*	3	1	0	3	
SKMM 1503	Engineering Drawing	1	0	6	3	
SKMM 1912	Experimental Methods	2	0	3	2	
SKMM 1922	Introduction to Mechanical Engineering	0	0	3	2	
SKEU 1002	Electrical Technology	2	1	0	2	
SSCE 1693	Engineering Mathematics I	3	1	0	3	
ULAB 1122	Academic English Skills	3	0	0	2	
		Total			**17**	

SEMESTER II

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1013	Programming for Engineers	3	0	0	3	
SKMM 1113	Mechanics of Solids I*	3	1	0	3	SKMM 1203
SKMM 1213	Dynamics*	3	1	0	3	SKMM 1203
SKMM 1512	Introduction to Design	1	0	3	2	SKMM 1503
SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
UICI 1012/ ULAM 1012	Islamic and Asian Civilization/ Malay Language for Communication 2#	2	0	0	2	
		Total			**16**	

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

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

SECOND YEAR

SEMESTER III

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2123	Mechanics of Solids II*	3	1	0	3	SKMM 1113
SKMM 2313	Mechanics of Fluids I*	3	1	0	3	SKMM 1203
SKMM 2413	Thermodynamics*	3	1	0	3	
SKMM 2613	Materials Science	3	1	0	3	
SKMM 2921	Laboratory I	0	0	2	1	SKMM 1912
ULAB 2122	Advanced Academic English Skills	3	0	0	2	ULAB 1122
UHAS 1172/ UHAK 1022	Malaysian Dynamics/ Malaysian Studies 3#	2	0	0	2	
		Total			**17**	

SEMESTER IV

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2223	Mechanics of Machines and Vibration*	3	1	0	3	SKMM 1213
SKMM 2323	Mechanics of Fluids II*	3	1	0	3	SKMM 2313
SKMM 2433	Applied Thermodynamics and Heat Transfer*	3	1	0	3	SKMM 2413
SKMM 2713	Manufacturing Processes	3	1	0	3	
SKEU 2012	Electronics	2	0	0	2	SKEU 1002
SSCE 1993	Engineering Mathematics II	3	1	0	3	SSCE 1693
		Total			**17**	

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

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

THIRD YEAR

SEMESTER V

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMB 3612	Physical Metallurgy	2	0	0	2	
SKMM 3233	Control Engineering	3	0	0	3	SKMM 1213**, SSCE 1793**
SKMM 3523	Component Design	2	0	3	3	SKMM 2123**, SKMM 1512
SKMM 3813	Industrial Engineering	3	1	0	3	
SKMM 3931	Laboratory II	0	0	3	1	SKMM 2921
UHAK 1012	Graduate Success Attributes	2	0	0	2	
UHAK 1032	Introduction to Entrepreneurship	2	0	0	2	
		Total			**16**	

SEMESTER VI

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMB 3623	Mechanical Properties of Materials	3	0	0	3	
SKMB 3633	Materials Characterization	3	0	0	3	
SKMM 3023	Applied Numerical Methods	3	0	0	3	SKMM 1013, SSCE 1793
SKMM 3242	Instrumentation	2	0	0	2	SKEU 2012**
SKMM 3941	Laboratory III	0	0	3	1	SKMM 3931
SSCE 2193	Engineering Statistics	3	1	0	3	
ULAB 3162	English for Professional Purposes	3	0	2	2	ULAB 1122, ULAB 2122
		Total			**17**	

SHORT SEMESTER

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3915	Industrial Training				5	##, SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
		Total			**5**	

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

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

FOURTH YEAR

SEMESTER VII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMB 4613	Corrosion and Corrosion Control	3	0	0	3	
SKMB 46x3	Elective I	3	0	0	3	
SKMB 46x3	Elective II	3	0	0	3	
SKMM 4823	Engineering Management, Safety and Economics	3	0	0	3	
SKMM 4912	Undergraduate Project I	0	0	6	2	SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
UICL 2302	Thinking of Science and Technology	2	0	0	2	
		Total			**16**	

SEMESTER VIII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMB 46x3	Elective III	3	0	0	3	
SKMM 4902	Engineering Professional Practice	0	0	2	2	Must be 3rd year
SKMM 4924	Undergraduate Project II	0	0	12	4	SKMM 4912
SKMM 4533	System Design	2	0	3	3	SKMM 3523
ULAX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQX xxx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			**16**	

** Minimum grade D- (30%) in the pre-requisite courses

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

ELECTIVE COURSES

Students may take up any THREE (3) of the following elective courses subject to them being offered in the respective semester.

SKMB 4603	Non Destructive Testing
SKMB 4623	Materials Selection
SKMB 4013	Modern Materials
SKMB 4663	Materials Processing
SKMB 4673	Surface Engineering
SKMB 4683	Nano Materials
SKMB 4693	Modelling in Materials Engineering

BACHELOR OF ENGINEERING (MECHANICAL – INDUSTRIAL)
PROGRAMME SPECIFICATIONS

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

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

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

12. Programme Objectives (PEO)

To Produce graduates who are able to:

(i) demonstrate their academic and technological excellence professionally and globally, particularly in areas related to mechanical engineering practices and contribute innovatively to the nation's wealth creation.

(ii) advance their careers by assuming increasing levels of responsibility, leadership and acquiring professional and advanced academic qualifications.

(iii) recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of their work and society.

(iv) adapt and communicate effectively and be successful working with multi disciplinary teams.

13. Programme Learning Outcomes (PO)

(a) Technical Knowledge and Competencies

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

PO4		
Ability to investigate complex mechanical and industrial engineering problems using research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
(b) Generic Skills		
Intended Learning Outcomes	**Teaching and Learning Methods**	**Assessment**
PO5		
Ability to use modern engineering and information technology (IT) tools in complex mechanical and industrial engineering activities, with an understanding of limitations; Keywords: **Modern Tools Usage**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO6		
Ability to apply professional engineering practice related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Ability to identify the impact of mechanical and industrial engineering solutions on sustainability and demonstrate the needs for sustainable development in societal and environmental contexts. Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.
PO8		
Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Ability to communicate effectively on complex mechanical and industrial engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Ability to work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

PO11		
Ability to undertake life long learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO12		
Ability to demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses

No.	Classification	Credit Hours	Percentage
i.	Programme Core	91	66
ii.	Programme Elective	26	19
iii.	Compulsory University Courses	20	15
Total		**137**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	85
	Total credit hours for Part A	**117**	
B	Non – Engineering Courses	20	15
	Total credit hours for Part B	**20**	
Total credit hours for Part A and B		**137**	**100**
15.	**Total Credit Hours to Graduate**	**137**	

AREAS OF STUDY

Industrial Engineering covers studies in the design, installation, control and performance improvement of an integrated system which includes man, material and machine. The field of study includes:-

a) Operation Research

Operations Research is divided into deterministic and stochastic categories. This field involves modelling of problems using tools such as linear programming, integer programming and network analysis. This course also covers operational problems which essentially involve probability such as queuing line and simulation models. All these methods aim to arrive at an optimum solution for an organisation.

b) Ergonomics and Safety

Ergonomics is concerned with the study of man and workplace relationship including tools and the environment. All these must be designed to fulfill human needs. The subject is closely related to the industrial safety that concerns with the aspects of workers' safety and health, work tools and machines.

c) Quality Engineering

Quality Engineering is a field that is involved in controlling and improving product and service quality. Statistical methods including Statistical Process Control (SPC) are used to control quality. In addition, Failure Mode Engineering Analysis (FMEA), Quality Function Deployment (QFD) and Design of Experiments (DOE) techniques are also introduced.

d) Production Planning and Control

Production needs to be controlled using a production planning and control system. Students will be exposed to forecasting, inventory control, scheduling and facility planning activities.

e) Work and Facilities Design

Work design involves work method improvement that is best for the worker. A good work system will improve productivity. On the other hand, facilities' planning is related to design of facility layout and determination of location. Various techniques and algorithms are used to design good layouts.

CAREER PROSPECTS

Graduates of this programme are essentially Mechanical Engineers but with specialisation in Industrial Engineering who can easily find job opportunities in various sectors. Alternatively, they can also be known as Industrial Engineers depending on their job placements in industries they are in. Additionally, they may also be known as Quality Engineer, Planner, Process Engineer, Quality Assurance Engineer, Product Engineer, Ergonomic/Safety and Health Engineer, Plant Layout Engineer etc.

Technology and all other resources need to be managed in an integrated and efficient manner either to produce a product or a service. Industrial Engineering concentrates on assembly activities and those of improving the performance of an integrated system involving man, material and machine. This activity requires specific knowledge and expertise in physics, engineering and social sciences together with principles and methods of engineering analysis and design to specify, predict and evaluate results that can be obtained from such system.

An Industrial Engineer generally focuses on work design, planning, management and control in industry. He/she is expected to possess sufficient background in mathematics and engineering principles complemented with knowledge in human factors related to psychology, sociology, physiology and others.

In order to complete the education in industrial engineering, the above aspects are further complemented with understanding of the organisational operations of industries, cost, quality and productivity which constitute the basis of any industrial activity. Industrial Engineering is wider than the conventional engineering and is interdisciplinary in nature and can be applied in many places and situations where cost, quality and productivity are important.

Hence, an Industrial Engineering graduate can be employed in both the industrial sector (small, medium and large) and service sector (government, education, financial, etc.).

CURRICULUM

FIRST YEAR

SEMESTER I

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1013	Programming for Engineers	3	0	3	3	
SKMM 1203	Static*	3	1	0	3	
SKMM 1503	Engineering Drawing	1	0	6	3	
SKMM 1922	Introduction to Mechanical Engineering	0	0	3	2	
SSCE 1693	Engineering Mathematics I	3	1	0	3	
ULAB 1122	Academic English Skills	3	0	0	2	
		Total			**16**	

SEMESTER II

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1113	Mechanics of Solids I*	3	1	0	3	SKMM 1203
SKMM 1213	Dynamics*	3	1	0	3	SKMM 1203
SKMM 1512	Introduction to Design	1	0	3	2	SKMM 1503
SKMM 1912	Experimental Methods	2	0	3	2	
SKEU 1002	Electrical Technology	2	1	0	2	
SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
UICI 1012/ ULAM 1012	Islamic and Asian Civilization/ Malay Language for Communication 2#	2	0	0	2	
		Total			**17**	

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

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

SECOND YEAR

SEMESTER III

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2123	Mechanics of Solids II*	3	1	0	3	SKMM 1113
SKMM 2223	Mechanics of Machines and Vibration*	3	1	0	3	SKMM 1213
SKMM 2313	Mechanics of Fluids I*	3	1	0	3	SKMM 1203
SKMM 2413	Thermodynamics*	3	1	0	3	
SKMM 2921	Laboratory I	0	0	2	1	SKMM 1912
ULAB 2122	Advanced Academic English Skills	3	0	0	2	ULAB 1122
UHAS 1172/ UHAK 1022	Malaysian Dynamics/ Malaysian Studies 3#	2	0	0	2	
		Total			**17**	

SEMESTER IV

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2323	Mechanics of Fluids II*	3	1	0	3	SKMM 2313
SKMM 2433	Applied Thermodynamics and Heat Transfer*	3	1	0	3	SKMM 2413
SKMM 2613	Materials Science	3	1	0	3	
SKEU 2012	Electronics	2	0	0	2	SKEU 1002
SSCE 1993	Engineering Mathematics II	3	1	0	3	SSCE 1693
SSCE 2193	Engineering Statistics	3	1	0	3	
		Total			**17**	

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

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

THIRD YEAR

SEMESTER V

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMI 3843	Production Planning and Control	3	0	0	3	
SKMI 3853	Work Design and Productivity	3	0	0	3	
SKMM 2713	Manufacturing Processes	3	1	0	3	
SKMM 3233	Control Engineering	3	0	0	3	SKMM 1213**, SSCE 1793**
SKMM 3931	Laboratory II	0	0	3	1	SKMM 2921
UHAK 1012	Graduate Success Attributes	2	0	0	2	
UHAK 1032	Introduction to Entrepreneurship	2	0	0	2	
		Total			**17**	

SEMESTER VI

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMI 3822	Quality System	3	0	0	2	
SKMI 3863	Engineering Economy and Accounting	3	0	0	3	
SKMM 3023	Applied Numerical Methods	3	0	0	3	SKMM 1013, SSCE 1793
SKMM 3242	Instrumentation	2	0	0	2	SKEU 2012**
SKMM 3523	Component Design	2	0	3	3	SKMM 2123**, SKMM 1512
SKMM 3941	Laboratory III	0	0	3	1	SKMM 3931
ULAB 3162	English for Professional Purposes	3	0	2	2	ULAB 1122, ULAB 2122
		Total			**16**	

SHORT SEMESTER

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3915	Industrial Training				5	##, SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
		Total			**5**	

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

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

FOURTH YEAR

SEMESTER VII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMI 3833	Operation Research	3	0	0	3	
SKMI 4xx3	Elective I	3	0	0	3	
SKMI 4xx3	Elective II	3	0	0	3	
SKMM 4533	System Design	2	0	3	3	SKMM 3523
SKMM 4912	Undergraduate Project I	0	0	6	2	SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
UICL 2302	Thinking of Science and Technology	2	0	0	2	
		Total			**16**	

SEMESTER VIII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMI 4053	Safety and Engineering Management	3	0	0	3	
SKMI 4xx3	Elective III	3	0	0	3	
SKMM 4902	Engineering Professional Practice	0	0	2	2	Must be 3rd year
SKMM 4924	Undergraduate Project II	0	0	12	4	SKMM 4912
ULAX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQX xxx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			**16**	

** Minimum grade D- (30%) in the pre-requisite courses

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

ELECTIVE COURSES

Students may take up any THREE (3) of the following elective courses subject to them being offered in the respective semester.

SKMI 4063	Ergonomics and Occupational Safety
SKMI 4073	Industrial Systems Simulation
SKMI 4083	Reliability and Maintenance
SKMI 4093	Supply Chain Management and Sustainability
SKMI 4813	Quality Engineering
SKMI 4833	Facility Design

BACHELOR OF ENGINEERING (MECHANICAL – MANUFACTURING)
PROGRAMME SPECIFICATIONS

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

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

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

12. Programme Objectives (PEO)

To Produce graduates who are able to:

(i) demonstrate their academic and technological excellence professionally and globally, particularly in areas related to mechanical engineering practices and contribute innovatively to the nation's wealth creation.

(ii) advance their careers by assuming increasing levels of responsibility, leadership and acquiring professional and advanced academic qualifications.

(iii) recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of their work and society.

(iv) adapt and communicate effectively and be successful working with multi disciplinary teams.

13. Programme Learning Outcomes (PO)

(a) Technical Knowledge and Competencies

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

PO4		
Ability to investigate complex mechanical and manufacturing engineering problems using research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
(b) Generic Skills		
Intended Learning Outcomes	**Teaching and Learning Methods**	**Assessment**
PO5		
Ability to use modern engineering and information technology (IT) tools in complex mechanical and manufacturing engineering activities, with an understanding of limitations; Keywords: **Modern Tools Usage**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO6		
Ability to apply professional engineering practice related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Ability to identify the impact of mechanical and manufacturing engineering solutions on sustainability and demonstrate the needs for sustainable development in societal and environmental contexts. Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.
PO8		
Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Ability to communicate effectively on complex mechanical and manufacturing engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Ability to work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

PO11		
Ability to undertake life long learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO12		
Ability to demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses

No.	Classification	Credit Hours	Percentage
i.	Programme Core	96	70
ii.	Programme Elective	21	15
iii.	Compulsory University Courses	20	15
Total		**137**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	85
	Total credit hours for Part A	**117**	
B	Non – Engineering Courses	20	15
	Total credit hours for Part B	**20**	
Total credit hours for Part A and B		**137**	**100**
15.	**Total Credit Hours to Graduate**	**137**	

AREAS OF STUDY

The study of Manufacturing Engineering involves the selection of machines, tooling, manufacturing systems, system design and product processing parameters. The focus of study will be in the manufacturing technology.

a) Tooling for Production

The manufacturing of products requires appropriate tools. This area covers jig and fixture design, principle of tooling design such as locating and clamping. Theory of metal shearing and sheet metal bending are also introduced.

b) CAD/CAM/CNC/CAE

Computer aided design (CAD) and computer aided manufacturing (CAM) is a field involving the production of models and part programming for computer numerical control (CNC) machines. The principle of computer aided engineering (CAE) and coordinate measuring machine (CMM) are also introduced.

c) Design for Manufacture and Assembly

Design for manufacture and assembly (DFMA) provide students with the necessary concepts and procedures to understand the integration for manufacturing criteria into the product design process such as the principles for design of reliable and easy-to-produce components with having minimal cost, design of machined, powder metallurgy/particulates and casting parts. Materials selection and benefits of DFMA in reduction part and assembly costs will also be discussed.

d) Other Technologies

Elective courses and other technologies taught include welding, casting, metal forming and plastic moulding. Their fundamentals and methods of processing are also described including sustainable engineering and product design.

CAREER PROSPECTS

The programme is designed to fulfill the needs of the manufacturing sector in Malaysia which has grown continuously since 30 years ago and thus required many manufacturing engineers. The Faculty of Mechanical Engineering has contributed immensely towards producing and the development of manufacturing engineers capable of satisfying the need of the manufacturing industry for multi-national companies (ie: Intel, Dyson, Technips, Subsea, Kiswire, Infineon etc) as well the local companies. PROTON, PERODUA, HONDA, YAMAHA, MODENAS, DRB HICOM, Faiza Beras and automotive components and parts manufacturers. Other industries that require the service of a manufacturing engineer are plastic manufacturing, compact disc, fabric, furniture, paper, semiconductor, metal parts, food production and packaging and many others.

Generally, the career of a manufacturing engineer is focused towards improving the efficiency of manufacturing processes uses and management of production system, equipment and human resources in manufacturing a particular product. Today the career opportunity for manufacturing engineers has increased rapidly in facing the challenges of globalization, the national vision 2020 and various trade agreements such as AFTA. These challenges have further placed the manufacturing sector under pressure to ensure the products produced can compete internationally, are inexpensive and of good quality.

A wealth a career opportunity awaits the manufacturing engineering graduate to serve in various industries. Among these are the automotive industries such as other than working in the manufacturing sector, a manufacturing engineer can also find career in the consulting, research and development sectors. The academic field is another opportunity for the manufacturing engineer to serve in universities and colleges throughout the nation in order to produce more highly qualified graduates especially in the area of advanced manufacturing.

The faculty will always ensure that the manufacturing engineering graduate is equipped with interdisciplinary knowledge in order to allow them to participate in various sectors of the industry. Hence, the role of manufacturing engineers is always relevant and we ensure that the manufacturing engineering graduates are equipped with up-to-date knowledge and tools to keep in phase with current development.

CURRICULUM

FIRST YEAR

SEMESTER I

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1013	Programming for Engineers	3	0	3	3	
SKMM 1203	Static*	3	1	0	3	
SKMM 1503	Engineering Drawing	1	0	6	3	
SKMM 1922	Introduction to Mechanical Engineering	0	0	3	2	
SSCE 1693	Engineering Mathematics I	3	1	0	3	
ULAB 1122	Academic English Skills	3	0	0	2	
		Total			**16**	

SEMESTER II

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1113	Mechanics of Solids I*	3	1	0	3	SKMM 1203
SKMM 1213	Dynamics*	3	1	0	3	SKMM 1203
SKMM 1512	Introduction to Design	1	0	3	2	SKMM 1503
SKMM 1912	Experimental Methods	2	0	3	2	
SKEU 1002	Electrical Technology	2	1	0	2	
SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
UICI 1012/ ULAM 1012	Islamic and Asian Civilization/ Malay Language for Communication 2#	2	0	0	2	
		Total			**17**	

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

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

SECOND YEAR

SEMESTER III

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2123	Mechanics of Solids II*	3	1	0	3	SKMM 1113
SKMM 2223	Mechanics of Machines and Vibration*	3	1	0	3	SKMM 1213
SKMM 2313	Mechanics of Fluids I*	3	1	0	3	SKMM 1203
SKMM 2413	Thermodynamics*	3	1	0	3	
SKMM 2921	Laboratory I	0	0	2	1	SKMM 1912
ULAB 2122	Advanced Academic English Skills	3	0	0	2	ULAB 1122
UHAS 1172/ UHAK 1022	Malaysian Dynamics/ Malaysian Studies 3#	2	0	0	2	
		Total			**17**	

SEMESTER IV

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2323	Mechanics of Fluids II*	3	1	0	3	SKMM 2313
SKMM 2433	Applied Thermodynamics and Heat Transfer*	3	1	0	3	SKMM 2413
SKMM 2613	Materials Science	3	1	0	3	
SKEU 2012	Electronics	2	0	0	2	SKEU 1002
SSCE 1993	Engineering Mathematics II	3	1	0	3	SSCE 1693
SSCE 2193	Engineering Statistics	3	1	0	3	
		Total			**17**	

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

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

THIRD YEAR

SEMESTER V

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2713	Manufacturing Processes	3	1	0	3	
SKMM 3233	Control Engineering	3	0	0	3	SKMM 1213**, SSCE 1793**
SKMM 3623	Materials Engineering	3	0	0	3	SKMM 2613
SKMM 3931	Laboratory II	0	0	3	1	SKMM 2921
SKMP 3813	Manufacturing System	3	0	0	3	
UHAK 1012	Graduate Success Attributes	2	0	0	2	
UHAK 1032	Introduction to Entrepreneurship	2	0	0	2	
		Total			**17**	

SEMESTER VI

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3023	Applied Numerical Methods	3	0	0	3	SKMM 1013, SSCE 1793
SKMM 3242	Instrumentation	2	0	0	2	SKEU 2012**
SKMM 3523	Component Design	2	0	3	3	SKMM 2123**, SKMM 1512
SKMP 3712	Design for Manufacture and Assembly	2	0	0	2	
SKMP 3722	Modern Manufacturing	2	0	0	2	
SKMP 3942	Laboratory III CAD/CAM/CNC/CAE	0	0	6	2	SKMM 3931
ULAB 3162	English for Professional Purposes	3	0	2	2	ULAB 1122, ULAB 2122
		Total			**16**	

SHORT SEMESTER

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3915	Industrial Training				5	##, SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
		Total			**5**	

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

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

FOURTH YEAR

SEMESTER VII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 4533	System Design	2	0	3	3	SKMM 3523
SKMM 4912	Undergraduate Project I	0	0	6	2	SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
SKMP 4723	Tooling for Production	3	0	0	3	
SKMP 4xx3	Elective I	3	0	0	3	
SKMP 4xx3	Elective II	3	0	0	3	
UICL 2302	Thinking of Science and Technology	2	0	0	2	
		Total			**16**	

SEMESTER VIII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 4823	Engineering Management, Safety and Economics	3	0	0	3	
SKMM 4902	Engineering Professional Practice	0	0	2	2	Must be 3rd year
SKMM 4924	Undergraduate Project II	0	0	12	4	SKMM 4912
SKMP 4xx3	Elective III	3	0	0	3	
ULAX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQX xxx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			**16**	

** Minimum grade D- (30%) in the pre-requisite courses

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

ELECTIVE COURSES

Students may take up any THREE (3) of the following elective courses subject to them being offered in the respective semester.

SKMP 4703	Sustainable Manufacturing
SKMP 4713	Industrial Automation
SKMP 4723	Product Design and Development
SKMP 4743	Plastic Technology
SKMP 4753	Modern Machining
SKMP 4763	Quality Engineering and Metrology
SKMP 4783	Quality Engineering
SKMP 4793	CAD/CAM
SKMP 4823	Engineering Economy and Accounting
SKMP 4833	Project Management and Maintenance

BACHELOR OF ENGINEERING (MECHANICAL – AERONAUTICS)
PROGRAMME SPECIFICATIONS

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

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

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

12. Programme Objectives (PEO)

To Produce graduates who are able to:

(i) demonstrate their academic and technological excellence professionally and globally, particularly in areas related to mechanical and aeronautical engineering practices and contribute innovatively to the nation's wealth creation.

(ii) advance their careers by assuming increasing levels of responsibility, leadership and acquiring professional and advanced academic qualifications.

(iii) recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of their work and society.

(iv) adapt and communicate effectively and be successful working with multi disciplinary teams.

13. Programme Learning Outcomes (PO)

(a) Technical Knowledge and Competencies

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

PO4		
Ability to investigate complex mechanical and aeronautical engineering problems using research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
(b) Generic Skills		
Intended Learning Outcomes	**Teaching and Learning Methods**	**Assessment**
PO5		
Ability to use modern engineering and information technology (IT) tools in complex mechanical and aeronautical engineering activities, with an understanding of limitations; Keywords: **Modern Tools Usage**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO6		
Ability to apply professional engineering practice related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Ability to identify the impact of mechanical and aeronautical engineering solutions on sustainability and demonstrate the needs for sustainable development in societal and environmental contexts. Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.
PO8		
Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Ability to communicate effectively on complex mechanical and aeronautical engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Ability to work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

PO11		
Ability to undertake life long learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO12		
Ability to demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses

No.	Classification	Credit Hours	Percentage
i.	Programme Core	88	52
ii.	Programme Elective	29	33
iii.	Compulsory University Courses	20	15
Total		**137**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	85
	Total credit hours for Part A	**117**	
B	Non – Engineering Courses	20	15
	Total credit hours for Part B	**20**	
Total credit hours for Part A and B		**137**	**100**
15. Total Credit Hours to Graduate		**137**	

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, aerodynamic study will determine a suitable shape for an aircraft, missile etc.

b) 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) Propulsion

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

d) Aircraft instrumentation and Avionics

Avionics is the acronym for `Aviation Electronics' and together with aircraft instrumentation 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 together 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 operation smoothly. Regulations concerning the construction and operations of aircraft have been so devised in order to avoid accidents and mistakes which may sacrifice lives.

f) Transportation

Apart from transporting passengers an aircraft is also used as cargo carriers, ambulance etc. Study in this area trains transportation experts to modify flight schedule and load so that 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, plastic, 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 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 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. The area includes the 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.

CAREER PROSPECTS

Graduates of this programme are essentially Mechanical Engineers but those with specialisation to 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 industries they are in.

The Aeronautical Engineering programme was first offered by UTM during the 1980/81 session, jointly run by UTM and TUDM. Its objective was to fulfil the need for skilled and semi-skilled human resources in the aeronautical field especially in the public sector. TUDM required human resources to operate, maintain, repair, oversee and manage different types of aircraft and UTM had the capability to produce graduates in this field. This need has continued to increase with the development in the airline industry in Malaysia which demands for more trained manpower especially engineers and technical assistants.

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, Air Asia, AIROD, Eagle Aircraft, 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 involved actively in the airline industry of the country by offering more job opportunities to UTM graduates.

CURRICULUM

FIRST YEAR

SEMESTER I

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1203	Static*	3	1	0	3	
SKMM 1503	Engineering Drawing	1	0	6	3	
SKMM 1912	Experimental Methods	2	0	3	2	
SKMM 1922	Introduction to Mechanical Engineering	0	0	3	2	
SKEU 1002	Electrical Technology	2	1	0	2	
SSCE 1693	Engineering Mathematics I	3	1	0	3	
ULAB 1122	Academic English Skills	3	0	0	2	
		Total			**17**	

SEMESTER II

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1013	Programming for Engineers	3	0	0	3	
SKMM 1113	Mechanics of Solids I*	3	1	0	3	SKMM 1203
SKMM 1213	Dynamics*	3	1	0	3	SKMM 1203
SKMM 1512	Introduction to Design	1	0	3	2	SKMM 1503
SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
UICI 1012/ ULAM 1012	Islamic and Asian Civilization/ Malay Language for Communication 2#	2	0	0	2	
		Total			**16**	

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

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

SECOND YEAR

SEMESTER III

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2123	Mechanics of Solids II*	3	1	0	3	SKMM 1113
SKMM 2313	Mechanics of Fluids I*	3	1	0	3	SKMM 1203
SKMM 2413	Thermodynamics*	3	1	0	3	
SKMM 2921	Laboratory I	0	0	2	1	SKMM 1912
SSCE 1993	Engineering Mathematics II	3	1	0	3	SSCE 1693
ULAB 2122	Advanced Academic English Skills	3	0	0	2	ULAB 1122
UHAS 1172/ UHAK 1022	Malaysian Dynamics/ Malaysian Studies 3#	2	0	0	2	
		Total			**17**	

SEMESTER IV

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2223	Mechanics of Machines and Vibration*	3	1	0	3	SKMM 1213
SKMM 2323	Mechanics of Fluids II*	3	1	0	3	SKMM 2313
SKMM 2433	Applied Thermodynamics and Heat Transfer*	3	1	0	3	SKMM 2413
SKMM 2613	Materials Science	3	1	0	3	
SKMM 2713	Manufacturing Processes	3	1	0	3	
SKEU 2012	Electronics	2	0	0	2	SKEU 1002
		Total			**17**	

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

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

THIRD YEAR

SEMESTER V

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMA 3333	Aerodynamics	3	1	0	3	SKMM 2323**
SKMM 3023	Applied Numerical Methods	3	0	0	3	SKMM 1013, SSCE 1793
SKMM 3233	Control Engineering	3	0	0	3	SKMM 1213**, SSCE 1793**
SKMM 3622	Materials Technology	2	0	0	2	SKMM 2613
SKMM 3931	Laboratory II	0	0	3	1	SKMM 2921
UHAK 1012	Graduate Success Attributes	2	0	0	2	
UHAK 1032	Introduction to Entrepreneurship	2	0	0	2	
		Total			**16**	

SEMESTER VI

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMA 3132	Aircraft Structure I	2	0	0	2	SKMM 2123
SKMA 3212	Flight Mechanics	2	0	0	2	SKMA 3333, SKMM 2323
SKMA 3423	Aerospace Propulsion System	3	0	0	3	SKMM 2413
SKMA 3812	Aviation Management	2	0	0	2	
SKMM 3033	Finite Element Methods	3	0	0	3	SKMM 1113**
SKMM 3941	Laboratory III	0	0	3	1	SKMM 3931
SSCE 2193	Engineering Statistics	3	1	0	3	
ULAB 3162	English for Professional Purposes	3	0	2	2	ULAB 1122, ULAB 2122
		Total			**18**	

SHORT SEMESTER

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3915	Industrial Training				5	##, SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
		Total			**5**	

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

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

FOURTH YEAR

SEMESTER VII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMA 4143	Aircraft Structure II	3	0	0	3	SKMA 3132
SKMA 4223	Flight Dynamics and Control	3	0	0	3	SKMA 3212**, SKMA 3333, SKMM 3233
SKMA 4253	Aircraft Instrumentation and Avionics	3	0	0	3	SKEU 2012
SKMA 4513	Aircraft Design I	2	0	3	3	SKMA 3212, SKMM 1512
SKMM 4912	Undergraduate Project I	0	0	6	2	SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
UICL 2302	Thinking of Science and Technology	2	0	0	2	
		Total			**16**	

SEMESTER VIII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMA 4523	Aircraft Design II	2	0	3	3	SKMA 4513
SKMA 4822	Aviation Economy	2	0	0	2	
SKMM 4902	Engineering Professional Practice	0	0	2	2	Must be 3rd year
SKMM 4924	Undergraduate Project II	0	0	12	4	SKMM 4912
ULAX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQX xxx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			**16**	

** Minimum grade D- (30%) in the pre-requisite courses

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

BACHELOR OF ENGINEERING (MECHANICAL – AUTOMOTIVE)
PROGRAMME SPECIFICATIONS

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

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

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

12. Programme Objectives (PEO)

To Produce graduates who are able to:

(i) demonstrate their academic and technological excellence professionally and globally, particularly in areas related to mechanical – automotive engineering practices and contribute innovatively to the nation's wealth creation.

(ii) advance their careers by assuming increasing levels of responsibility, leadership and acquiring professional and advanced academic qualifications.

(iii) recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of their work and society.

(iv) adapt and communicate effectively and be successful working with multi disciplinary teams.

13. Programme Learning Outcomes (PO)

(a) Technical Knowledge and Competencies

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

PO4		
Ability to investigate complex mechanical and automotive engineering problems using research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
(b) Generic Skills		
Intended Learning Outcomes	**Teaching and Learning Methods**	**Assessment**
PO5		
Ability to use modern engineering and information technology (IT) tools in complex mechanical and automotive engineering activities, with an understanding of limitations; Keywords: **Modern Tools Usage**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO6		
Ability to apply professional engineering practice related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Ability to identify the impact of mechanical and automotive engineering solutions on sustainability and demonstrate the needs for sustainable development in societal and environmental contexts. Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.
PO8		
Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Ability to communicate effectively on complex mechanical and automotive engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Ability to work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

PO11		
Ability to undertake life long learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO12		
Ability to demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses

No.	Classification	Credit Hours	Percentage
i.	Programme Core	96	70
ii.	Programme Elective	21	15
iii.	Compulsory University Courses	20	15
Total		**137**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	85
	Total credit hours for Part A	**117**	
B	Non – Engineering Courses	20	15
	Total credit hours for Part B	**20**	
Total credit hours for Part A and B		**137**	**100**
15. Total Credit Hours to Graduate		**137**	

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 main system and sub-systems which constitute a car; such as the internal combustion engine (ICE), transmission chassis and its electrical and electronics instrumentation 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 essentials 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 drivetrain with the powerplant to predict the essential vehicle performances 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 covers the fundamental aspects of automotive production processes which emphasize on casting, forming and the challenging 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 relation 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 fundamental and applications of internal combustion engines, mainly on transportation. Projects in this field can vary from intake system configuration to combustion study and exhaust energy recovery. The area broadly aims for 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 specialisation in Automotive Engineering who can seek job opportunities in various mechanical and automotive sectors. Alternatively, they can also be known as Automotive Engineers depending on their job placements in the industries they are in.

Mechanical-Automotive graduates from UTM will be able to perform job requirements in the field of research, design, development and production of various types of vehicles. In most cases they will be working in 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 to quality assurance practice to fulfil the requirements of 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 vehicles, and even branch into locomotives companies such as MASTER BUILDERS and MALAYSIAN TRUCKS & BUS. Furthermore, the advancement of motorsports related industry has created the need for technical expertise to support the industry; another exciting industry in which Mechanical-Automotive graduates can adapt 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 to take a position and advance their career 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.

CURRICULUM

FIRST YEAR

SEMESTER I

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1203	Static*	3	1	0	3	
SKMM 1503	Engineering Drawing	1	0	6	3	
SKMM 1912	Experimental Methods	2	0	3	2	
SKMM 1922	Introduction to Mechanical Engineering	0	0	3	2	
SKEU 1002	Electrical Technology	2	1	0	2	
SSCE 1693	Engineering Mathematics I	3	1	0	3	
ULAB 1122	Academic English Skills	3	0	0	2	
		Total			**17**	

SEMESTER II

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1013	Programming for Engineers	3	0	0	3	
SKMM 1113	Mechanics of Solids I*	3	1	0	3	SKMM 1203
SKMM 1213	Dynamics*	3	1	0	3	SKMM 1203
SKMM 1512	Introduction to Design	1	0	3	2	SKMM 1503
SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
UICI 1012/ ULAM 1012	Islamic and Asian Civilization/ Malay Language for Communication 2#	2	0	0	2	
		Total			**16**	

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

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

SECOND YEAR

SEMESTER III

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2123	Mechanics of Solids II*	3	1	0	3	SKMM 1113
SKMM 2313	Mechanics of Fluids I*	3	1	0	3	SKMM 1203
SKMM 2413	Thermodynamics*	3	1	0	3	
SKMM 2921	Laboratory I	0	0	2	1	SKMM 1912
SSCE 1993	Engineering Mathematics II	3	1	0	3	SSCE 1693
ULAB 2122	Advanced Academic English Skills	3	0	0	2	ULAB 1122
UHAS 1172/ UHAK 1022	Malaysian Dynamics/ Malaysian Studies 3#	2	0	0	2	
		Total			**17**	

SEMESTER IV

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2223	Mechanics of Machines and Vibration*	3	1	0	3	SKMM 1213
SKMM 2323	Mechanics of Fluids II*	3	1	0	3	SKMM 2313
SKMM 2433	Applied Thermodynamics and Heat Transfer*	3	1	0	3	SKMM 2413
SKMM 2613	Materials Science	3	1	0	3	
SKMM 2713	Manufacturing Processes	3	1	0	3	
SKEU 2012	Electronics	2	0	0	2	SKEU 1002
		Total			**17**	

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

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

THIRD YEAR

SEMESTER V

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3023	Applied Numerical Methods	3	0	0	3	SKMM 1013, SSCE 1793
SKMM 3233	Control Engineering	3	0	0	3	SKMM 1213**, SSCE 1793**
SKMM 3523	Components Design	2	0	3	3	SKMM 1512, SKMM 2123**
SKMM 3931	Laboratory II	0	0	3	1	SKMM 2921
SKMV 3012	Automotive Technology	2	0	0	2	SKEU 2012
UHAK 1012	Graduate Success Attributes	2	0	0	2	
UHAK 1032	Introduction to Entrepreneurship	2	0	0	2	
		Total			**16**	

SEMESTER VI

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3033	Finite Element Methods	3	0	0	3	SKMM 1113**
SKMM 3242	Instrumentation	2	0	0	2	SKEU 2012**
SKMM 3813	Industrial Engineering	3	1	0	3	
SKMV 3413	Internal Combustion Engines	3	0	0	3	SKMM 2413, SSCE 1793
SKMV 3941	Laboratory III	0	0	2	1	SKMM 3931
SSCE 2193	Engineering Statistics	3	1	0	3	
ULAB 3162	English for Professional Purposes	3	0	2	2	ULAB 1122, ULAB 2122
		Total			**17**	

SHORT SEMESTER

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3915	Industrial Training				5	##, SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
		Total			**5**	

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

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

FOURTH YEAR

SEMESTER VII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3622	Materials Technology	2	0	0	2	SKMM 2613
SKMM 4823	Engineering Management, Safety and Economics	3	0	0	3	
SKMM 4912	Undergraduate Project I	0	0	6	2	SKMM 2123**, SKMM 2223**, SKMM 2323**, SKMM 2433**
SKMV 4212	Automotive Electronics and Instrumentation	2	0	0	2	SKMM 3242, SKMV 3012
SKMV 4xx3	Elective I	3	0	0	3	
SKMV 4yy3	Elective II	3	0	0	3	
UICL 2302	Thinking of Science and Technology	2	0	0	2	
		Total			**17**	

SEMESTER VIII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 4902	Engineering Professional Practice	0	0	2	2	Must be 3rd year
SKMM 4924	Undergraduate Project II	0	0	12	4	SKMM 4912
SKMV 4523	Automotive Engineering Design	2	0	3	3	SKMM 3233, SKMM 3523
SKMV 4792	Automotive Production Technology	2	0	0	2	SKMM 2713, SKMV 3012
ULAX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQX xxx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			**15**	

** Minimum grade D- (30%) in the pre-requisite courses

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

ELECTIVE COURSES

Choose one (1) from each elective (Elective I and Elective II):

Elective I

SKMV 4213	Vehicle Dynamics
SKMV 4413	Engine Turbocharging

Elective II

SKMV 4123	Vehicle Structures
SKMV 4423	Vehicle Powertrain

BACHELOR OF ENGINEERING (NAVAL ARCHITECTURE AND OFFSHORE ENGINEERING)
PROGRAMME SPECIFICATIONS

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

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

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

12. Programme Objectives (PEO)

To Produce graduates who are able to:

(i) demonstrate their 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.

(ii) advance their careers by assuming increasing levels of responsibility, leadership and acquiring professional and advanced academic qualifications.

(iii) recognize and practice professional, ethical, environmental and societal responsibilities and value different global and cultural aspects of their work and society.

(iv) adapt and communicate effectively and be successful working with multi disciplinary teams.

13. Programme Learning Outcomes (PO)

(a) Technical Knowledge and Competencies

Intended Learning Outcomes	Teaching and Learning Methods	Assessment
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**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem – based learning.	Examinations, laboratory reports, seminar presentations, problem – based exercises, individual and group project reports.
PO2		
Ability to identify, formulate and analyse complex naval architecture and offshore engineering problems; Keywords: **Problem Analysis**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem – based learning.	Examinations, laboratory reports, seminar presentations, problem – based exercises, individual and group project reports.
PO3		
Ability to design solutions for complex naval architecture and offshore engineering problems that fulfil health, safety, societal, cultural and environmental needs; Keywords: **Design/Development of Solutions**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.

PO4		
Ability to investigate complex naval architecture and offshore engineering problems using research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
(b) Generic Skills		
Intended Learning Outcomes	**Teaching and Learning Methods**	**Assessment**
PO5		
Ability to use modern engineering and information technology (IT) tools in complex naval architecture and offshore engineering activities, with an understanding of limitations; Keywords: **Modern Tools Usage**	Lectures, tutorials, laboratory works, seminars, studio works, directed reading, final year projects and problem-based learning.	Examinations, laboratory reports, seminar presentations, problem-based exercises, individual and group project reports.
PO6		
Ability to apply professional engineering practice related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Ability to identify the impact of naval architecture and offshore engineering solutions on sustainability and demonstrate the needs for sustainable development in societal and environmental contexts. Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.
PO8		
Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Ability to communicate effectively on complex naval architecture and offshore engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Ability to work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

PO11		
Ability to undertake life long learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO12		
Ability to demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses

No.	Classification	Credit Hours	Percentage
i.	Programme Core	62	45
ii.	Programme Elective	55	40
iii.	Compulsory University Courses	20	15
Total		**137**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	85
	Total credit hours for Part A	**117**	
B	Non – Engineering Courses	20	15
	Total credit hours for Part B	**20**	
Total credit hours for Part A and B		**137**	**100**
15. Total Credit Hours to Graduate		**137**	

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, performance and dynamic behaviour of marine vehicles such as ships and submarines, and also other marine structures fixed or floating. The curriculum has about forty five percents (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 percents (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 which introduces students to basic naval architectural knowledge. It enable students to familiarise themselves with naval architectural terms, ship components and undertakes simple hydrostatics and stability calculations. Tools and techniques which 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 calculation of areas, moments and centroids, transverse stability, longitudinal stability, large angle stability, damage stability, 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 motion of Viscous/Real fluid and an Ideal fluid. Further discussion are also given in surface waves and hydrodynamic of slender bodies.

c) Ship and Offshore Structures

Ship and Offshore Structures concerns 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 will then discuss in detail. The important structural strength analysis for ship and offshore structures will be highlighted on bending and buckling afterward.

d) Ship and Offshore Production Technology

Ship and Offshore Production Technology study 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 to 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 yards location, layout and facilities. Material treatment including surface preparation, cutting process, welding and painting process which involve in the construction process. It followed by subassembly, block assembly and erection process of offshore structures. Upon completion, launching, transporting and upsetting process will also be discussed. On the soft engineering side, the quality control and production system will also be taught. Apart from normal lecture hours, the students are expected to carry out class assignment, field surveys or site visits to ship 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 team effectively, long life learning and communication skills.

e) Ship and Offshore Design

The course firstly explains the concepts of engineering design and later relates them to the process and procedures in ship and offshore design. Emphasis is made on preliminary design calculations to satisfy 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 Handson 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 areas much as possible tailored to the real design practice in industry.

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 main components, operating principles and plant performances will be studied. This includes the marine diesel engine and steam turbine power plant, electric and hydraulic power systems. Other important support system such as air conditioning, fire, condition and Performance monitoring system 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 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 app raising 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 management part 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 safety will 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 testing and 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, Maritime Defence and Law Enforcement, Government Authorities & Marine/Maritime Associations, Marine and Inland Fishing, Marine Tourism, Marine Mining, Marine Environment and Marine Products & Services.

Over the past few years, marine and offshore industry has experienced rapid growth. The industry is expected to continue growing in the future. With particular, exploration activities have increased thus increasing the need for infrastructure such as FPSO (Floating Production Storage and offloading), semi-submarine platforms and so forth.

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

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 also 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 work place may be a large company, a small group, a consultancy or a government department.

CURRICULUM

FIRST YEAR

SEMESTER I

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1203	Static*	3	1	0	3	
SKMM 1503	Engineering Drawing	1	0	6	3	
SKMM 1912	Experimental Methods	2	0	3	2	
SKMO 1922	Introduction to Naval Architecture and Offshore Engineering	0	0	3	2	
SKEU 1002	Electrical Technology	2	1	0	2	
SSCE 1693	Engineering Mathematics I	3	1	0	3	
ULAB 1122	Academic English Skills	3	0	0	2	
		Total			**17**	

SEMESTER II

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 1013	Programming for Engineers	3	0	0	3	
SKMM 1113	Mechanics of Solids I*	3	1	0	3	SKMM 1203
SKMM 1213	Dynamics*	3	1	0	3	SKMM 1203
SKMM 1512	Introduction to Design	1	0	3	2	SKMM 1503
SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
UICI 1012/ ULAM 1012	Islamic and Asian Civilization/ Malay Language for Communication 2#	2	0	0	2	
		Total			**16**	

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

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

SECOND YEAR

SEMESTER III

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2613	Materials Science	3	1	0	3	
SKMM 2313	Mechanics of Fluids I*	3	1	0	3	SKMM 1203
SKMM 2413	Thermodynamics*	3	1	0	3	
SKMM 2921	Laboratory I	0	0	2	1	SKMM 1912
SSCE 1993	Engineering Mathematics II	3	1	0	3	SSCE 1693
ULAB 2122	Advanced Academic English Skills	3	0	0	2	ULAB 1122
UHAS 1172/ UHAK 1022	Malaysian Dynamics/ Malaysian Studies 3#	2	0	0	2	
		Total			**17**	

SEMESTER IV

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 2223	Mechanics of Machines and Vibration*	3	1	0	3	SKMM 1213
SKMO 2123	Ship and Offshore Structures I	3	1	0	3	SKMM 1113
SKMO 2322	Naval Architecture I	1	0	3	2	
SKMO 2343	Marine Hydrodynamics	3	1	0	3	SKMM 2313
SKEU 2012	Electronics	2	0	0	2	SKEU 1002
SSCE 2193	Engineering Statistics	3	1	0	3	
		Total			**17**	

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

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

THIRD YEAR

SEMESTER V

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3023	Applied Numerical Methods	3	0	0	3	SKMM 1013, SSCE 1793
SKMM 3931	Laboratory II	0	0	3	1	SKMM 2921
SKMO 3333	Naval Architecture II	3	1	0	3	SKMO 2322
SKMO 3353	Ship Resistance and Propulsion	3	1	0	3	SKMM2313
SKMO 3713	Ship and Offshore Production Technology	3	0	0	3	
UHAK 1012	Graduate Success Attributes	2	0	0	2	
UHAK 1032	Introduction to Entrepreneurship	2	0	0	2	
		Total			**17**	

SEMESTER VI

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 3033	Finite Element Methods	3	0	0	3	SKMM 1113**
SKMM 3242	Instrumentation	2	0	0	2	SKEU 2012**
SKMM 3623	Materials Engineering	3	0	0	3	SKMM 2613
SKMO 3133	Ship and Offshore Structure II	3	1	0	3	SKMO 2123**
SKMO 3523	Ship and Offshore Design I	2	0	3	3	SKMO 3333**, SKMO 3353**
SKMO 3812	Marine Transport and Economics	2	0	0	2	
ULAB 3162	English for Professional Purposes	3	0	2	2	ULAB 1122, ULAB 2122
		Total			**18**	

SHORT SEMESTER

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMO 3915	Industrial Training				5	##, SKMO 2123**, SKMM 2223**
		Total			**5**	

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

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

FOURTH YEAR

SEMESTER VII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMO 4233	Dynamics of Marine Vehicles	3	0	0	3	SKMM 2223, SKMO 2343
SKMO 4422	Marine and Offshore Engineering System	2	0	0	2	SKMM 2413
SKMO 4533	Ship and Offshore Design II	2	0	3	3	SKMO 3523
SKMO 4912	Undergraduate Project I	0	0	6	2	SKMM 2223**, SKMO 2123**
SKMO 4941	Marine Laboratory I	0	0	3	1	SKMO 3333**, SKMO 3353**
SKMO 4xx2	Marine and Offshore Elective I	2	0	0	2	
UICL 2302	Thinking of Science and Technology	2	0	0	2	
		Total			**15**	

SEMESTER VIII

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SKMM 4902	Engineering Professional Practice	0	0	2	2	Must be 3rd year
SKMO 4924	Undergraduate Project II	0	0	12	4	SKMO 4912
SKMO 4823	Marine Management, Safety and Environment	3	0	0	3	
SKMO 4951	Marine Laboratory II	0	0	3	1	SKMO 4233**
SKMO 4yy2	Marine and Offshore Elective II	3	0	0	2	
ULAX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQX xxx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			**16**	

** Minimum grade D- (30%) in the pre-requisite courses

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

ELECTIVE COURSES

Choose one (1) from each elective (Elective I and Elective II):

Elective I

SKMO 4012	Marine Meteorology and Oceonography
SKMO 4132	Marine Control Engineering
SKMO 4142	Reliability of Ship and Offshore Structures

Elective II

SKMO 4152	Platform, Pipeline and Sub-Sea Technology
SKMO 4262	Risers and Mooring Dynamics
SKMO 4452	Marine Engineering System Project

UNIVERSITY GENERAL COURSES

UNIVERSITY GENERAL COURSE

Undergraduates in the Bachelor Degree Program in the Faculty of Mechanical Engineering are required to register for University's General Courses during their duration of study as a pre-requisite for graduation. The total numbers of credits for these courses are 20. The courses are categorized into cluster as follows:-

(i) Appreciation of Philosophy, Value & History
(ii) Soft Skills
(iii) Expansion of Knowledge
(iv) Co-curriculum and Service Learning
(v) Language Skills
(vi) Entrepreneurship

Cluster 1: Appreciation of Philosophy, Value & History

Students are required to register a total of four (4) credits of Appreciation of Philosophy, Value & History cluster as listed in the following table:

Code of Course	Name of Course	Credit
UICI 1012	Islamic and Asian Civilization *(for local student only)*	2
ULAM 1012	Malay Language for Communication 2 *(for International student only)*	
UHAS 1172	Malaysian Dynamics *(for local student only)*	2
UHAK 1022	Malaysian Studies 3 *(for International student only)*	

Cluster 2: Soft Skills

Students are required to register a total of two (2) credits of Soft Skills cluster as listed in the following table:

Code of Course	Name of Course	Credit
UHAK 1012	Graduate Success Attributes	2

Cluster 3: Expansion of Knowledge

Students are required to register a total of two (2) credits of Expansion of Knowledge cluster as listed in the following table:

Code of Course	Name of Course	Credit
UICL 2302	Thinking of Science & Technology	2

Cluster 4: Co-curriculum and Service Learning

Students are required to register a total of two (2) credits of Co-curriculum and Service Learning cluster as listed in the following table:

Code of Course	Name of Course	Credit
UKQA 2xx2*	Academic & Professional Cluster	2
UKQR 2xx2*	Volunteerism Cluster	
UKQS 2xx2*	Sport, Recreation & Cultural Cluster	
UKQU 2xx2*		
* Elective courses (choose only one)		

Cluster 5: Language Skills

Students are required to register a total of six (6) compulsory and two (2) elective credits of Language Skills cluster as listed in the following table:

Code of Course	Name of Course	Credit
ULAB 1122	Academic English Skills	2
ULAB 2122	Advanced Academic English Skills	2
ULAB 3162	English for Professional Purpose	2
ULAC 1112*	Mandarin Language 1	2
ULAF 1112*	French Language 1	
ULAJ 1112*	Japanese Language 1	
* Elective courses (choose only one)		

Cluster 6: Entrepreneurship

Students are required to register a total of two (2) credits of Entrepreneurship cluster as listed in the following table:

Code of Course	Name of Course	Credit
UHAK 1032	Introduction to Entrepreneurship	2

ACADEMIC REGULATIONS & GUIDELINE

PROGRAMME REGISTRATION

All students are required to register their programmes on the dates stipulated by the University. F o r n e w students who fail to register without any valid and acceptable reason to the University, the offer will be annulled.

Programme registration for senior students will be done automatically by the University Administration based on their examination results in the previous semester. However, students whose studies have been interrupted due to a deferment or suspended from study etc are required to re-register their programme.

COURSE CODES AND ABBREVIATIONS

For each programmes, the course code offered by the faculty is made up of four letters followed by four numbers.

S = Award/Programme/Level of Study
KM = Faculty/Centre/School/Academy
M = Specialisation
4 = Year of programme
2 = Field of course/panel
8 = Course sequence
3 = Course credit

SKMM = Bachelor of Engineering (Mechanical)
SKMB = Bachelor of Engineering (Mechanical – Materials)
SKMI = Bachelor of Engineering (Mechanical – Industrial)
SKMP = Bachelor of Engineering (Mechanical – Manufacturing)
SKMT = Bachelor of Engineering (Mechanical – Aeronautics)
SKMV = Bachelor of Engineering (Mechanical – Automotive)
SKMO = Bachelor of Engineering (Naval Architecture & Offshore Engineering)

A. Award/Programme/Level of Study

C = Certificate
D = Diploma
S = Degree
L = Post Graduate Diploma/Advanced Diploma
M = Master
P = Doctor of Philosophy
U = University General Course

B. Faculty/Centre

BB = Built Environment CS = Computing
DP = UTM Space (Diploma Study Programme)
GH = Geoinformation & Real Estate
HA = Management
IC = Islamic Civilization
KA = Civil Engineering
KE = Electrical Engineering
KM = Mechanical Engineering
KQ = Centre for General Courses & Co-Curriculum
PP = Education
RS = Razak School SC = Science

C. Specialisation

M = Mechanical
B = Material
I = Industrial
P = Manufacturing
O = Naval Architecture & Offshore Engineering
A = Aeronautical
V = Automotive

D. Field of Course/Panel

1 = Panel of Mechanics of Materials and Structure
2 = Panel of Control and Automation/Panel of Machines and Vibration
3 = Panel of Fluid Mechanics
4 = Panel of Thermodynamics
5 = Panel of Design
6 = Panel of Materials Engineering
7 = Panel of Manufacturing Engineering
8 = Panel of Industrial Engineering
9 = Laboratory/Workshop/Industrial Training/Engineering Professional Practice/Undergraduate Project
0 = Panel of Engineering Computational

CHANGING PROGRAMME OF STUDY

Students may apply to change their study programme within the faculty or between faculties. This can be done after undergoing at least one semester of study at the University. However, changing of study programme is not encouraged.

COURSE REGISTRATION

It is compulsory in every semester for students to register the courses to be taken with the correct codes and sections. Course registration must be done within the pre-registration or registration period. Students can only register for the course offered with the faculty's permission. Students are to note that there are courses designated as pre-requisites to some other courses (refer the chapter on curriculum). This means that the pre-requisite courses must be registered and passed before the other subject can be registered. For example, a student must pass course SKMM 1203 (Statics) before the student can register for SKMM 1213 (Dynamics). If a student registers both courses concurrently in the same semester the student will be recorded a zero mark (Grade E) for SKMM 1213 (Dynamics) in the examination results and its credits will be taken into account in the computation of the CPA and GPA.

Compulsory course registration will be conducted over a period of two (2) working days during the last week before the semester begins according to the date determined by the university. Registration after this period is restricted to the last working day of the first week of the semester and will include a fine of RM50.00 (subject to change). Course registration after this period of time will not be allowed unless permission is obtained from the faculty. Students who fail to register for the course after the registration period will have their study be terminated with the exception that the university accepts their reasons.

Full-time students must register for the minimum number of **TWELVE (12)** credits inclusive of Audit Course (HS) and Compulsory Audit course (HW) in a semester with the exception of student who are under academic probation (KS) and/or is in the final **TWO (2)** semesters of their study. Students who would like to take more than **EIGHTEEN (18)** credits will have to seek approval from the Dean of the Faculty **and would not be** allowed to take more than **TWENTY ONE (21)** credits in a semester. Students under academic probation (KS) are allowed to take between **NINE (9)** and **THIRTEEN (13)** credits only in the following semester. Pre-registration for students under probation will be nullified and they will need to re-register within the time given. Students are encouraged to pre-register their courses by using the online or other facilities within the registration period given by the university.

Students are responsible for ensuring that there are no mistakes in their course registration record. Students may make amendments to the previous registration during the first week of the semester. Late registration or amendments to course registration will not be accepted except for valid reasons accepted by the University. Any changes in the registration made in the second week will incur a fine of **RM50.00** (subject to change) per course up to a maximum of **RM300.00** (subject to change). The amendments include insertion, deletion, change of code and status of courses. Any application for amendments to course registration after last working days of second week will not be entertained.

A student with the approval of his lecturer and Academic Advisor can withdraw from a registered course in the semester no later than the last working day of week **EIGHT (8)** of the academic semester. Any late application will not be entertained.

Approvals for withdrawing from a course are subjected to the required total number of minimum credits **unless** permission from the Dean is obtained. Withdrawals (TD) will be recorded in the course registration and transcript.

STATUS OF COURSE

Apart from the regular course there are courses which have particular status as the following:

(a) HW - **(Compulsory Audit Course)**: A student is required to attend lectures practical training or seminar and will be awarded either a **HL (Passed Attendance)** or a **HG (Failed Attendance)** grade. If the student passes credits will be taken into account in computing **Credits Obtained** but will not be considered in computing the **GPA (Grade Point Average)** and **CPA (Cumulative Grade Point Average)**. If the student fails credits will not be counted into **Credits Obtained** and the subject must be repeated until a pass is obtained.

(b) UM - **(Replacement Course)**: For a course with an **UM** status grade **HL** will be awarded if the course is of an **HW** status. For core courses students are required to pass with at least a **C** grade. However, the credits for a failed **UM** course will not be counted in the **CPA** computation since they have been taken into consideration during the previous semester. This is to avoid duplication. A student who fails an elective course is allowed to take another elective course as a substitute but the credits and grade of the original course will be taken into account in **Credits Counted** and the **CPA**.

(c) UG - **(Replacement Grade)**: A student may improve any course with a **B-** grade or lower using the **UG** status. For a particular course this permission is given once only. The better grade between the previous and current grade will be awarded and used in the computation of **GPA** and **CPA**.

(d) HS - **(Attendance Only)**: A student can take course which are not stipulated for his/her programme and this course must be registered with an **HS** status. An **HS** grade will be awarded and the credits will not be used in the computation of **Credits Obtained, Credits Counted, GPA** and **CPA**.

Students may take a course with an **HS** status for the following reasons:

i. To fulfill the requirement as a full time students as stipulated by scholarship sponsors
ii. To seek further knowledge in the related course

SPECIFIC REQUIREMENTS FOR COURSES IN THE FACULTY

Pre-requisite Course

Passing grade for all courses is 40% (D+) except for core courses, the passing grade is 50% (C). Therefore a student must pass the pre-requisite course before taking the next course.

Core Courses for Engineering Programmes

The core courses for all 7 engineering programmes in the faculty are given in the following table. The minimum passing mark for these courses is 50% (C).

Core Courses for SKMM programme

<table>
<tr><td rowspan="3">SKMM 1203
(Statics)</td><td>SKMM 1213
(Dynamics)</td><td>SKMM 2223
(Mechanics of Machines and Vibration)</td></tr>
<tr><td>SKMM 1113
(Mechanics of Solids I)</td><td>SKMM 2123
(Mechanics of Solids II)</td></tr>
<tr><td>SKMM 2313
(Mechanics of Fluids I)</td><td>SKMM 2323
(Mechanics of Fluids II)</td></tr>
<tr><td>SKMM 2413
(Thermodynamics)</td><td colspan="2">SKMM 2423
(Applied Thermodynamics)</td></tr>
</table>

Core Courses for SKMB, SKMI, SKMP, SKMT and SKMV Programmes

<table>
<tr><td rowspan="3">SKMM 1203
(Statics)</td><td>SKMM 1213
(Dynamics)</td><td>SKMM 2223
(Mechanics of Machines and Vibration)</td></tr>
<tr><td>SKMM 1113
(Mechanics of Solids I)</td><td>SKMM 2123
(Mechanics of Solids II)</td></tr>
<tr><td>SKMM 2313
(Mechanics of Fluids I)</td><td>SKMM 2323
(Mechanics of Fluids II)</td></tr>
<tr><td>SKMM 2413
(Thermodynamics)</td><td colspan="2">SKMM 2433
(Applied Thermodynamics &Heat Transfer)</td></tr>
</table>

Core Courses for SKMO Programme

<table>
<tr><td rowspan="3">SKMM 1203
(Statics)</td><td>SKMM 1213
(Dynamics)</td><td>SKMM 2223
(Mechanics of Machines and Vibration)</td></tr>
<tr><td colspan="2">SKMM 1113
(Mechanics of Solids I)</td></tr>
<tr><td colspan="2">SKMM 2313
(Mechanics of Fluids I)</td></tr>
<tr><td colspan="3">SKMM 2413
(Thermodynamics)</td></tr>
</table>

CREDIT SYSTEM

Every course is accorded a credit value except those specified by the University.

CREDIT VALUE

The credit value is based on the number of contact hours per week per semester.
Lectures and Practical Period

1 credit = 1 lecture hour per week or (14 hours per semester)
1 credit = 28 – 42 meeting hours per semester for practical/studio

Example:
Determination of credits for lectures and equivalent for practical period

3 lecture hours per week or
2 lecture hours per week + 2 – 3 hours of practical/studio work per week or
1 lecture hour per week + 4 – 6 hours of practical/studio work per week or
6 – 9 hours of practical/studio work per week

Undergraduate Project

The undergraduate/final year project is split into 2 semesters. In the first semester the project is taken, 2 credits are given and in the following semester 4 credits are given, both are evaluated individually.

Industrial Training

Industrial Training is evaluated with a pass or fail grade.

CREDIT EXEMPTION

1. Credit exemption refers to courses taken by a student before being accepted to the first degree programme at UTM as approved by the Senate. Courses given credit exemption will not be taken into account in the computation of GPA and CPA.

2. Conditions for credit exemption are as the following :

    a. Courses to be applied for credit exemption must have the same content or at least not less than 80% with the course offered by the University;
    b. The grade or grade point obtained in the course should not be less than C; and
    c. The total credit hours to be exempted must not exceed 30% of the total credits for graduation.

CREDIT TRANSFER

1. Credit transfer is for courses taken by a student at other institution of higher learning after his/her admission to the first degree studies at UTM is approved by the faculty.

2. In the case of credit transfer, all credits obtained from the institutions of higher learning at which the student has undertaken the study, together with their grades and grade points, will be taken into account in the GPA and CPA computation subject to the condition that a student is not allowed to transfer more than 30% of the total number of credits for graduation but not more than one semester of study for any institute of higher learning.

3. Application for transfer of credits must be made at least one semester before a student undergoes study at another Institute of Higher Learning for the purpose of credit transfer.

CREDITS OBTAINED

Credits Obtained is the total number of credits for courses for which a student has passed including courses with **HW (Compulsory Audit Courses)** which have a credit value. Credits for courses registered with the **HS (Audit Courses)** will not be taken into account in computing **Credits Obtained**. **Credits Obtained** is computed for each semester, all semesters. For students with credit transfer, the credits will be added to the passed course credits in order to determine the overall Credits Obtained. The total **Credits Obtained** is very closely related to the **Credits for Course Graduation**.

CREDIT COUNTED

Credits Counted is the total number of credits taken by a student in a semester and in all semesters. The number of credits is used in the computation of GPA and CPA. Credits for course registered with HS and HW status will not be used in computing **Credits Counted**. Credits for courses registered with a **UM (Replacement Course)** status will not be involved in the CPA.

CREDITS FOR PROGRAMME YEAR

The stage of study or the year of the programme for a student is determined by the total number of **Credits Obtained**. A student is deemed to have progressed a particular year of programme if the **Credits Obtained** is not less than the following value:

To Progress To Year	Minimum Total Credit Obtained
Second	27
Third	60
Fourth	93

CREDITS FOR GRADUATION

A student must pass all courses specified for his/her programme of study. The total minimum credits and the maximum duration to complete and pass a programme are shown in the following table.

Total Credit Hours for Graduation and Maximum Duration of Study

Degree	Minimum Credits	Maximum Semester
Bachelor of Engineering (Mechanical)	137	12
Bachelor of Engineering (Mechanical – Materials)	137	12
Bachelor of Engineering (Mechanical – Industrial)	137	12
Bachelor of Engineering (Mechanical – Manufacturing)	137	12
Bachelor of Engineering (Mechanical – Aeronautics)	137	12
Bachelor of Engineering (Mechanical – Automotive)	137	12
Bachelor of Engineering (Naval Architecture & Offshore Engineering)	137	12

LECTURE ATTENDANCE

Students must attend all course meetings (lectures/practical/studio etc.). If they do not attend these meetings, they will have to inform their lecturers immediately and give their reasons for being absent. Students must attend not less than 80% of their meetings for a course in **ONE (1)** semester. This applies to Compulsory Audit Courses (HW) or Audit Courses (HS).

Students who do not fulfill the 80% of their meetings without valid reasons accepted by the university will not be allowed to attend lectures and sit for any form of assessment. The mark **ZERO (0)** will be given for such courses: or Failed Attendance (HG) for compulsory audit courses (HW): however, audit courses (HS) will not be recorded in the transcript.

GRADING SYSTEM

A student's performance in a course is indicated by the grade obtained. The relationship between marks grades and grade points are given in the following table. Generally the passing grade for any course is D+. However, the passing grade for a particular course is subjected to the Faculty's requirement with the approval of the University Senate.

Relationship Between Marks Grades and Grade Points

Mark	Grade	Grade Point
90 – 100	A+	4.00
80 – 89	A	4.00
75 – 79	A-	3.67
70 – 74	B+	3.33
65 – 69	B	3.00
60 – 64	B-	2.67
55 – 59	C+	2.33
50 – 54	C	2.00
45 – 49	C-	1.67
40 – 44	D+	1.33
35 – 39	D	1.00
30 – 34	D-	0.67
00 - 29	E	0.00

Apart from the above grades the following status are also used:

TD (Withdrawal)	**This status is given to courses withdrawn during a specified duration as stipulated by the Senate. Credits will not be taken into account when computing Credits Counted, Credits Obtained, GPA and CPA**
TS (Incomplete)	This status is given to students who are unable to sit for the final examination or to complete the course work for a particular course due to illness as certified by a Medical Officer of the University or of a government hospital or due to other reasons acceptable to the Senate. Students must submit the medical certificate to the Faculty not later than 24 hours before the commencement of the examination of the said course. Credits will not be taken into account when computing the **Credits Counted, Credit Obtained, GPA** and **CPA**.
HS (Attendance Only)	This status is given to courses registered with **Attendance Only** status. Credits will not be taken into account when computing **Credits Counted, Credits Obtained, GPA** and **CP**A.
HL (Compulsory	This is a passed grade given to courses registered with **Attendance) Compulsory Audit Course (HW)** status. Passed **(HL)** credits will be taken into account when computing **Credits Counted** and **Credit Obtained** only but not in **GPA** and **CPA**.
HG (Failed Attendance)	This is a failed grade given to courses registered with **Compulsory Audit Course (HW)** status. Failed **(HG),** credits will not be taken into account when computing **Credits Counted, GPA** and **CPA**.

EXAMINATIONS

The end of semester examinations are the final examinations for courses taught through lectures. The allocation of marks for this should not exceed 50% of the overall evaluation mark for the course. Grades for each course will be displayed by the course lecturer and students may submit an appeal for re-evaluation of the examination grade for any course to the faculty within a specified duration, following a specified procedure.

Appeals will not be entertained after the expiry date. Students will be charged a sum of RM50.00 for each of the courses appealed.

SPECIAL EXAMINATION

Special examination may be held for any student in the following cases:

(a) Student who are unable to sit for the final examination because of illness and validated by a medical officer from the university or government hospital or have given reasons accepted by the university.

(b) Students in their final semester who have passed with Good Standing (KB) but failed in ONE (1) course taken in the last TWO (2) semesters of study not including the semester used for Practical/Industrial Training.

The special examination mark will be used to determine the results of the course based on the following:

(a) The special examination marks as in case (i) will be used to replace the previous final examination mark whereas the coursework marks remain the same.

(b) The special examination marks as in case (ii) will be used fully to determine the result of that course either Pass or Fail and it will not be calculated as part of their GPA and CPA.

If the student fails in his/her special examination he/she is required to repeat the course in the following semester (subject to the remaining duration of study).

Special examination may not be held in the following cases:

(a) courses that have no final examination, or

(b) students who did not sit for the final examination and gave reasons that are not accepted by the university, or

(c) students who have been barred from sitting for the final examination Special examination will only be conducted once in a semester unless with the approval of the Senate.

ACADEMIC PERFORMANCE

The student's performance is evaluated based on GPA and CPA

GPA : Grade Point Average

GPA is the grade point average obtained by a student in a particular semester.GPA is computed as follows:

$$\textbf{GPA} = \frac{\text{Total Point Value for the Semester}}{\text{Total Credits Counted for the Semester}}$$

CPA : Cumulative Grade Point Average

CPA is the cumulative grade point average obtained by a student for all semesters studied. CPA is computed as follows:

$$\textbf{CPA} = \frac{\text{Total Point Value for all Semesters}}{\text{Total Credits Counted for all Semesters}}$$

Example of GPA and CPA calculation

Semester I

Courses	Grade	Point Value	Credit	Total Point Value	Credits Counted	Credits Obtained
SKMM 1203	A-.	67	3	11.01	3	3
SKMM 1013	A	4.00	3	12.00	3	3
SKMM 1503	B+	3.33	3	9.99	3	3
SKMM 1912	A-	3.67	2	7.34	2	2
SKEU 1002	A-	3.67	2	7.34	2	2
SSCE 1693	A-	3.67	3	11.01	3	3
ULAB 1112	B+	3.33	2	6.66	2	2
	Total		**18**	**65.35**	**18**	**18**

GPA = 65.35/18 = 3.6

Semester I

Courses	Grade	Point Value	Credit	Total Point Value	Credits Counted	Credits Obtained
SKMM 1213	A	4.00	3	12.00	3	3
SKMM 1113	A-	3.67	3	11.01	3	3
SKMM 1512	A	4.00	2	8.00	2	2
SKMM 1922	B+	3.33	2	6.66	2	2
SSCE 1793	B+	3.00	3	9.00	3	3
UICI 1012	A-	3.67	2	7.34	2	2
	Total		**15**	**54.01**	**15**	**15**

GPA = 54.01/15 = 3.60
CPA = (65.35 + 54.01)/(18 + 15) = 3.62

ACADEMIC PERFORMANCE RATING

The academic rating of a student is determined at the end of a regular semester using CPA as follows :

Academic Performance Rating	CPA
KB – Good Status	CPA ≥ 2.00
KS – Probation Status	1.70 ≤ CPA < 2.00
KG – Failed Status (Study Terminated)	CPA < 1.70

Students who obtain GPA < 1.0 although the CPA > 1.70 can continue his/her study. However, the Senate can defer the student's study on the following semester, or give Failed Status (KG) and student will be dismissed.

The academic rating of a student for the short semester will not be accounted for. The grade obtained in that semester will be taken into account for the calculation of the CPA in the following semester.

Students who have THREE (3) Probation Status (KS) continuously will be given the Failed Status (KG) and the student will be terminated from his program of study.

THE DEAN'S LIST

The Dean's List is a recognition of academic excellence awarded to students with a GPA of 3.67 or above and have registered for at least TWELVE (12) credit hours for the particular semester excluding courses with HW & HS status.

The Dean's List recognition will be written in the student's transcript.

PROCEDURE FOR AWARDING DEGREE

The endorsement for the award is done for every regular semester. Students in the final semester who will be completing their study must apply for the award of the degree within the time given by the university. Students who have applied previously but did in the previous semester is no longer valid. A penalty will be imposed on late application of degree award. Students who are not eligible for the application will be fined RM50.00 if they submit their application.

Students who do not submit their application for the award of a degree during the specified duration will be given a Good Status (Completed Program) or KB (TK).

Students who do not submit the application forms to the faculty office after or within the time given will not be awarded the degree in the semester. However, the student may apply for the award to be given in following semester according to the time period given for that semester. Students who do not apply for the award will not be considered for registration of a postgraduate study at the university.

Students who do not submit their application for the award of degree within five years of completion of their programme will not be awarded with a degree.

A student is eligible to be awarded a degree after fulfilling the following conditions :

i. Obtained Good Pass (KB)
ii. Has passed all specified courses
iii. Has applied for graduation and has been approved by the faculty
iv. Has completed all four (4) short courses and one (1) test in UTM Professional Skills Certificate Programme
v. Other condition as specified

DEFERMENT OF STUDY

1) Deferment of study can be made due to the following reasons:

   i) Health reason
   ii) Other reasons besides health
   iii) GPA < 1.00
   iv) Misconduct

2) Students who have been certified sick by the government or university Medical Practitioner may request to the Dean of Faculty for a deferment of study

3) The maximum deferment for every application is TWO (2) continuous semesters. If the students require more than TWO (2) continuous semesters, the case will be referred to the University Medical panel to decide if the student should be allowed to continue or withdraw from study.

4) Students may also apply for deferment due to other reasons besides health. The application must be made before the last working day of week NINE (9) of the semester.

5) The period for deferment that will not be counted as part of the total semester for the following cases:-

   i) Students deferred by University due to health reasons
   ii) Students deferred by University due to GPA<1.00
   iii) Students deferred by University due to misconduct

6) As per in (4), the period for deferment will be counted as the semester being used. However, with the endorsement from the Dean and approval from the Deputy Vice Chancellor (Academic and International), the semester requested for the deferment will be excluded from the calculation.

LECTURE HOURS

Lecture hours are as specified by the University, from Sunday to Thursday, 8:00 am to 6:00 pm. If necessary, lectures may be held at night from 8:00 pm to 11:00 pm.

The University allocates Tuesday afternoon starting from 2:00 pm to 6:00 pm for co-curricular courses.

Lecture periods are generally limited to 1 hour/lecture. Lectures will commence on the hour as specified by the timetable and will stopped 10 minutes before the following period.

PERMISSION NOT TO ATTEND CLASS

Permission not to attend class can be given to students who submit an application to exempted from attending lecture/tutorial/laboratory/workshop/seminar for a short duration based on the following reasons:

i. Visiting of a family member who is ill/attending burial ceremony or;
ii. Attending a court proceeding or;
iii. Participating in sporting/cultural practice/competition; or
iv. Other reasons acceptable by the faculty

The application must be made using the Leave From Lecture Application Form available from the Faculty Academic Office. Consent of the course lecturer must be obtained. The duration for which a student may be granted permission not to attend class is limited to 20% of the number of lectures/tutorial/practical session for each semester.

APPLICATION FOR ACADEMIC TRANSCRIPT

Students who are eligible to apply for an academic transcript may do so at the Academic Management Division Office of Deputy Vice Chancellor (Academic and International) by filling online in the UTM Transcript Application System on the AIMS2000 website. Students who are eligible to apply are:

i. Students who have their study terminated from the University (Graduates Completed Programme or Dismissed from study).
ii. Students who obtained Failed Rating (dismissed).

Students may apply for their academic transcripts to be prepared in Malay or English. Academic transcripts will not be issued to students who are yet to settle their debt with the University.

DOCUMENT AND EXAMINATION RESULTS CERTIFICATION

Faculty Administrative officials namely the Deputy Registrar and Assistant Registrar have been empowered by the University to certify copies of the said documents. Students who require certification of certificates/examination results or other documents may see one of the above-mentioned officers by bringing along the original copies of the relevant documents.

CONFIRMATION LETTER FOR STUDENT STATUS

Students who require such certification/confirmation letters may submit an application to the Faculty Academic Office. This letter is only issued to students for the purpose of applying for financial assistance extension of scholarship/loan, conducting off campus study/practical work, driving licence and other purposes deemed as necessary for the benefit of student education in the University.

CHANGE OF STUDY/PERMANENT ADDRESS

It is the responsibility of the student to inform the faculty administration of his/her latest address in case of any change in his/her study/permanent address in order to ensure that he/ she can be easily contacted by the University. Students are required to use the Change of Address Form available from the Faculty Academic Office.

ACADEMIC AND PERSONAL RECORDS

Students may check their individual academic and personal records online via the website prepared by the university at https://my.utm.my.

PRIZES AND AWARDS

Royal Education Award
The award is a contribution from the Keeper of The Ruler's Seal of Malaysia and given to two outstanding First Class graduates comprising one Malay/Bumiputera graduate and one Non-Malay/Non-Bumiputera graduate. Each recipient will receive a special token in the forms of cheque/cash, Pingat Jaya Cemerlang and Certificate of Commendation.

Chancellor Award
The Chancellor Award is given at every Convocation Ceremony to two excellent graduates who have obtained First Class for their Bachelor Degree and fulfilled the selection criteria and conditions set by the university. Each recipient will receive a medal, cash and Certificate of Commendation. This award is also given to two postgraduate candidates.

Tun Fatimah bt Hj. Hashim Gold Medal Excellence Award
This award is a contribution by the family of the late Tan Sri Dato' Abdul Kadir bin Yusof and Tun Fatimah bt Hj. Hashim through the Kadir & Fatimah Foundation. This award is given to a female graduate who has shown excellence in academic and co-curricular activities. The award is in the forms of a gold medal and cash.

Academic Excellence Award
This award is given by the university to each Bachelor Degree graduate who obtained perfect academic achievement with a CGPA of 4.00 without taking into consideration his/her involvement and contribution to the academic and non-academic activities. The graduates must attain a CGPA of 4.00 for each academic semester. Other conditions and criteria will be determined by the university. Each recipient will receive cash, medal and Certificate of Commendation.

Vice-Chancellor Award
The award is given to the most outstanding graduate from each faculty, UTMSPACE mainstream programmes and also part time programmes who have met the selection criteria and conditions set by the university. Each recipient from the faculties and UTMSPACE will receive the award in the forms of a medal, cash and Certificate of Commendation.

Board of Engineers Malaysia Academic Excellence Award
This award will be given to a Bachelor Degree graduate who has shown excellent achievement in any engineering programme. The selection criteria and conditions are determined by the university. The recipient will receive cash and certificate contributed by the Board of Engineers Malaysia.

MALAKOFF Academic Excellence Award
This award will be given to four best graduates comprising two graduates from the Electrical Engineering Faculty and Mechanical Engineering Faculty. The selection criteria and conditions are determined by the university. Each recipient will receive cash contributed by MALAKOFF BERHAD.

UEM Engineering Excellence Award
This award is given to a Bachelor Degree graduate with outstanding achievements, with a minimum of grade B for the Undergraduate Project (PSM)from any of the following faculties : Faculty of civil Engineering, Faculty of Electrical Engineering, Faculty of chemical & Energy Engineering and Faculty of Mechanical Engineering. The selection criteria used in determining the candidate are as stipulated by the University. Each recipient will receive a cash prize and certificate. The award is contributed by the UEM Foundation.

Alumni Award
The award will be given to four outstanding graduates comprising one from engineering studies, management and science studies, Diploma studies and international student. The award will be in the form of cash, certificate and souvenirs contributed by UTM Alumni.

Faculty Academic Award
This award will be given to the best graduates in each faculty. The total number of recipients will be subject to the decision and resolution of the faculty. The award will be in the forms of medal, cash, souvenirs, books and acknowledgement certificate contributed by the government, organizations, associations and/or private companies.

Dean's Award
The award will be given to graduates who have attained CGPA of 3.50 and above. The recipient will receive certificates and medals. Customarily the award session will be held at the faculty a day before the convocation ceremony. The recipients are required to wear the medal during the Convocation Ceremony.

STUDENT MOBILITY PROGRAMME

Students mobility programmes are offered at UTM to foster internationalization and create a partnership with overseas universities and education providers. They are designed to provide academic and intellectual benefit through to the exchange of students between UTM and overseas institutions.

Students mobility programmes consist of Inbound and Outbound Programme. **Inbound Programm**e is for students from overseas universities wishing to study in Universiti Teknologi Malaysia whereby **Outbound Programme** is for current Universiti Teknologi Malaysia students wishing to study in overseas universities.

INBOUND PROGRAMME

UTM Exchange Programme
UTM offers one to two semesters exchange at undergraduate and postgraduate levels. A wide range of courses on Engineering, Science and Technology, ICT, Education and Management are taught in English.

Research Internship /Attachment
UTM provides opportunities for students who are studying outside Malaysia to pursue cutting-edge trans-disciplinary research work for one to two semesters. Students can apply throughout the year.

Student Academic Visit
A visit of an individual or a group of students to UYM and spend 1 to 7 days to experience the unique southeast Asian cultures, to study the global issue or to get access to extraordinary learning opportunities.

UTM MyTREE Summer School
This two to three weeks programme offers a number of interesting courses. The courses incorporate theory and practice, blended with the local culture and social activities.

OUTBOUND PROGRAMME

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 :

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.

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.

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

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

1. Seminar, Conference or Paper Presentation
2. Cultural Exhibition and Conference
3. Student Development Activity

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/

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
iii. Guiding students to work in a team
iv. Assisting any student who faces difficulties especially in the academic field
v. Acting as a link between students and staff (academic and general) with FKM
vi. 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

SYLLABUS SUMMARY

SYNOPSIS OF GENERAL COURSES

COURSES FROM FACULTY OF SCIENCE

SSCE 1693 Engineering Mathematics I
This is the first course in Engineering Mathematics. It covers topics including differentiation and integration which focus on hyperbolic and inverse functions. Improper integrals are also studied. Vectors and matrices including basic operations, solving related problems in 3 dimensions are discussed. In addition, vector spaces, eigenvalues and eigenvectors are introduced. Sketching of polar graphs is discussed. This course also covers complex numbers, function of complex variable, series and power series.

SSCE 1793 Differential Equations
This is an introductory course on differential equations. Topics include first order ordinary differential equations (ODEs), linear second order ODEs with constant coefficients up to fourth order, the Laplace transform and its inverse, Fourier series, and partial differential equations (PDEs). Students will learn how to classify and solve first order ODEs, use the techniques of undetermined coefficients, variation of parameters and the Laplace transform to solve ODEs with specified initial and boundary conditions, and use the technique of separation of variables to solve linear second order PDEs and the method of d'Alembert to solve wave equation.

SSCE 1993 Engineering Mathematics II
This course is about multivariable calculus of real and vector-valued functions. The basic theory of partial derivatives and multiple integrals of real functions with their applications are discussed. This theory is extended to vector valued functions to describe motion in space, directional derivatives, gradient, divergence and curl, line integrals, surface integrals and volume integral. Related theorems, namely Green's Theorem, Stokes' Theorem and Gauss Divergence Theorem and their applications are discussed.

SSCE 2193 Engineering Statistics
This course begins with basic statistics, elementary probability theory and properties of probability distributions. Introduction to sampling distribution, point and interval estimation of parameters and hypothesis testing are also covered. Simple linear regression and one-way analysis of variance are also taught in this course. Students are taught on how to use and incorporate statistical tools and software for solving engineering statistics problem through group assignment.

COURSES FROM CENTER OF CO-CURRICULUM AND SERVICE LEARNING (CCSL)

UICI 1012 Islamic Civilization and Asian Civilization
The course familiarizes students with the Islamic Civilization and Asian Civilization. It discusses on the science of civilization that embraces an introductory to the science of civilization, the interactions of various civilizations (Malay, China and India) Islamic Civilization contemporary issues on the Islamic and Asia Civilization, Islamic in Malay Civilization and its role in establishing the Malaysian Civilization. At the end of the course, student will be extensively exposed to the history, principles, value and fundamental aspects of the civilizational studies in Malaysia as well as strengthen the integrity of Malaysian as a citizen of a multi-racial country which has a high tolerance towards others. Throughout the learning process, some aspects of generic skills namely team working, communication skills and ethics will be emphasized.

UHAK 1022 Art Customs and Beliefs of Malaysia (for International Students only)
This course is designed for first year foreign undergraduates. Students will be exposed to various aspects of the Malaysian culture such as the belief system, religious festivals, customs and etiquette of different racial groups in Malaysia. They will also be introduced to Malaysia's traditional music, arts and crafts.

UHAS 1172 Malaysian Dynamics
This course covers various disciplines of social sciences, which includes the knowledge of sociology, political science, history and international relations. This course will add value to the UTM students to develop self- esteem, promote unity among students, and produce dynamic students and global thinking.

COURSES FROM FACULTY OF ELECTRICAL ENGINEERING

SKEU 1002 Electrical Technology
The students will be exposed to the concept and theory of basic electrical engineering. This subject will highlight the fundamentals of electrical engineering to enable the student to understand and apply simple electric circuits and network in their working environment. This subject will cover on DC and AC systems (single and three-phase system), current and voltage divider, nodal and loop analysis. Students will also be exposed on the magnet and electromagnet, single-phase transformer, and basic electrical machines and its applications.

SKEU 2012 Electronics
This course is directed towards students in non-electrical engineering major. Students are exposed to characteristics, functions and applications, of electronic devices such as diodes, bipolar junction transistors, field effect transistors, operational amplifiers, logic gates, and flip-flops. Some of the applications include rectifier circuits, power supply, amplifier, square wave generator, Boolean logic with OR, AND, NOT, NAND, NOR and XOR; and counter circuits using flip-flops.

COURSES SYNOPSIS FOR B.ENG (MECHANICAL) AND OTHER PROGRAMMES

SKMM 1013 Programming for Engineers
This course formally introduces the concept of computers, algorithms, programming languages, pseudocode and problem solving. 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.

SKMM 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.

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

SKMM 1213 Dynamics
The course is an extension to SKMM 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.

SKMM 1503 Engineering Drawing
This subject introduces students 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 students on the significant changes in the engineering and technical graphic due to the use of computer and CAD (Computer Aided Design) software. At the end of the course, students 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.

SKMM 1512 Introduction to Design
This course is designed to expose students to the concepts and methods to develop an efficient design process and apply it to solve engineering design problems creatively and effectively.

SKMM 1912 Experimental Methods
This course is conducted through lectures and laboratory experiments. For the first seven weeks, students are exposed to the experimental method theory followed by laboratory works for the next seven weeks. The lectures shall cover the fundamental or experimental method and the basic principles in measurements, instrumentation and analysis of results. It shall focus on the design of mechanical experiments, selection of sensors and transducers, estimation of errors and display of results. It also covers the analysis of the results and proper report writing. Student comprehension will be tested by two written examinations. During the practical sessions, several groups of 5 – 6 students will be formed to conduct several experiments. The students are expected to apply the theories thought earlier in the first part of the semester in designing experiments, recording data and displaying results. The students will also conduct statistical analysis of the results and present the experimental outcome in a report.

SKMM 1922 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 Mechanical Engineering and a description of the mechanical engineer's work and professional responsibilities. It discusses the education requirements for today's mechanical engineers as well as exposes the students to the skill required for an engineer entrepreneur. The second module aims to expose students to the hands-on nature of mechanical engineering and introduces a range of workshop skills which forms necessary knowledge and experience in the work of a mechanical engineer.

SKMM 2123 Mechanics of Solids II
The course is an extension to SKMM 1113, which is the pre-requisite to this course. It aims to extend the student's knowledge and understanding of the behavior 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 criterias are investigated. The course provides an opportunity to investigate thick cylinders, structural deformation behavior by using the energy method, instability problems of struts and elasto-plastic bending of beams. Determinate and indeterminate problems will be examined. At the end of the course, students should be able to calculate and evaluate stress, strain and deformation of structures in torsion and bending. They should also be able to evaluate failure modes and estimate fracture life of structures and components. The aspect of designing safe components and structures shall also be emphasized to the students.

SKMM 2223 Mechanics of Machines and Vibration
The course requires SKMM 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.

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

SKMM 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 analyzing hydrodynamically the flow field. It will emphasize on the analysis and the importance of boundary layer, ideal and compressible flow in practical engineering applications. The course will also provide the analysis of flow through fluid machines such as pump and turbine. At the end of the course, students should be able to demonstrate and apply the theory to solve problems related to flow of fluids.

SKMM 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 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.

SKMM 2423 Applied Thermodynamics
Applied Thermodynamics is the science of the relationship between heat, work and the properties of thermodynamics systems. It is concerned with the means necessary to convert thermal energy from available sources such as fossil fuels, natural gases, coal etc. into a useful mechanical work. The mechanical work can then be used for example to drive an electric generator in generating electricity. The mechanical work can also be used to drive a reciprocating compressor for producing compressed air. Heat engine is a name given to a thermodynamics system which operates in a cyclic manner and produces a network from the heat supplied to it. Examples of such system include internal combustion engines, vapor power plants and a gas turbine plants. Reversed heat engine is a thermodynamics system used to absorb heat from a cooled space and reject the heat to a warmer space. Its applications are in refrigeration, heat pump and air-conditioning systems. In this course, students will be thought on the basic components, principles of operation and methods to assess and improve the performance of these systems. Some aspects of energy sustainability is also included in this course.

SKMM 2433 Applied Thermodynamics & Heat Transfer
Applied Thermodynamics is the science of the relationship between heat, work and the properties of thermodynamics systems. Heat engine is a name given to a thermodynamics system which operates in a cyclic manner and in doing so produces a network from the heat supplied to it. Examples of such system include internal combustion engines, vapor power plants and a gas turbine plants. Reversed heat engine is a thermodynamics system that is used to absorb heat from a cooled space and rejects the heat to a warmer space. Its applications are in refrigeration, heat pump and air-conditioning systems. In this course, students will be thought on the basic components, principles of operation and methods to assess and improve the performance of these systems. In this course, conduction, convection and radiation, the three basic modes of heat transfer with the covered. Emphasis will be on developing a physical and analytical understanding of the three modes of heat transfer, as well as its applications. This course also introduces the methods for calculating rates of heat transfer by these three modes.

SKMM 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 behavior of materials, and use the principles of phase diagrams and heat treatments to the design of materials and their properties.

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

SKMM 2921 Laboratory I
This course is introduced in the second year of the Mechanical Engineering programme involving two hours per week session and experimental based courses. It consists of six laboratories; Strengths of Materials Laboratory, Materials Science Laboratory, Mechanics of Machines Laboratory, Electrical Laboratory and Fluid Laboratory. Students will be grouped into 5 to 6 people for each experiment. It is based on the theory that have been learned in the particular courses at the same semester. In general, every student has to carry out a total of twelve experiments. At the end of the session, students have to submit a report for each experiment and will be evaluated based on this report.

SKMM 3023 Applied Numerical Methods
This course introduces the steps involved in engineering analysis (mathematical modeling, solving the governing equation, and interpretation of the results). Examples of case studies in applied mechanics, strength of materials, thermal science, and fluid mechanics are presented. Methods in 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.

SKMM 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 available finite element application software in solving real-life engineering problems.

SKMM 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 throughoutthe course.

SKMM 3242 Instrumentation
The course shall cover the essential and basic theory of instrumentation for undergraduate. It shall cover the followings : fundamentals and components of instrumentation system, characteristics of instrumentation system,signal conditioning, transducers and application of strain gauges in load measurements.

SKMM 3252 Mechatronics
The course provides students with an introduction to mechatronics and its application in the real world. It will examine a number of key topics of mechanical engineering, electrical/ electronics and computer control disciplines with an emphasis on the integrated approach. At end of the course, students should be able to define and describe clearly the term `mechatronics' and its philosophy, relating to the importance and contribution of mechatronic system in industry, identify and describe clearly a mechatronic system and its main components, analyze and synthesize a basic mechatronic system and design simple mechatronic system.

SKMM 3443 Heat Transfer
In this course, conduction, convection and radiation, 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 to apply 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 these three modes. The calculations usually involved energy balances and may include flow of material to and from thesystem.

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

SKMM 3622 Materials Technology
This course introduces students to the basic concepts required to understand and describe the mechanical behavior 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, estimate the 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 materials and conduct failure analysis of engineering components. This course also covers the properties, processing and applications of non-metallic materials mainly polymer, ceramic and composite.

SKMM 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 behavior 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 behavior of polymeric materials, ceramics and composites will also be covered as well examples of case studies of selecting engineering materials for specific product designs.

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

SKMM 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.

SKMM 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 have 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.

SKMM 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 Lab I and II. The second part, i.e., the lab module is based on the PBL concept. Student have to plan and design their own experimental work right from the very beginning until the end of the module based on the topics given by the lecturer. Students will be grouped into 5 to 6 for each module. In general, every group have to conduct two experimental works and two modules. At the end of the session, students have to submit two short reports and two formal reports.

SKMM 4533 System Design
This course is designed for students to gain detailed topical exposure to design methodologies and principles specific to the practice of mechanical design. Emphasis is on developing efficient and effective design techniques as well as project-oriented skills from both technical and non-technical considerations. At the end of this course, students should be able to identify and apply appropriate methodology in performing design tasks, recognize the fundamental principles of mechanical design and practices, and formulate and apply general problem solving strategy in the analysis of situation, problem and potential problem. At the end of this course, students should also be able to identify and apply industry standards in design communication.

SKMM 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 economic principles and methods of engineering economic analysis. At the end of the course, students should be able to describe fundamental aspects of management; integrate knowledge in engineering and management in making business decisions; apply the principles of hazard identification, risk assessment/control; plan, design and implement an effective safety program; and also perform engineering economic analysis to solve problems and evaluate engineering investment/projects.

SKMM 4902 Engineering Professional Practice
This course introduces students to engineering ethics and an engineer's responsibilities towards safety, health and welfare of the public. It emphasizes on the engineer as a professional man, engineers & society, code of ethics and professional conduct, standards, laws and regulations pertaining to professional engineering practice. At the end of the course, students should be able to demonstrate and apply engineering professional ethics in their career as an engineer.

SKMM 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.

SKMM 4924 Undergraduate Project II
This course is the continuation of Undergraduate Project (UGP) 1. 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.

ELECTIVE COURSES

SKMM 4113 Plasticity and Applications
This course addresses the background of metal under plastic behaviour and their possible generalizations under combined stresses. It also deals with the technologies and analyses in various metal forming applications. By the end of the course, the students should be able to state and analyze the loading and unloading behavior of metal materials with few hardening rules and their characteristics, analyze the stresses and strains in 3-D, Apply the yield and failure criteria analysis for the starting of plastic behaviour, analyze the plastic bending behavior of metal with hardening rule. The students should also be able to present, differentiate and simplify the various technologies and analysis on metal forming applications i.e. Sheet metal Forming. Blanking, Stamping, Cup- Drawing, Indentation, Stretching and drawing over a radius, Wire Drawing, Extrusion and Pultrusion processes.

SKMM 4123 Structural Analysis
This course builds upon the materials covered in SKMM 1113 and SKMM 2123, to develop an understanding of structural behaviour. Matrix analysis methods are used as the basis for computer-based structural analysis. Analytical techniques are used to analyse trusses, beams, frames, flat plates and domes. At the end of this course, the students should be able to differentiate between various types of space structures and determine member forces, deflections and extension and reactions in truss structures, using stiffness method, apply governing equations for rectangular flat and circular plates when subjected to lateral loads, using the exact and energy methods, apply the differential equations of infinite and semi-infinite beams on elastic foundation, when acted upon by load, point and couple loads. Students should be able to explain shell theory and determine membrane stresses in thin walled plate structures, in the light of designing thin shells of revolution under symmetric loads as well as assess and evaluate stresses obtained from Design by Analysis and Design by Rule according to standard design codes.

SKMM 4133 Failure of Engineering Components and Structures
This course introduces systematic approach in performing engineering failure analysis to identify the causes of failure. The procedure covers both metallurgical aspects and mechanics of materials analyses. The scope covers failure events due to static load, fatigue, creep and buckling. It also addresses component failure in specific application interest such as microelectronics devices.

SKMM 4143 Mechanics of Composite Materials
This course introduces students to some major views and theories in polymer based composite materials, types of materials, production methods, quality assurance, failure analysis, test methods and mechanics of laminated composites. It will focus on key issues such as stress-strain relation, and interaction behavior due to extensional, coupling and bending stiffness. The course includes visits to related industries in order to understand the practical aspects of the course. It is expected that at the end of this course, the students are able to explain the different types of materials used to form polymer-based composites, explain different types of production methods used to form polymer-based composites components, determine properties of lamina using Rule of Mixtures, develop stress-strain relation for unidirectional lamina to determine extensional, coupling and bending stiffness matrix of laminate, state different modes of micromechanic failure to evaluate types of failure criteria of laminates and explain standard test procedures for strength, stiffness and toughness for quality assurance.

SKMM 4153 Applied Stress Analysis
The course is an extension of SKMM 1113 and SKMM 2123 where the basic knowledge of stress, strain, displacement, equilibrium and compatibility are extended to the use of stress function in rectangular and polar coordinates, with applications to torsion, flexure, plane stress and plane strain problems. The theory is then supported by experimental techniques which include strain gauging transducer design and data acquisition and photoelasticity. It is expected that at the end of this course, the students are able to apply the skills of mathematical manipulations at an advanced level for stress analysis in terms of their applicability and limitations, evaluate the stress functions of plane stress and plane strain problems in rectangular and polar coordinate systems, determine stress distributions and resultants in beams, plates, cylinders and discs by using the stress function concept, apply strain gauge technique to determine the state of stress on a component, design and calibrate force, displacement, pressure, torque and acceleration transducers and apply photoelasticity method to determine the direction and magnitude of principal stresses.

SKMM 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.

SKMM 4213 Mechanical Vibration
This subject covers the fundamentals of vibration analysis of 1,2 and multi DOF mechanical system including the effects of damping; free response, the significance of natural modes, resonance frequency, mode shape, and orthogonality; vibration absorbers and vibration control; and introduction to vibration measurement. A measurement project involves the use of an accelerometer, signal conditioning and analysis instrumentation.

SKMM 4233 Mechanisms and Linkages
The course provides necessary techniques to study the motion of machines where position and displacement, and advance kinematics analysis are addressed. The course focuses on the application of kinematics theories to practical linkages and mechanisms. Statics and dynamics mechanism force analysis are addressed. Students will be exposed to the design and analysis of cam-and-follower systems. The course also introduces kinematic synthesis of linkages and mechanisms.

SKMM 4243 Advanced Control
The course is structured to encompass the essentials and basic theory of design and analysis of control system which are not covered by SKMM 3233. It will include the cascade compensation technique using lead and lag compensator, non-linear system analysis, discrete system and state-space analysis. By the end of the course, students should be able to design lead and lag compensators that satisfy gain margin or phase margin specification, analyse the stability of non-linear feedback system using describing function, derive the response of a discrete system, analyse the stability of discrete system, derive state-space model for a dynamic system, derive the output response of a system represented by state-space model and design a constant state-feedback controller based on pole-placement method. MATLAB and Simulink software package shall be taught and used as a tool on solving the control engineering problems throughout the course.

SKMM 4253 Industrial Automation
The course is an elective for students seeking a specialty to mechanical engineering related to the field of industrial automation. It introduces students to the methods, rools, and technologies used to automate a product or a system. Primary automation technologies covered include programmable logic controllers (PLCs), PC-based control, robotics and NC machines. It is expected that students should be able to acquire knowledge on the principles of an industrial automation, identify industrial automation components and peripherals, develop or draw control system schematics using relay logic, develop and debug ladder logic programs for industrial PLCs, describe clearly a PC-based automation system, determine robot components, configuration and specification, develop basic NC part program, describe automated inventory control and inspection technologies, describe automation communication and networking and design an automated system.

SKMM 4273 Robotics
This course is designed to enable students 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's 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, statics and dynamics which typically constitute the important pre-requisites in designing the mechanical structure, planned tajectory path and control aspects. The robot control topic included in later section provides a platform for students to explore the various control algorithm that address the stability, accuracy and robustness of systems. Particular emphasis is laid on the mathematical modeling and simulation of the control schemes. A number of case studies pertaining to selected robotic systems will be discussed to further strengthen the students' understanding and insight into actual systems.

SKMM 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 projects assigned to students during this course require 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 analyze noise levels whenever required.

SKMM 4313 Turbo-Machinery
Gas dynamics turbo machine theory and general concept, design aspects of axial flow compressors, design aspects of axial flow compressors, design aspects of axial flow compressors, design aspects of axial flow turbine, design aspects of radial flow compressor, design aspects of radial flow turbines.

SKMM 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.

SKMM 4333 Computational Fluid Dynamics
This course introduces on computational fluid dynamics, the application of the solver [A]x = [b], fundamental equation of fluid dynamics and heat transfer. Limited differentiation method, Taylor series, polynomial curve fittings and control volume method are also discussed. Navier Stokes equation solve, projects fixed volume method for convection diffusion problems, pressure-Velocity Coupling algorithms also included.

SKMM 4343 Hydraulics Machines and Pipes System
This course comprises of basic elements of water flow in pipes which are applied to practical problems or pipelines and pipe networks for steady, quasi-steady and unsteady flow Hardy-Cross Method. Pressure wave and water hammer analysis method of characteristic, as well as p ump operation and pipe system also discussed. Pump working range: selection of pump as an integrated part of the pipeline system, Operating point and Cavitation-NSPH are included.

SKMM 4413 Internal Combustion Engines
This course is an elective for students who seek knowledge and necessary insight into the topic of internal combustion engines. It introduces students to the basic principles of the design and operating characteristics of various types of internal combustion engines with major emphasis on reciprocating engines. It will examine two and four-stroke spark ignition (SI) and compression ignition (CI) engines. Thermochemistry and fuels, air and fuel induction, combustion and fluid motion, exhaust flow and emission, heat transfer in engines as well as friction and lubrication are covered within the course. By the end of the course, students should be able to analyse and evaluate the performance of SI and CI engines, explain the combustion process of SI and CI engines and describe the pollutants as well as emission control and treatment of internal combustion engines.

SKMM 4423 Power Plant Engineering
This course is designed as an elective for students to develop the necessary knowledge and understanding of power plant technology. It introduces different power generation methods and deals with how power plants are operated as well as the components in a power plant. Power generation applications will be treated in detail as well as deeper cycle studies of power generation with emphasis on thermal systems and analysis firmly based on thermodynamics. By the end of the course, students should be able to perform technical and economical assessments of a power plant. They should be able to describe the main features of power generation methods and alternative energy sources. The students should also be able to explain the environmental aspects of power generation.

SKMM 4433 Refrigeration and Air-Conditioning
This course is an elective for students who seek knowledge and necessary insight into the area of refrigeration and air-conditioning. It introduces students to the basic principles of the design and operations of refrigeration and air-conditioning systems. It will include analysis of vapour compression and vapour absorption refrigeration systems and a discussion on refrigerants. Students will be exposed to air-conditioning systems and equipment. Psychrometric analysis, comfort and inside design condition, heat load estimation and duct design are covered within the course. By the end of the course, students should be able to perform air-conditioning system analysis and design calculations using the principles of thermodynamics and fluid mechanics, psychrometric analysis and ASHRAE standards for heat load calculations.

SKMM 4443 Thermal Fluid System Design
This course introduces students to thermal fluid system design. The course begins with a review of fluid mechanics, thermodynamics and heat transfer, which are important fundamentals to the thermal design process exchangers such as boilers, condensers, cooling towers etc. Students are then taught the basic design principles, design methodology, system identification and description, component design and simulation. This is followed by the theory and design of heat exchangers. The course continues with aspects of system design, system simulation and system optimization. Students are exposed to various simulation and optimization techniques that can be used to optimize the design of both components and complete systems. By the end of this course, students are expected to be able to apply the knowledge in designing simple thermal systems, optimize the basic (workable) design, simulate the process, evaluate and optimize the performance of the system.

SKMM 4453 Combustion
This course is designed as an elective for students who seek knowledge and necessary insight into the area of combustion. Basic thermodynamics and chemical kinetics of combustion will be introduced. Types of fuel especially liquid and gaseous fuels will also be introduced. Premixed and non-premixed flames and where their applications can be found will be examined. Detonation phenomena will also be studied. Students will be exposed to pollutant formation and control. By the end of the course, students should be able to explain the basic concepts of combustion, identify areas of applications of combustion and perform basic calculations pertaining to fuels and their analysis. Students should also be able to analyse various types of flames and the combustion processes involved and explain the impact of pollution and emissions from combustion processes on the environment.

SKMM 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.

COURSE SYNOPSIS FOR B. ENG (MECHANICAL - MATERIALS)

SKMB 3612 Physical Metallurgy
The course introduces the students 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 transformations, and modes of alloy strengthening mechanisms. 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 will give the optimum performance through the use of the interrelationship between microstructures mechanical properties and processes.

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

SKMB 3633 Materials Characterisation
This course provides students with an understanding of the principles of advanced techniques used in characterizing and determining the structure and properties of materials. These techniques include x-ray diffraction and x-ray analysis, analytical techniques of microscopy including light, scanning and transmission microscopy, as well as the basic principles of thermal analysis techniques.

SKMB 4613 Corrosion and Corrosion Control
This course introduces students to the basic principles of electrochemical and aqueous corrosion and environmental degradation of metals. It will examine the principles that lead to metal corrosion and oxidation based on thermodynamics and Porbaix diagrams, mixed potential theory and application of passivity. The course will also provide knowledge on the various forms of corrosion and methods to control by design, materials selection, cathodic protection, coatings and the use of inhibitors. At the end of the course, the students should be able to apply the knowledge to determine whether corrosion will occur in any given environment and recognize the different types of corrosion as well as be able to design a corrosion control system for protection against environmental degradation.

ELECTIVE COURSES

SKMB 4023 Non Destructive Testing
This course is designed to acquaint students with six major non destructive evaluation disciplines, radiography, ultra sonic, eddy current, magnetic particle, liquid penetrant and visual inspection as well as provide students with an overview of less common NDT methods in general that gives an important contribution to the safety and the economic and ecological welfare of our society. NDT is the only choice for the test of an object which must not be destroyed, modified or degraded by the testing process. This is generally required for objects which will be used after testing, for example safety parts, pipelines, power plants and also materials under in- service inspection. NDT is based on physical effects at the surface or the inner structure of the object under test. Often the outcome of the test needs to be interpreted to give a useful result; sometimes different NDT methods must be combined, or verified by the other test methods. At the end of the course, the students should be able to apply knowledge of using different NDT methods: acoustic emission testing, x-rays (radiographic testing) and Ultrasonic Testing for inner defects, Penetrant and Magnetic Particle Testing for surface cracks. Electronically linked methods like Eddy Current Testing, RADAR, Computer Tomography and Thermography and visual testing and leak testing

SKMB 4623 Materials Selection
This course introduces students to the basic concepts of materials selection and provide 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 impact on materials and process selection is also introduced. The course also provides students with case studies in which the methodology of materials and process selection 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.

SKMB 4653 Advanced Materials
This course introduces students to the recent developments on the various classes advanced materials used in applications such as aerospace, automotive, biomedical and electronic industries. It will emphasise on the important properties exhibited by metallic, polymeric, ceramics and composite materials which make them selected for high- end and advanced applications. The physical and mechanical properties of the various classes of advanced materials (superalloys, titanium and aluminium alloys, intermetallics and biomaterials) will be detailed as well as the processing techniques associated with producing these materials. The course will also cover the latest advanced materials being developed such as nanomaterials, shape memory alloys and other functional materials. At the end of the course students should be able to gain understanding of the physical and mechanical properties of advanced materials and apply the knowledge to select suitable materials for a given engineering project.

SKMB 4663 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 ceramics, polymers and composite materials. The course emphasizes 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.

SKMB 4673 Surface Engineering
This course introduces students to the concepts of surface engineering and how surface engineering may be used to enhance the performance of engineering components. It will provide an overall view of the commonly used surface engineering techniques with emphasis on the strengths and limitations of each method. The course will also examine key issues on the role that surfaces play in materials behavior; concentrating on wear and corrosion processes. The factors affecting the selection of surface treatment method are also covered in terms of performance, properties and process factors. At the end of the course, students should gain an understanding on how improvements in the surface properties are achieved through a range of processes and also be able to apply the knowledge to select the suitable surface treatment for a given application.

SKMB 4683 Nanomaterials
This course introduces students to fundamental aspects of nanomaterials. The importance of the nanoscale materials and their improved properties compared to conventional materials. The principles and relative merits of a range of techniques for the production of nanostructures including ultra-thin films and multi layers are discussed. The analytical and imaging characterization techniques and the recent applications of nanomaterials in electronics and biomaterials will be briefly discussed.

SKMB 4693 Modelling in Materials Engineering
This course introduces students to the basic concepts of computer modeling in materials science and engineering. The course covers basic principles in establishing numerical simulation for the evaluation of material properties and phenomena during material processing. It will emphasize on atomistic 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 phase-field method will be introduced as an example.

COURSE SYNOPSIS FOR B. ENG (MECHANICAL - INDUSTRIAL)

SKMI 3822 Quality Systems
This course emphasizes on the importance of quality in manufacturing systems. Statistical process control (SPC) techniques such as seven basic tools, variable and attribute control charts, process capability studies, acceptance sampling and reliability are covered. The principles of Quality Improvement strategies and quality management philosophies such as Six Sigma and ISO 9000 are highlighted. Students are required to work in groups to integrate the quality and statistical tools learned to solve case studies problems.

SKMI 3833 Operation Research
This course will cover both deterministic and non deterministic operations research. It focuses on developing mathematical models and applying operational research methods to solve problems in manufacturing and service industries. Topics covered include linear programming, sensitivity analysis, transportation model, network optimization, decision analysis, multi criteria decision analysis, queuing system etc.

SKMI 3843 Production Planning & Control
This course is designed to expose students to 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). 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 knowledge in 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.

SKMI 3853 Work Design and Productivity
This course is designed to introduce students to techniques in designing work in manufacturing and service industries to improve productivity. The importance of productivity and productivity measurement model will be discussed. This course will focus on method study and work measurement. Other concepts and approach will also be introduced such as 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 the course, students should be able to select the appropriate techniques, approaches and concepts in solving case studies problems that optimizes the use of resources such as man, machine, materials and time to improve productivity.

SKMI 3863 Engineering Economy & Accounting
This course is designed to equip students to acquire 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 is divided to two parts. Part 1 is designed to teach students to formulate cash-flow diagram, perform analysis on engineering economic problems and evaluate between alternative of engineering investments/projects to make economical 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 making and control.

SKMI 4053 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, past management 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. 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.

ELECTIVE COURSES

SKMI 4063 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 emphasizes the study on the safety and health hazards which comprises the short and long term exposure. It covers basic principles of accident prevention, hazard identification, risk assessment and control. At the end of the course, students should be able to apply occupational safety and health principles and techniques in the design and analysis of workplace, processes and products.

SKMI 4083 Reliability and Maintenance
This course gives an introduction to reliability engineering concepts related to engineering. Relevant statistical tools to solve reliability engineering problems, statistical data analysis to estimate reliability of component and system and apply related reliability engineering knowledge to improve product quality. This course also covers major topics related to maintenance such as introduction to maintenance engineering, preventive maintenance, total productive maintenance (TPM), sixmajor losses, overall equipment effectiveness (OEE), reliability and maintenance cost.

SKMI 4073 Industrial Systems Simulation
This course provides students with the concepts and tools to model manufacturing or service systems efficiently using a practical Simulation software. Topics under Discrete-Event Simulation that span from basic modeling concepts, types of discrete-event approaches, analysis of input data, goodness-of-fit tests, model building, model verification and validation, to full model experimentation and analysis of outputs are covered. Through this course, students will be able to develop computerized discrete-event simulation models and conduct scenario- based analysis and evaluation.

SKMI4093 Supply Chain Management and Sustainability
This course aims to provide students with an understanding of the sustainability challenges and opportunities facing supply chain today. We will look at some of the factors contributing to the adoption of sustainability strategies, such as legislation which penalize negative environmental and social impacts and society's expectation of business in terms of health, human rights and the environmental. The supply chains today cannot be concerned only with creating shareholder value; their performance is also measured in terms of social, environmental and economic impact. The main topics covered in the course are sustainable concept and framework, global warming, environmental legislation, sustainable design of products, renewable energy, closed- loop supply chains, facilities and locations decisions, transportation decisions, supplier management and strategic sustainability implementation.

SKMI 4813 Quality Engineering
This course covers process and product variation, Six Sigma, Quality Function Development (QFD), Failure Mode Effect Analysis (FMEA), Gage Repeatability and Reproducibility (GRR), Short Run SPC and experimental method such as Taguchi Methods and Classical Experimental Designs. Students are required to work in groups to integrate these tools in solving case studies problems.

SKMI 4833 Facility Design
This course is designed to equip students with the basic knowledge on designing manufacturing facilities layout, manufacturing processes, work design and production planning control. 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 appropriate material handling requirements for the manufacturing plant.

COURSE SYNOPSIS FOR B. ENG (MECHANICAL - MANUFACTURING)

SKMP3712 Design for Manufacture & Assembly
This course aims to provide students with the necessary concepts and procedures to understand 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 with 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 also be discussed.

SKMP 3722 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 applications in various manufacturing automation systems such as GT, CNC, FMS and CIMS. This course will also allow student to carry out small case studies in real environments and expose them on certain issues related to manufacturing automation.

SKMP 3813 Manufacturing Systems
Technology plays an important role in the success of a manufacturing system but what is more important is the systematic management of the technology and system. To ensure effective use of technology and efficient manufacturing system, all resources have to be managed efficiently. This subject is an introduction to selected Industrial Engineering (IE) techniques in improving productivity of an organization. At the end of the course, students should be able to select appropriate techniques, approaches and concepts to reduce waste and optimize the use of resources such as man, machine, materials and time

SKMP 3942 Laboratory 3 CAD/CAM/CNC/CAE
This course provides an in-depth coverage on various aspects of computer aided application for advanced operations in manufacturing industries. This include the exposure on computer aided design (CAD) for modeling products, computer aided manufacturing (CAM) for simulation of machining operations, G & M codes for programming parts on computer numerical controlled (CNC) machines and computer aided engineering (CAE) for simulation of moulding process or parts under mechanical/thermal stresses. The students are directly exposed to several mini-exercises related to the use of CAD/CAM/CNC/CAE software throughout this course. At the end of this course, the students will be able to model products using CAD software, preparing CNC part programming, simulate machining conditions via CAM interface and finally use CAE software to simulate moulding conditions or mechanical/thermal stresses in parts.

SKMP 4723 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 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.

ELECTIVE COURSES

SKMP 4013 Additive Manufacturing
Additive Manufacturing (AM) is the use of additive material processes in producing parts directly or indirectly from computer (CAD) models, without utilizes the tooling support. These technologies and techniques are the use of 3D printing technology in realizing end use of functional parts. In this course, students will learn about a variety range of AM technologies and their potential to support in making fast prototyping and manufacturing components. In addition, the important research challenges associated with these technologies in supporting of Advanced Manufacturing Technology and Precision manufacturing processes also will be discussed.

SKMP 4713 Industrial Automation
Industrial Automation is becoming more important in the near future to many organizations due to increasing global competition to produce products at the competitive price and quality. Knowledge in automation for future engineers is vital in allowing the designing a competitive and productive system. In this course, students are exposed to various automation control systems which are commonly used in industries such as pneumatic, electro pneumatic, hydraulic, electro hydraulic, electric motor controls and Programmable Logic Control (PLC). At the end of this course, the students will be able to design a simple control system circuit for an automated system.

SKMP4733 Product Design & Development
This course introduces the students to the various stages of product design and development methods which 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 rapid prototyping and manufacturing systems.

SKMP 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 (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 presently serious gap of local engineering know how in this field.

SKMP 4753 Modern Machining
This course introduces students to several non-traditional machining processes. For each of the processes, it will examine the basic principles and the important machining parameters involved, as well as the equipment, tooling and application issues. Where appropriate, theoretical or empirical models employed to estimate process attributes such as material removal rate will be described. Case studies will also be presented.

SKMP 4763 Quality Engineering & Metrology
Product quality and the proper functioning of processes are among the important issues for any manufacturing and service organization. Manufacturing engineers play animportant 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 determining the effect of independent variables on the output of a system. In addition, 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.

SKMP 4773 Engineering Economy & Accounting
This course is designed to equip students to acquire 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 is divided into two parts. Part 1 is designed to teach students to formulate cash-flow diagram, perform analysis on engineering economic problems and evaluate between alternative of engineering investments/projects to make economical 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 making and control.

SKMP 4783 Quality Engineering
This course covers process and product variation, Six Sigma, Quality Function Deployment, Failure Mode Effect Analysis, Gage Repeatability and Reproducibility and Short Run SPC. This course will focus more on experimental methods such Classical Experimental Designs and Taguchi Methods. Students are required to work in groups to integrate these tools in solving case studies problems.

SKMP 4793 CAD/CAM
This course discusses about the important role of CAD in the design process, the Design/ Manufacturing interface between CAD/CAM/CAE, the basic techniques involved in CAD/ CAM/CAE, its importance in the selection, implementation and management of CAD/ CAM/CAE system with the association to machine control, fundamentals of Numerical Control (NC) and others Advanced Manufacturing Technology processes. The course also involves hands-on experience in CAD/CAM/CAE.

SKMP 4833 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. In general project management the topic covers are project manager, project planning, work breakdown structure (WBS) and negotiation and conflict resolution. In project scheduling, topics such as PERT, critical path method (CPM), resource allocation, reducing project duration and project progress and performance measurement are addressed. Major topics covered under maintenance are introduction to maintenance engineering, preventive maintenance, total productive
maintenance (TPM), six major losses, measuring overall equipment effectiveness (OEE), reliability and maintenance cost. At the end of the course, students should be able to apply knowledge in project management to plan, schedule and control projects as well as to apply basic maintenance concept and develop a total productive maintenance (TPM)
program in a company.

SKMP470 Sustainable Manufacturing
This course introduces students to sustainability considerations in product design and manufacture. It presents the principles, methodology and case studies to develop understanding of sustainable development which can reduce environmental impact and promote sustainable practice. Besides that, it is also introduces 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).

COURSE SYNOPSIS FOR B. ENG (MECHANICAL – AERONAUTICS)

SKMA 3132 Aircraft Structures I
The course introduces the students 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 of truss 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 investigates the stress analysis of the multi-cell structures due to the acting loads and its design characteristics.

SKMA 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 safety 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 analyze and design aircraft. Proper due shall be given to both aspects of performance and static stability.

SKMA 3333 Aerodynamics
The course gives an introduction to aerodynamics with specific emphasis on aircraft. The purpose is to increase the understanding and interest in aerodynamics. The contents include; Fluid flow equations: Continuity equation, Euler and navier Stokes equations. Inviscid flow theory: complex potential function, Conformal and Kutta Joukowski transformation. 2D aerofoil theory (infinite wing theory): Vortex law, Biot-Savart and thin aerofoil theory, fourier theory, Thick and cambered aerofoil, Finite wing theory: Vortex system and horseshoe vortex, downwash and lift distribution, and Introduction to industrial aerodynamics (vehicles and buildings).

SKMA 3423 Aerospace Propulsion System
This course comprises of an introduction to aircraft propulsion system including its historical background. Review of thermodynamics and fluid mechanics, Piston engines, shaft and thrust power. Cycle analysis; air standard and cycle with friction, and Turbojet engine cycle will be discussed. Turbofan engine cycle, Gas turbine engine components and their functions, Turbine blades cooling techniques, Gas turbine emissions and Chemical rocket engines will also be mentioned.

SKMA 3812 Aviation Management
This course begins by emphasizing on the fundamental concepts of management. This follows by the general overview of the aviation industry which includes airport operations, aviation organizations, aviation rules and regulations. A detailed look on the main activities of the aviation industry is included. Several visits to the aviation industry are organized throughout the period of the course.

SKMA 4143 Aircraft Structures II
This course gives students an understanding of the basic principles in the analysis of aircraft structural components and determine their strengths under the various operational loading conditions.

SKMA 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.

SKMA 4253 Aircraft Instrumentation and Avionics
Avionics and Aircraft instrumentation encompasses the basic aircraft avionics and instrumentation systems. The major topics covers for avionics include historical background, short, long and satellite navigations, radio navigation devices, radar and reliability. For aircraft instrumentation, this course covers major topics including an introduction to instrumentation system, component

of instrumentation, air data and indicators signal conditioning, data acquisition system, transducers in aircraft, application of strain gauges in aircraft load measurement.

SKMA 4513 Aircraft Design I
This course will allow student to learn basic philosophy of aircraft design using traditional and modern design tools (CAD, CFD etc). Student will learn the basic methodology and decisions surrounding aircraft design. The course is a project based and students will use knowledge and skill from previous studies in aeronautics to conduct a practical aircraft design project. Students will work in teams to design the selected aircraft. Contents of learning include feasibility study, aerodynamic design, performance analysis and wing loading determination.

SKMA 4523 Aircraft Design II
This course gives students an exposure to the aircraft design. Students are splits into a number of groups to carry out aircraft components design. The progress of the project is closely monitored by the lecturers. Lectures are given to provide the student with information as project goes along. Group presentation and feedback from lecturers are regularly arranged for student evaluation and design improvement.

SKMA 4822 Aviation Economy
This course aims to expose Aeronautical engineering students with fundamental elements of economics. The course begins by introducing key economic concepts such as the cash flow diagram and factors. 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.

COURSE SYNOPSIS FOR B. ENG (MECHANICAL – AUTOMOTIVE)

SKMV 3012 Automotive Technology
This course introduces students to the fundamental knowledge of automotive areas such as design principal, components or modern automotive system function and operation, interaction between one system and the other system. Students will then be taught to identify problem that may arise on the components or system. Students will also have some hands-on assignment to be done in automotive laboratory which will give them exposure to work on real automotive components andsystems.

SKMV 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 for a 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.

SKMV 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 and objective 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.

SKMV 4212 Vehicle Electronics and Instrumentation
Vehicle Electronics and Instrumentation System is a subject which consists of several major topics. These major topics include introduction to Automotive Basic Electrical System and Components, General Electrical System Diagnosis, Automotive Starting System, Automotive Lighting and Accessories, Automotive Instrumentation System. The Basic of Electronic Engine Control and Typical Digital Engine Control System.

SKMV 4523 Automotive Engineering Design
This is a problem-based-learning course. In this course, students will have to undertaken (in group) one mechanical-automotive engineering design exercise. The main aim of this course is for the students to experience how to undertake real group design project. Students will have to go through the process of applying the various techniques and scientific principles (which they have learnt during their undergraduate course) for them to achieve their goals. Students will also be taught to be creative, brainstorm their ideas, discuss and apply the appropriate PR (public relation) to earn cooperation and commitment from various level of people (such as technicians, lecturers and their own peers), departments and other agencies (such as automotive car and component manufacturers), in order to get sufficient details for their goals to materialise within the time allocated. Concurrently, students will be given lectures related to mechanical design process and engineering design method (technology- independent), based on relevant engineering design books.

SKMV 4792 Automotive Production Technology
This course introduces students to manufacturing processes involved in automotive production as well as some of the major issues related to automotive manufacturing. It will emphasize on casting and forming processes employed in the automotive industry. A brief review on machining and joining processes is also given. The course will also
highlight some of the challenging issues such as Quality, Group Technology, Lean Manufacturing and Automation.

ELECTIVE I

SKMV 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 motion of vehicle dynamics model and to analyze its performance in terms or ride, comfort & handling behavior.

SKMV 4413 Engine Turbocharging
This course is designed to deliver the principles of engine boosting and 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 cover 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 and 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 contribution of engine boosting to meet these targets will be discussed and elaborated as part of the course.

ELECTIVE II

SKMV 4213 Vehicle Structures
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 and manufacturing/assembly of body panels.

SKMV 4423 Vehicle Powertrain
This course introduces students to the fundamental of vehicle powertrain engineering systems. Students will be lectured on vehicle powertrain system which employs manual and automatic transmission which 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 predictions that will be covered in this course are how to determine vehicle gradebility, top speed, and acceleration and steady state fuel consumptions. In conjunction to these, students will be taught on how to determine top, bottom and intermediate gear ratios taking into consideration overgeering and undergeering conditions. The current continuously variable transmission (CVT) technology and exploiting its capability to achieve the above vehicle performances will be highlighted.

COURSE SYNOPSIS FOR B. ENG
(NAVAL ARCHITECTURE AND OFFSHORE ENGINEERING)

SKMO 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 different fields 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.

SKMO 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.

SKMO 2322 Naval Architecture I
This course introduces students to basic naval architectural knowledge. It enables students to familarise themselves with naval architectural terms, ship components, and undertakes simple hydrostatics and stability calculations. Tools and techniques required in future naval architecture work are introduced here. The course includes hands-on individual and group projects.

SKMO 2343 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 motion of Viscous/Real fluid and an Ideal fluid. Further discussion are also given in surface waves and hydrodynamic of slender bodies

SKMO 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 analysis of 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 coverage given 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 team and interpret the results objectively will also be emphasized in this course.

SKMO 3333 Naval Architecture II
This course introduces students to further naval architectural knowledge. It enables students to familarise 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 stability and launching.

SKMO 3523 Ship and Offshore Design I
This course firstly explains the concepts of engineering design and later relates them to the process and procedures in ship design. Emphasis is made on preliminary design calculations to satisfy owner's requirements and related legislations. The hands on part will deals with design tasks, including hull form design (manually and computer aided) hydrostatics calculation and General Arrangement Design. The students will be given a real design job and working as consultant group to closely replicates the real ship design practice.

SKMO 3353 Ship Resistance & Propulsion
This course introduces students to ship hydrodynamics, dimensional analysis, fundamental of ship resistance, ship resistance and its components, fundamental of ship model testing and 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.

SKMO 3713 Ship and Offshore Production Technology
This course is essential as it prepares the students 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 to shipbuilding 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 subassembly, block assembly and erection process of offshore structures. Upon completion, launching, transporting and upsetting process will also be discussed. On the soft engineering side, the quality control and production system will also be 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, work in team effectively, long life learning and communication skills.

SKMO 3812 Marine Transport & Economic
The 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 influencing the world maritime scenario. The topics selected are globalization, technology and knowledge while addressing environmental issues.

SKMO 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 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.

SKMO 4233 Dynamics of Marine Vehicles
Marine vehicles and structures are built for transportation and also 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 sea keeping and solving seakeeping in waves using strip theory, Introduction to maneuverability of vessels that are motions in the horizontal plane so that they can proceed on a straight path, turn or take other avoiding actions in calm water as well as in waves, wind and current. This course emphasises on the students' ability to identify and solve the behaviour marine vehicles/ structures problems by carrying the necessary calculation and analysis.

SKMO 4422 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 and hydraulic power system. Other important support system such as air conditioning, fire, condition and performance monitoring system will also be covered.

SKMO 4533 Ship and Offshore Design II
This course is the continuation of Ship Design I course. Having design the ship hull forms and its related general arrangement to serve its functions done previously, this course continues by 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 much as possible tailored to the real design practice in industry.

SKMO 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.

SKMO 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.

SKMO 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.

SKMO 4941 Marine Laboratory I
This course is designed to enable students to apply knowledge on ship resistance and ship stability, and motions in their laboratory works. This course will also train students to plan and manage their work within a given timeline. It also develops students' capability to present, discuss and analyse experimental results clearly, effectively and confidently in an oral presentation as well as in a written laboratory reports.

SKMO 4951 Marine Laboratory II
This course is designed to enable students to apply knowledge of seakeeping, maneuvering and also ship propulsion in their laboratory works. This course will also train students to plan and manage their work within a given timeline. It also develop students' capability to present, discuss and analyse experimental results clearly, effectively and confidently in an oral presentation as well as in a 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. Elective I tend to focus on general issues in marine industry. While Elective II covers more technically inclined matters. Details of each course are as follows;

ELECTIVE I

SKMO 4012 Marine Meteorology and Oceanography
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.

SKMO 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

SKMO 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.

ELECTIVE II

SKMO 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.

SKMO 4262 Riser and 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, design codes and criteria. It starts with the types and layout of risers layout, 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 analyze the static and dynamic performances including floater. The students also solve the dynamic performances of riser/ mooring lines using simulation software (eg. MOSES) and analyze the fatigue of riser and mooring chains.

SKMO 4452 Marine Engineeering 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 systems for a chosen ship or offshore vehicles. Students are then required to integrate these systems together to form a workable compromise and fulfill the vessel's intended function. The students are expected to understand the design processes, operations and selection of the auxiliary systems. During the course of the subject students are required to have numerous discussions and presentations to complete the design. Implementation of this course is via group project.

ACADEMIC STAFF

DEPARTMENT OF APPLIED MECHANICS & DESIGN

Head of Department

Dr. Intan Zaurah bt Mat Darus
BEng. (Hons.) (Mech. Eng.), Univ. of Wales Cardiff
PhD (Automatic Control & Sys. Eng.), Sheffield
Room : E07-04.03.15/ C24 - 336
Ext : 57044 /34584
Email : intan@utm.my
kjmg@mail.fkm.utm.my
intan@mail.fkm.utm.my

Professors

Ir. Dr. Leong Yew Mun @ Mohd. Salman
BSc (Hons) (Mech. Eng.), Heriot-Watt
PhD (Rotordynamics), Heriot-Watt
PEng, M.I.E.M
Room : C24-336
Ext : 34584
Email : salman.kl@utm.my
salman@ic.fkm.utm.my

Dr. Mohd. Nasir bin Tamin
BSc (Mech. Eng.), Northrop
MSc (Mech. Eng.), Washington State
PhD (Mech. Eng. & App. Mechs.), Univ. of Rhode Island
Room : C23-328
Ext : 34622
Email : taminmn@utm.my
taminmn@fkm.utm.my

Dr. Musa bin Mailah
BEng (Mech.), UTM
MSc (Mechatronics), Dundee
PhD (Control & Mechatronics), Dundee
Room : Level 5, E07
Ext : 57090
Email : musamailah@utm.my
musa@mail.fkm.utm.my

Associate Professors

Dr. Amran bin Alias
BSc (Mech. Eng.), Texas
MSc (Eng. Solid Mechs.), UMIST
PhD (Mech. Eng.), Liverpool
Room : C24-214
Ext : 34632
Email : amran_al@utm.my
amran_al@mail.fkm.utm.my

Dr. Intan Zaurah bt Mat Darus
BEng. (Hons.) (Mech. Eng.), Univ. of Wales Cardiff
PhD (Automatic Control & Sys. Eng.), Sheffield
Room : E07-04.03.15/ C24 - 336
Ext : 57044 /34584
Email : intan@utm.my
intan@mail.fkm.utm.my

**Dr. Mohamad Kasim bin Abdul Jalil
BSc (Mech. Eng.), Union College
MSc (Eng. Design), L'borough
PhD (Mech. Eng.), SUNNY
Room : C25 – 335
Ext : 34741
Email : kasimjalil@utm.my
kasim@mail.fkm.utm.my

Dr. Mohamed bin Hussein
BEng (Mech.), UTM
MSc (Adv. Mnfg. Sys. & Tech.), Liverpool
PhD (Mech. Eng.), De Monfort University, UK
Room : C23 - 318
Ext : 34639
Email : mohamed@utm.my
mohamed@mail.fkm.utm.my

Dr. Mohamed Ruslan bin Abdullah
BEng (Mech.), UTM
MSc (Mfg. Sys. Eng.), Warwick
PhD (Impact Properties of Composite Materials), Liverpool
Room : C23 - 218
Ext : 34707
Email : ruslanabdullah@utm.my
ruslan@mail.fkm.utm.my

Dr. Mohd. Shafiek bin Haji Yaacob
BSc (Hons) (Mech. Eng.), Texas Tech. Univ.
Master (Mech. Eng.), Rice University
PhD (Mech. Eng.) UTM
Room : C24 - 327
Ext : 34561
Email : shafiek@utm.my
shafiek@mail.fkm.utm.my

Dr. Mohd. Yazid bin Yahya
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Mech. Eng.), Liverpool
Room : C25 – 410
Ext : 34752
Email : yazidyahya@utm.my
yazid@mail.fkm.utm.my

Dr. Mohd. Zarhamdy bin Md. Zain
BEng (Mech.), UTM
MSc (Mech. Eng.), Sheffield
PhD (Mech. Eng.), Sheffield
Room : C23 – 320
Ext : 34690
Email : zarhamdy@utm.my
zarhamdy@mail.fkm.utm.my

Mustafa bin Yusof
BSc (Hons) (Mech. Eng.), Strathclyde
MSc (Mech. Eng.), UMIST
Room : C24-213
Ext : 34570
Email : mustafayusof@utm.my
mustafa@mail.fkm.utm.my

Senior Lecturers

Abdul Halim bin Muhaimin
BEng (Mech.), UTM
MEng (Mech.), UTM
Room : C23 – 418
Ext : 34681
Email : halimmuhaimin@utm.my
halim@mail.fkm.utm.my

Ahmad Zafri bin Zainudin
BSc (Mech. Eng.), Strathclyde
MSc (Auto Eng. Design & Mnfg.), Coventry
Room : C23 – 230
Ext : 34701
Email : zafri@utm.my
zafri@mail.fkm.utm.my

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

**Dr. Ardiyanshah Syahrom
BEng (Mech. Eng.), Indonesia
MEng (Mech. Eng.), UTM
PhD (Mech. Eng.), UTM
Room : C23 – 410
Ext : 34677
Email : ardi@utm.my
ardi@mail.fkm.utm.my

Badri bin Abd. Ghani
BSc (Mech. Eng.), Strathclyde
MEng (Mech.), UTM
Room : C23 – 231
Ext : 34674
Email : agbadri@utm.my
agbadri@mail.fkm.utm.my

Hairul Anuar bin Abdullah
BSc (Mech. Eng.), Evansville
MSc (Eng. Design), L'borough
Room : C23 – 221
Ext : 34662
Email : hairul@utm.my
hairul@mail.fkm.utm.my

Dr. Hishamuddin bin Alham
BSc (Mech. Eng.), UMIST
MSc (Mechs. of Mtl and Structures), Strathclyde
PhD (Mech. Eng.), UTM
Room : C24 – 315
Ext : 34708
Email : ahisham@utm.my
ahisham @mail.fkm.utm.my

Dr. Jamaludin bin Hj. Mohd. Taib
BSc (Mech. Eng.), Texas
MPhil (Mech. Eng.), Heriot-Watt
PhD (Computer Aided Eng.), Dundee
Room : C23 – 225
Ext : 34654
Email : jamalt@utm.my
jamalt@mail.fkm.utm.my

Dr. Kamarulafizam bin Ismail
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Mech. Eng.), UTM
Room : C25 – 412
Ext : 34760
Email : kamarulafizam@utm.my
kamarulafizam@mail.fkm.utm.my

Khairul Anwar bin Hanafiah
BEng (Mech.), UTM
MEng (Mech.), UTM
Room : C23 – 425
Ext : 34686
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), Sheffield
Room : C23 - 419
Ext : 34666
Email : maziah@utm.my
maziah@mail.fkm.utm.my

Dr. Md. Afendi bin M Yusuf
BEng (Mech. Eng.), Sunderland Poly
MEng (Mech.), UTM
PhD (Mech. Eng.), Strathclyde
Room : P23
Ext :
Email : affendi@utm.my
affendi@mail.fkm.utm.my

Dr. Mohd. Ayub bin Sulong
BEng (Mech. Eng), UTM
MEng (Mech. Eng), UTM
PhD (Mech. Eng), Newcastle
Room : C23 – 424
Ext : 34683
Email : mayub@utm.my
mayub@mail.fkm.utm.my

Dr. Mohd. Azuwan bin Mat Dzahir
BEng (Mech. Eng.),UTM
MEng (Mech. Eng.), UTM
PhD (Functional Control System),
Shibaura Institute of Technology
Room : C25-332
Ext : 34743
Email : azuwan@utm.my
azuwan@mail.fkm.utm.my

Dr. Mohd. Fadzil bin Daud
BEng (Mech. Eng. Design), Huddersfield
MSc (Integrated Mnfg. Sys.), Birmingham
PhD (Eng. Edu.), UTM
Room : C23 – 214
Ext : 34672
Email : fadzil@utm.my
fadzil@mail.fkm.utm.my

Dr. Mohd. Foad bin Abdul Hamid
BSc (Mech. Eng.), Arizona
MSc (Mech. Eng.), Arizona
PhD (Mech. Eng.), New York
Room : C25 – 334
Ext : 34570
Email : mfah@utm.my
mfah@mail.fkm.utm.my

Dr. Mohd. Nasir bin Hussain
Bachelor of Design (Industrial), ITM
MA (Ind. Design), Birmingham
PhD (Ind. Design), L'borough
MINDS (Malaysia)
Room : C23 – 313
Ext : 34633
Email : nasirhussain@utm.my
mnasir@mail.fkm.utm.my

Dr. Mohd. Shuisma bin Mohd. Ismail
BSc (Mech. Eng.), Strathclyde
MSc (Auto Eng. Design & Mnfg.), Coventry
PhD (Mnfg. & Mechs. Eng.), Coventry
Room : C23 - 219
Ext : 34652
Email : shuisma@utm.my
shuisma@mail.fkm.utm.my

Mohd Yunus bin Abdullah
BSc (Mech. Eng.), Glasgow
MEng (Mech.), UTM
Room : C24 - 114 - 02/C25 - 414
Ext : 34861/34759
Email : myunus@utm.my
myunus@mail.fkm.utm.my

Dr. Muhamad Noor bin Harun
Bachelor Mech. Eng., UiTM
MSc (Mech. Eng.), L'borough
PhD (Mech. Eng), Leeds
Room : C23 – 224
Ext : 34655
Email : mnoorharun@utm.my
mnoor@mail.fkm.utm.my

Dr. Nor Fasiha bt Mohd. Yusof
BSc of Eng., Saitama
MEng (Mech.), UTM
PhD (Mech. Design), Kobe, Japan
Room : C23 – 226
Ext : 34693
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
Room : C23-416
Ext : 34680
Email : safwati@utm.my
safwati@mail.fkm.utm.my

Ir. Razali bin Sulaiman
BSc (Mech. Eng.), Swansea
MSc (Automotive Product Eng.), Cranfield
Room : C25 – 415
Ext : 34723
Email : razalisulaiman@utm.my
razali@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
Ext : 34673
Email : shaharil@utm.my
shaharil@mail.fkm.utm.my

Dr. Shukur bin Abu Hassan
BEng (Mech. Eng), UTM
MSc (Mnfg. Sys. Eng.), Warwick
PhD (Mech. Eng.), UTM
Room : P23 - 303 - 01
Ext : 35989
Email : shukur@fkm.utm.my
shukur@mail.fkm.utm.my

Dr. Tang Howe Hing
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Electrical Eng/Biomedical), UNSW Room
: C23 - 220
Ext : 34687
Email : tanghh@utm.my
tanghh@mail.fkm.utm.my

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

Dr. Zainab bt Asus
BEng (Mech.), UTM
Master (Automotive Eng.), ISAT
PhD (Mech Automobile), ISAT
Room : C23-210
Ext : 34651
Email : zainabasus@utm.my
zainab@mail.fkm.utm.my

Dr. –Ing. Zaini bin Ahmad
BEng (Mech.), UTM
MSc (Structures & Energy Studies), Leeds
PhD (Built Environment and Eng.), Australia
Room : C23 - 312
Ext : 34647
Email : azaini@utm.my
azaini@mail.fkm.utm.my

Zulkafli bin Yusoff
BSc (Mech. Eng.), Strathclyde
MEng (Mech.), UTM
Room : C23 - 420
Ext : 34682
Email : zulkafli@utm.my
zulkafli@mail.fkm.utm.my

Ahmad Humaizi bin Rozaini
BSc (Hons) (Mech. Eng.), UNITEN
MSc (Product Design & Management), Liverpool
Room : C23 - 412
Ext : 34678
Email : humaizi@utm.my
humaizi@mail.fkm.utm.my

Afandi bin Dzakaria
BEng (Mech.), UTM
MSc (Mech. Eng.), Coventry
Room : C23 - 222
Ext : 34653
Email : dafandi@fkm.utm.my

* Study Leave
** Seconded
*** Unpaid Leave

DEPARTMENT OF THERMO-FLUIDS

Head of Department

Dr. Mazlan bin Abdul Wahid
BSc (Aero. Eng.), Embry-Riddle Florida
MSc (Combustion & Energy), Leeds
PhD (Mech. Eng.), State Univ. Of New York
Ext : 57036 / 34705
Room : E07 - 04.03.18/C24 – 434
Email : mazlan@utm.my
mazlan@mail.fkm.utm.my

Professors

Kept. Dato' Ir. Dr. Alias bin Mohd. Noor PSSTLDM
DSDK, PAT, SDK, KAT, PK, PPA
BSc (Hons) (Mech. Eng.), Glasgow
MSc (Thermofluids), Strathclyde
PhD (Turbomachinery), Bath
P.Eng. F.I.E.M. ASEAN Eng. APEC Eng. IntPE,
ACPE, Arthur Charle Main Prize
Room : C24 - 335
Ext : 34780
Email : aliasmn@utm.my
alias@mail.fkm.utm.my

Ir. Dr. Azhar bin Dato' Abdul Aziz
BSc (Hons.) (Mech. Eng), Brighton
MEng (Alternative Fuel), UTM
PhD (Mech. Eng.) (I.C Engines), UMIST
PEng. MIEM Apec. Eng. ASEAN Eng. Mem SAE
Room : C24 – 222
Ext : 35980
Email : azharaziz@utm.my
azhar@mail.fkm.utm.my

Ir. Dr. Farid Nasir bin Haji Ani
BSc (Mech. Eng.), Glasgow
MSc (Thermo & Related Studies), Birmingham
PhD (Fuel & Energy), Leeds
PEng. MIEM
Room : C23 – 327
Ext : 34515
Email : farid@utm.my
farid@mail.fkm.utm.my

Dr. Mazlan bin Abdul Wahid
BSc (Aero. Eng.), Embry-Riddle Florida
MSc (Combustion & Energy), Leeds
PhD (Mech. Eng.), State Univ. Of New York
Room : E07 - 04.03.18/C24 – 434
Ext : 57036 / 34705
Email : mazlan@utm.my
mazlan@mail.fkm.utm.my

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

Associate Professors

Dr. Abu Hasan bin Abdullah
BSc (Hons.) (Mech. Eng), Newcastle
MSc (Mech. Eng.), Strathclyde
PhD (Mech. Eng.), Bath
Room : C25 – 333
Ext : 34740
Email : abuhasan@utm.my
abuhasan@mail.fkm.utm.my

**Ir. Hayati bt Abdullah
BSc (Mech. Eng.), Clemson
MEng (Mech.), UTM
PEng. MIEM MIEEE
Room : C23 – 438
Ext : 34621
Email : hayatiabdullah@utm.my
hayati@mail.fkm.utm.my

**Dr. Kahar bin Osman
BSc (Mech. Eng.), Hartford
MSc (Computational Fluid Dynamics), Leeds
PhD (Mech. Eng), Hampshire
Room : C25 – 324
Ext : 34733
Email : kahar@utm.my
kahar@mail.fkm.utm.my

Dr. Nazri bin Kamsah
BSc (Hons.) (Mech. Eng.), Sunderland
MEng (Mech.), UTM
PhD (Mech. Eng.), Hampshire
Room : C25 – 413
Ext : 34749
Email : nazrikh@utm.my
nazrikh@mail.fkm.utm.my

**Dr. Nor Azwadi bin Che Sidik
BSc (Mech. Eng.), Japan
MSc (Mech. Eng.), UMIST
PhD (Mech. Eng.), Japan
Room : C23 – 434
Ext : 34699
Email : azwadi@utm.my
azwadi@mail.fkm.utm.my

**Dr. Syahrullail bin Samion
BSc (Mech. Eng.), Japan
MSc (Eng.), Japan
PhD (Mech. Eng.), Japan
Room : C23 – 434
Ext : 34699
Email : syahruls@utm.my
syahruls@mail.fkm.utm.my

Senior Lecturers

Dr. Aminuddin bin Saat
BEng (Mech.), UTM
MSc (Mech. Eng.), Coventry
PhD (Mech. Eng.), Leeds
Room : C23 – 216
Ext : 34657
Email : amins@utm.my
amins@mail.fkm.utm.my

Dr. Fazila bt Mohd. Zawawi
BEng (Mech.), UTM
MEng (Aerospace Mechanics & Atomic), ISAE
PhD (Aeroelaslicity), ISAE
Room : C23 - 424
Ext : 34683
Email : fazilamz@utm.my
fazila@mail.fkm.utm.my

Dr. Haslinda bt Mohamed Kamar
BEng (Hons.) (Mech. Eng.), Glasgow
MEng (Mech.), UTM
PhD (Mech. Eng.), UTM
Room : C25 – 416
Ext : 34748
Email : haslinda@utm.my
haslinda@mail.fkm.utm.my

Dr. Md Mizanur Rahman
PhD (Mech. Eng.) Aalto University, Finland
Room : C23 – 228
Ext : 34605
Email : mdmizanur@utm.my

Mohamad Nor bin Musa
BSc (Mech. Eng.), Korea
MSc (Thermofluids), Korea
Room : C24 – 311
Ext : 34579
Email : mnormusa@utm.my
mnormusa@mail.fkm.utm.my

Dr. Mohd. Fairus bin Mohd. Yasin
BSc (Mech. Eng.), Wisconsin
PhD (Combustion), UK
Room : C24 - 309
Ext : 34574
Email : mohdfairuz@utm.my
mohdfairuz@mail.fkm.utm.my

Dr. Mohd. Faizal bin Hassan
BSc (Mech. Eng.), Japan
MEng (Mech.), UTM
PhD (Mech. Eng).), Japan
Room : C24 -212
Ext : 34852
Email : mfaizal@utm.my
mfaizal@mail.fkm.utm.my

Mohd. Kamal bin Ariffin
BEng (Mech.), UTM
MSc (Bldg. Service Eng.), Heriot-Watt
Room : C25 – 325
Ext : 34738
Email : mohdkamal@utm.my
mkamal@mail.fkm.utm.my

Dr. Mohd. Taufik bin Sulaiman
MSc (Manuf. & Foundry), INSAT, France
PhD (Aero. & Asstronautic), Tokyo
Room : C25 – 328
Ext : 34555
Email : mdtaufik@utm.my

Dr. Mohd. Yusoff bin Senawi
BSc (Mech.), New South Wales
MEng (Mech.), UTM
Post. Grad. Dip. (Computer Science), UTM
PhD (Mech. Eng.), UTM
Room : C25 – 323
Ext : 34747
Email : myusoff@utm.my
myusoff@mail.fkm.utm.my

Dr. Muhammad Hasbullah bin Padzillah
BEng (Mech.), UTM
PhD (Mech. Eng.), Imperial Collage, London
Room : C25 - 320
Ext : 34879
Email : mhasbullah@utm.my
hasbullah@mail.fkm.utm.my

Dr. Muhammad Noor Afiq Witri bin Muhammad Yazid
BSc (Mech. Eng.), UTM
MSc (Mech. Eng.), UTM
PhD (Mech. Eng.), UTM
Room : C25-335
Ext : 34741
Email : mnafiqwitri@utm.my
afiqwitri@mail.fkm.utm.my

Dr. Natrah bt Kamaruzaman
BSc (Mech.), Ryukyus, Japan
MEng (Mech. Eng), UTM
PhD (Mech. Eng.), UTM
Room : C23 – 215
Ext : 34663
Email : natrah@utm.my
natrah@mail.fkm.utm.my

Dr. Ummikalsom binti Abidin
BEng (Hons.) (Mech. Eng.), UNITEN
MEng (Mech.) UTM
PhD (Micro Eng.), UKM
Room : C23 - 211
Ext : 34661
Email : ummi@utm.my
ummi@mail.fkm.utm.my

Dr. Zulkarnain bin Abdul Latiff
BSc (Mech. Eng.), Glasgow
MEng (Mech.), UTM
PhD (Mech. Eng.), UTM
Room : C25 – 411
Ext : 34758
Email : zkarnain@utm.my
zkarnain@mail.fkm.utm.my

Lecturer

*Nuruain binti Yahya
BEng (Mech. Eng.), UTM
MEng (Mech.), UTM
Room : C25 – 411
Ext : 34758
Email : nurulain.y@utm.my
nurulain@mail.fkm.utm.my

Tutors

*Mohd. Hazmil Syahidy bin Abdol Azis
BEng (Mech. Eng.), UTM
MEng (Mech. Eng.), UTM
Email : hazmil@fkm.utm.my
hazmil@mail.fkm.utm.my

Mohd. Ibthisham bin Ardani
BEng (Automotive), UTM
MEng (Mech. Eng.), UTM
Email : ibthisham@utm.my
ibthisham@mail.fkm.utm.my

* Study Leave
** Seconded

DEPARTMENT OF MATERIALS, MANUFACTURING & INDUSTRIAL ENGINEERING

Head of Department

Dr. Muhamad Azizi bin Mat Yajid
BEng (Hons) (Materials Eng.), USM
MSc (Mech. Eng.), Leeds
PhD (Nanotechnology) The Univ. of Sheffield, UK
Room : E07 - 04.02.17/C23 - 319
Ext : 57042/34649
Email : azizi@utm.my
azizi_my@mail.fkm.utm.my

Professors

**Dr. Safian bin Sharif
BEng (Mech.), UTM
MSc (Adv. Mnfg. Tech.), UMIST
PhD (Machining), Coventry
Room : C25 - 315
Ext : 34850
Email : safian@utm.my
safian@mail.fkm.utm.my

Dr. Esah bt Hamzah
BSc (Materials Sc. & Tech.), Wales
MSc (Metallurgy), UMIST
PhD (Metallurgy), UMIST, FIMM
Room : C25 - 318
Ext : 34855
Email : esah@utm.my
esah@mail.fkm.utm.my

Dr. Izman bin Sudin
BEng (Mech.), UTM
MSc (Mnfg. Sys. Eng.), Warwick
PhD (Mech. Eng.), UTM
Room : E07 - 04.03.01/C25 - 313
Ext : 57038/34756
Email : izman@utm.my
izman@mail.fkm.utm.my

Dr. Jamaliah bt Hj. Idris
BSc (Hons) (Metallurgy & Materials), Wales PhD (Materials & Metallurgical Eng.), Wales
Room : C23 – 336
Ext : 34659
Email : jamaliah@utm.my
jamaliah@mail.fkm.utm.my

**Engr. Dr. Mohammed Rafiq bin Abdul Kadir
DIC, ACGI, Imperial College of London
Meng (Mech.), Imperial College of London PhD (Biomechanics & Biomaterials), Imperial College of London
Room : V01
Ext : 58514
Email : rafiqkadir@utm.my
rafiq@mail.fkm.utm.my

Dr. Mohd. Hasbullah bin Hj. Idris
BEng (Mech. Prod.), UTM
Mphil (Investment Casting), L'borough
PhD (Mech. Eng.), UTM
Room : E07 - 04.03.07/C25 - 316
Ext : 57051/ 34735
Email : hasbullah@utm.my
hsbullah@mail.fkm.utm.my

Dr. Noordin bin Hj. Mohd. Yusof
BEng (Mech.), UTM
MSc (Adv. Mnfg. Tech.), Cranfield
PhD (Mech. Eng.), UTM
Room : C23 - 429
Ext : 34697
Email : noordin@utm.my
noordin@mail.fkm.utm.my

**Ir. Dr. Sha'ri bin Mohd. Yusof
BSc (Ind. Eng.), Miami
MSc (Engineering), Birmingham
PhD (Mnfg. Eng.), Birmingham P.Eng
Ext : 03-21805185
Email : shari@fkm.utm.my

Dr. Wong Kuan Yew
BEng (Mech. Ind.), UTM
MEng (Eng. Mngt), UTM
PhD (Mech. Eng.), Birmingham
Room : E07 - 04.02.05/C24 - 320
Ext : 57061/34691
Email : m-wongky@fkm.utm.my
wongky@fkm.utm.my

Associate Professor

Dr. Adnan bin Hassan
BSc (Ind. Eng.), Miami
MSc (Ind. Measurements Sys.), Brunel
PhD (Mech. Eng.), UTM
Room : C24 - 334
Ext : 34583
Email : adnan@utm.my
adnan@mail.fkm.utm.my

***Dr. Masine bt Md. Tap
BEng (Mech.), UTM
Mphil (Computer Aided Eng.), Heriot-Watt
PhD (Computer Aided Mnfg), Dundee
Room : C25 - 310
Ext : 34781
Email : masine@utm.my
masine@mail.fkm.utm.my

Dr. Muhamad Azizi bin Mat Yajid
BEng (Hons) (Materials Eng.), USM
MSc (Mech. Eng.), Leeds
PhD (Nanotechnology) The Univ. of Sheffield, UK
Room : E07 - 04.02.17/C23 - 319
Ext : 57042/34649
Email : azizi@utm.my
azizi_my@mail.fkm.utm.my

**Dr. Muhamad Zameri bin Mat Saman
BEng (Mech.), UTM
MSc (Adv. Mnfg. Sys. Eng.), Coventry
PhD (Design Tool), UK
Room : C23 - 426
Ext : 34697
Email : zameri@utm.my
zameri@mail.fkm.utm.my

Senior Lecturers

Affandi bin Mohd. Zainal
BSc (Mech. Eng.), Mississippi
MEng (Mech.), UTM
Room : C24 - 316
Ext : 34687
Email : affzai@fkm.utm.my

Dr. Aini Zuhra bt Abdul Kadir
BSc (CAD Eng.), UM
MSc (Mnfg.), UM
PhD (Mech. Eng.), Auckland, New Zealand
Room : C24 - 215
Ext : 34564
Email : ainizuhra@utm.my
aini@mail.fkm.utm.my

Dr. Azanizawati bt Ma'aram
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Performance Measurement of SCM), UK
Room : C23 - 411
Ext : 34675
Email : niza@utm.my
niza@mail.fkm.utm.my

Dr. Engku Mohammad Nazim bin Engku Abu Bakar
BSc (Metallurgy), Seoul,
MSc (Properties & Applications of Eng. Materials), Strathclyde
PhD (Mech. Eng.) UTM
Room : C23 – 217
Ext : 34688
Email : nazim@utm.my
nazim@mail.fkm.utm.my

Dr. Foo Jin Hoe
BEng (Mnfg. Sys. Eng.), Coventry
MSc (Eng. Mnfg. Mngt.), Coventry
PhD (Regional Environment Sys.), Japan
Room : C23 - 408
Ext : 34703
Email : jinhoe@utm.my
jinhoe@mail.fkm.utm.my

Dr. Jafri bin Mohd. Rohani
BSc (Mathematics – Statistics), New Mexico
BSc (Ind. Eng.), New Mexico
MSc (Ind. & System Eng.), Ohio
PhD (Mech. Eng.) UTM
Room : C24 - 325
Ext : 34568
Email : jafrimr@utm.my
jafri@mail.fkm.utm.my

Dr. Jasmi bin Hashim
BEng (Mech.), UTM
MSc (Metallurgy), Sheffield
PhD (Materials Eng.), Dublin City Ireland
Room : C25 – 326
Ext : 34732
Email : jasmihashim@utm.my
jasmi@mail.fkm.utm.my

Dr. Joy Rizki Pangestu Djuansjah
BSc (Material Eng.), Inst. Tech. of Bandung
MSc (Mech. Eng.), Kobe University, Japan
PhD (Mech. Eng.), Kobe University, Japan
Room : C23 - 316
Ext : 34635
Email : joy@utm.my
joy@mail.fkm.utm.my

Dr. Mohd. Azlan bin Suhaimi
BEng (Manuf.), UTM
MEng (Mech. Eng), UTM
PhD (Mech. Eng.-Industry), Chonbuk National Univversity, Korea
Room : C23-321
Ext : 34646
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 Univversity, Korea
Room : C25-311
Ext : 34823
Email : firdaustaib@utm.my
firdaus@mail.fkm.utm.my

Dr. Mohd. Zamri bin Mohd. Yusof
BSc (Applied Physics), Japan
MSc (Eng.), Japan
PhD (Mech. Eng. – Frontier Materials), Nagoya Institute of Technology, Japan
Room : C23 - 431
Ext : 34696
Email : zamriyusop@utm.my
zamriyusop@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
Ext : 34668
Email : norakmal@utm.my
akmal@mail.fkm.utm.my

Dr. Nor Hasrul Akhmal bin Ngadiman
BEng (Mech. Eng.), UTM
PhD (Mech. Eng.), UTM
Room : C23 - 331
Ext : 34650
Email : norhasrul@utm.my
norhasrul@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
Ext : 34676
Email : nhayatiahmad@utm.my
nhayati@mail.fkm.utm.my

Dr. Norizah bt Hj. Redzuan
BEng (Hons.) (Mech. Eng.- Computer Integration), Glasgow MEng (Mech.), UTM
PhD (Mech.Eng.), Glasgow
Room : C24 - 234
Ext : 34608
Email : norizah@utm.my
norizah@mail.fkm.utm.my

Rozaimi bin Mohd. Saad
BEng (Mech. Prod.), UTM
MEng (Mech. Adv. Mnfg. Tech.), UTM
Room : C25 - 327
Ext : 34745
Email : rozaimi@utm.my
rozaimi@mail.fkm.utm.my

Dr. Syed Ahmad Helmi bin Syed Hassan
BSc (Mech. Eng.), Alabama
MEng (Mech.), UTM
PhD (Eng. Education), UTM
Room : C24 - 323
Ext : 34585
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
Ext : 34707
Email : tuty@utm.my
tuty@mail.fkm.utm.my

Dr. Uday M. Basheer Al-Naib Bakar
BEng (Chemical), Baghdad Univ., Iraq
MEng (Chemical), University of Iraq
PhD (Computer Sc.), USM
Room : C23 - 413
Ext : 34639
Email : uday@utm.my
ummb2008@gmail.com

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
Ext : 34620
Email : fahmin_faiz@utm.my
fahminfaiz@mail.fkm.utm.my

Wan Nazdah bt Wan Hussin
BSc (Hons.) (Mnfg. Sys. Eng.), Leeds
MSc (Adv. Mnfg. Sys. Eng.), Coventry
Room : C23 - 213
Ext : 34660
Email : wnazdah@utm.my
wnazdah@mail.fkm.utm.my

Zulkepli bin Hj. Muhamad
BEng (Mech.), UTM
MEng (Mech.), UTM
Room : C25 - 331
Ext : 34746
Email : zulkeplim@utm.my
zulkepli@mail.fkm.utm.my

Lectures

Khidzir bin Zakaria
BEng (Hons.) (Mech. Eng.), Portsmouth
MSc (Adv. Mnfg. Tech.), Portsmouth
Room : C23 - 413
Ext : 34639
Email : khidzir@utm.my
khidzir@mail.fkm.utm.my

Mohd. Faridh bin Ahmad Zaharuddin
BEng. (Mnfg. Sys. Eng.), Portsmouth
MSc (Adv. Mnfg. Tech.), Portsmouth
Room : C24-324
Ext : 34569
Email : faridh@utm.my
faridh@mail.fkm.utm.my

Rozlina bt Md. Sirat
BEng (Mech. Prod.), UTM
Advanced Diploma in Education (Mech.), UTM
MEng (Mech.), UTM
Room : C23 - 227
Ext : 34673
Email : rozlina@utm.my
rozlina@mail.fkm.utm.my

** Seconded
*** Sabatical Leave

DEPARTMENT OF AERONAUTICS, AUTOMOTIVE & OCEAN ENGINEERING

Head of Department

Ir. Dr. Shuhaimi bin Mansor
BSc (Aero. Eng.), Glasgow
MSc (Flight Dynamics), Cranfield
PhD (Aero), L'borough
Peng. MIEM
Room : E07 - 04.03.06/C23 - 432
Ext : 57043/34698
Email : shuhaimi@utm.my
shuhaimi@mail.fkm.utm.my

Professors

**Dr. Mohammad Nazri bin Mohd. Ja'afar
BSc (Aero Eng.), Wichita
MSc (Aero Eng.), Wichita
PhD (Combustion), Leeds
Room : C25 - 308
Ext : 34755
Email : nazrijaafar@utm.my
nazri@mail.fkm.utm.my

**Ir. Dr. Ab. Saman bin Abd. Kader
B.(Marine Eng.), Akademik Ilmu Pelayaran Indonesia
MSc (Shipping & Maritime Studies), Liverpool Certificate of Competency
Part A (Marine Engineering)
PhD (Marine Transport), Liverpool
PEng MIEM MCIT
Room : C23 - 335
Ext : 34720
Email : abdsaman@utm.my
abdsaman@mail.fkm.utm.my

Dr. Adi Maimun bin Abdul Malik
MRINA BSc (Hons) (Naval Arch.), Strathclyde
MSc (Marine Tech.), Strathclyde
PhD (Marine Technology), Strathclyde
CEng (UK), FRINA
Room : C25 - 309
Ext : 34761
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
PhD (Marine Tech.), Newcastle
CEng (UK), FRINA
Room : C23 - 428
Ext : 34764
Email : omar@utm.my
omar@mail.fkm.utm.my

Ir. Dr. Wan Khairuddin bin Wan Ali
BSc (Mech. Elect.), Tasmania
MSc (Electronic Sys. Design), Cranfield
PhD ESD (Avionics), Cranfield
PEng
Room : E07 – 05.04.07
Ext : 57086
Email : wankhai@utm.my
wankhai@mail.fkm.utm.my

Associate Professors

Ainullotfi bin Abdul Latif
BE (Aero Eng.), UNSW
MSc (Sc.), UNSW
Room : C25 - 409
Ext : 34754
Email : ainullotfi@utm.my
lotfi@mail.fkm.utm.my

**Dr. Mohd. Azman bin Zainul Abidin
BSc (Elect. Eng.), USM
MSc (Automotive), Conventory
PhD (Vehicle Dynamics), Loughborough
Email : mazman@utm.my
azman@mail.fkm.utm.my

**Dr. Mohd. Zamani bin Ahmad
BSc (Nautical Studies), Southampton
MSc (Maritime Studies), UWIST
Dr. Eng. Maritime (Port Planning), UTM
Chartered Member (CMILT UK),
CEng (UK)
Room : C24 – 217 – 01/C23 – 330
Ext : 34859/34640
Email : zamani@utm.my
drmohdzamani@mail.fkm.utm.my

**Dr. Pakharuddin bin Mohd. Samin
BSc (Mech. Eng.), Texas, A & M
MSc (Mech. Eng.), Texas, A & M
PhD (Automotive), UTM
Room : C23 - 433
Ext : 34714
Email : pakhar@utm.my
pakhar@mail.fkm.utm.my

Ir. Dr. Shuhaimi bin Mansor
BSc (Aero. Eng.), Glasgow
MSc (Flight Dynamics), Cranfield
PhD (Aero), L'borough
PEng. MIEM
Room : E07 - 04.03.06/C23 - 432
Ext : 57043/34698
Email : shuhaimi@utm.my
shuhaimi@mail.fkm.utm.my

**Dr. Srithar A/L Rajoo
BEng (Mech. Material), UTM
MEng (Eng. Mngt.), UTM
PhD (Mech.), London
Room : C24 - 317
Ext : 34889
Email : srithar@utm.my
srithar@mail.fkm.utm.my

Dr. Tholudin bin Hj. Mat Lazim
BSc (Aeronautical Eng.), Salford
MSc (Thermodynamics & Fluids), Strathclyde
PhD (Gas Turbine Combustion), Leeds
Room : C24 - 308
Ext : 34589
Email : tholudin@utm.my
tholudin@mail.fkm.utm.my

Senior Lecturers

Dr. Abd. Rahim bin Abu Bakar
BEng (Mech.), UTM
MSc (Automotive Eng.), Leeds
PhD (Mech. Eng.), Liverpool
Room : C24 – 312
Ext : 34572
Email : arahim@utm.my
arahim@mail.fkm.utm.my

Dr. Chiong Meng Soon
PhD (Mech.), UTM
Room : C24 – 328
Ext : 34555
Email : chiongms@utm.my

Dr. Chong Cheng Tung
BEng (Mech.), UTM
PhD (Combustion), Cambridge Univ., UK
Room : C23 - 309
Ext : 34631
Email : cctung@utm.my
ctchong@mail.fkm.utm.my

Dr. Farah Ellyza binti Hashim
BEng (Mech – Marine Tech), UTM
PhD (Mech. Eng.), UTM
Room : C24 - 332
Ext : 34719
Email : farahellyza@utm.my
ellyza@mail.fkm.utm.my

Dr. Haris Ahmad bin Israr Ahmad
BEng (Mech. Aero), UTM
MEng (Aerospace Mechanics & Avionics), ISAE
PhD (Composite Structure Aeronautique), ISAE
Room : C25 - 319
Ext : 34736
Email : harisahmad@utm.my
haris@mail.fkm.utm.my

Dr. Iskandar Shah bin Ishak
BEng (Mech. Aero), UTM
Master (Technique of Aeronautics & Space), ENSAE,
PhD (Mech. Eng.) (Aero), UTM
Room : C23 - 325
Ext : 34664
Email : shah@utm.my
shah@mail.fkm.utm.my

**Ir. Dr. Istas Fahrurrazi bin Nusyirwan
BEng (Mech. Aero), UTM
MEng (Mech.), UTM
PhD (Aero), RMIT, Australia
Room : C24 - 337
Ext : 34765
Email : istaz@utm.my
istaz@mail.fkm.utm.my

Dr. Jaswar, CEng
B.Eng (Marine) ITS, Surabaya
MSc (Marine) Curtin, Australia
PhD (Naval Arch & Marine), Osaka
Room : C23 – 324
Ext : 34664
Email : jaswar@utm.my
jaswar@mail.fkm.utm.my

Kang Hooi Siang
BEng (Mech.), UTM
MEng (Mech.), UTM
PhD (Mech.), Texas Agri. & Mech. Uni. College Station, USA
Room : C23 – 324
Ext : 34733
Email : kanghs@utm.my
kanghs@mail.fkm.utm.my

Mastura bt Ab. Wahid
BEng (Mech.Aero), UTM
MEng (Aeronautical and Space Systems), ISAE
PhD (Guidance Control and Navigation), Ecole Nationale l`Aviation Civile, France
Room : C23 – 323
Ext : 34635
Email : masturawahid@utm.my
mastura@mail.fkm.utm.my

Md. Nizam bin Dahalan
BEng (Mech. Aero), UTM
MEng (Mech.), UTM
Room : C23 - 232
Ext : 34692
Email : nizamdahlan@utm.my
nizam@mail.fkm.utm.my

Dr. Mohd Azman bin Abas
PhD (Mech. Eng.-Automotive), UTM
Room : C24 - 326
Ext : 34853
Email : azman.abas@utm.my
azmanabas@mail.fkm.utm.my

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
Ext : 34658
Email : mdfarid@utm.my
mfarid@mail.fkm.utm.my

Dr. Mohd. Kameil bin Abdul Hamid
BSc (Mech. Eng.), SUNNY
MSc (Eng.), Leeds
PhD (Automotive Tribology), Univ. of Western Australia
Room : C23 - 417
Ext : 34667
Email : kameil@utm.my
kameil@mail.fkm.utm.my

Dr. Mohd. Nazri bin Mohd. Nasir
BSc (Aero Eng.), Manchester
MSc (Aero Eng.), Delft Univ. of Tech
PhD (Aerospace Eng.), Univ. of Manchester Ins. Sc. & Tech., UK
Room : C25 - 329
Ext : 34739
Email : mnazrimnasir@utm.my
mnazri@mail.fkm.utm.my

Dr. Mohd Shariff bin Ammoo
BEng (Mech.), UTM
MSc (Inst. & Analytical Science), UMIST
PhD (Aircraft Structure), Cranfield
Room : C23 - 233
Ext : 34702
Email : mshariff@utm.my
mshariff@mail.fkm.utm.my

Nasrudin bin Hj. Ismail
BSc (Hons) (Marine Eng.), Newcastle
MSc (Marine Eng.), Newcastle
Room : C24 – 318
Ext : 34588
Email : nasrudin@utm.my
nasrudin@mail.fkm.utm.my

Dr. Nik Ahmad Ridhwan bin Nik Mohd
BEng (Mech. Aero), UTM
MEng (Mech.), UTM
PhD (Helicopter), Liverpool
Room : C23 - 209
Ext : 34656
Email : ridhwan@utm.my
ridhwan@mail.fkm.utm.my

Dr. Nik Mohd. Ridzuan bin Shaharuddin
BEng (Hons)(Mech –Marine Technology.), UTM
PhD (Mech.Eng.), UTM
Room : C23 -423
Ext : 34685
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
Room : C23 -423
Ext : 34685
Email : norazilao@utm.my
norazila@mail.fkm.utm.my

Dr. Nurulakmar bt Abu Husain
BEng (Mech. Auto), UTM
MSc (Auto-Eng.), Bath
PhD (Mech. Eng.), Liverpool
Room : C23 - 421
Ext : 34665
Email : nurulakmar@utm.my
nurul@mail.fkm.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
Ext : 34731
Email : saifulanuar@utm.my
saiful@mail.fkm.utm.my

Dr. Shabudin bin Mat, CEng
BEng (Mech. Aero), UTM
Master (Aeronautical Maintenance & Prod.), ENSICA
PhD (Aero), Glasgow
Room : C24 - 310
Ext : 34573
Email : shabudin@utm.my
shabudin@mail.fkm.utm.my

Dr. Siow Chee Loon
BEng (Marine Eng.), UTM
PhD (Offshore Eng.), UTM
Room : C25-322
Ext : 34859
Email : scheeloon@utm.my
scloon@mail.fkm.utm.my

Wan Zaidi bin Wan Omar
BSc (Aero. Eng.), Manchester
MSc (Applied Inst. & Control), Glasgow
Room : C23 - 223
Ext : 34689
Email : wanzaidi@utm.my
wanzaidi@mail.fkm.utm.my

Dr. William Chong Woei Fong
BEng (Hons)(Mech Eng..), UTM
Msc. (Automotive Product Eng.), Cranfield University
PhD (Adhesive and Molecular Friction in Tribological Conjunctions), Cranfield University
Room : C25 - 328
Ext : 34744
Email : william@utm.my
william@mail.fkm.utm.my

Yahya bin Samian
BSc (Naval Arch. & Ocean Eng.), Glasgow
MSc (Ship Prod. Tech.), Strathclyde
Room : C23 - 317
Ext : 34642
Email : yahyasamian@utm.my
yahya@mail.fkm.utm.my

Dr. Zul Hilmi bin Che Daud
BEng (Mech. Auto), UTM
MSc (Auto-Eng.), ISAT
PhD (Mechanical Automotive), ISAT
Room : C23 - 317
Ext : 34642
Email : zulhilmicdaud@utm.my
hilmi@mail.fkm.utm.my

Lecturer

*Nur Izwanne binti Mahyon
BEng (Mech. Aero), UTM
MSc (Mech.Eng) UTM
Room : C25 - 324
Ext : 34773
Email : izwanne@utm.my
izwanne@mail.fkm.utm.my

Tutors

*Muhammad Akmal bin Azizan
BEng (Mech.), UTM
MEng (Marine Tech.), UTM
Email : akmal@fkm.utm.my

* Study Leave
** Seconded

ACADEMIC STAFF
WITH OTHER DUTIES

A. Directors of Centres of Excellence

1. Prof. Ir. Dr. Mohd. Salman Leong
   Director Institute of Vibration & Noise

B. Departmental Coordinator of Programme/Field

1. Dr. Mohd. Nazri bin Mohd. Nasir
   Coordinator of Aeronautical Engineering Programme

2. Dr. Mohd Kameil bin Abdul Hamid
   Coordinator of Automotive Engineering Programme

3. Mr. Nasrudin bin Hj. Ismail
   Coordinator of Naval Architecture & Offshore Engineering Programme

4. Dr. Jafri bin Mohd. Rohani
   Coordinator of Industrial Engineering Programme

5. Dr. Norizah bt Hj. Redzuan
   Coordinator of Manufacturing Engineering Programme

6. Dr. Tuty Asma binti Abu Bakar
   Coordinator of Materials Engineering Programme

7. Dr. Fazila binti Mohd Zawawi
   Coordinator of Fluid Mechanics Field

8. Dr. Aminuddin bin Saat
   Coordinator of Thermodynamics Field

9. Assoc. Prof. Dr. Amran bin Alias
   Coordinator of Solid Mechanics Field

10. Dr. Mohd. Foad bin Abdul Hamid
    Coordinator of Design Field

11. Mr. Mohd. Yunus bin Abdullah
    Coordinator of Mechanics of Machines Field

12. Assoc. Prof. Dr. Mohd Shafiek bin Yaacob
    Coordinator of Automation & Control Field

13. Dr. Mohd Yusoff bin Senawi
    Coordinator of Engineering Computational Field

14. Prof. Ir. Dr. Wan Khairuddin bin Wan Ali
    Coordinator of Mechanical Engineering Career & Practice Field

SUPPORTING STAFF

Deputy Registrar

Khairull Azmi bin Ishak
Bachelor of Arts (Geography), USM
Master of Management (Technology), UTM
Room : E07 – 04.02.14
Ext : 57073
Email : khairull@utm.my

Assistant Registrar

Enna Fasihah binti Fadilah
Bachelor of Business Administration (BBA), UiTM
Room : E07 – 04.03.12
Ext : 57063
Email : ennafasihah@utm.my

Supporting Staff

Administrative Assistant (Clerical/Operation) N22
Kamaruddin bin Mat Taib
Ext : 57035
Email : kamaruddin@fkm.utm.my

Mohd. Sharif bin Majid
Ext : 57074
Email : mosma@mail.fkm.utm.my

Rosli bin Bohani
Ext : 57068
Email : roslibohani@mail.fkm.utm.my

Halizah binti A. Rahaman
Ext : 57067
Email : halizah@mail.fkm.utm.my

Norhayati binti Abu Ruddin
Ext : 57040
Emai : yatia.r@utm.my

Dean's Special Assistant/Office Secretary N30

Nor'aizan binti Mohd. Yasin
Ext : 34611
Email : aizan@mail.fkm.utm.my

Norah binti Mohamad
Ext : 57049
Email : norah@mail.fkm.utm.my

Office Secretary N29

Mariaty binti Mansor
Ext : 57050
Email : mariaty@mail.fkm.utm.my

Rahimah binti Mazlan
Ext : 57053
Email : rahimah@mail.fkm.utm.my

Sri Dewi Murni binti Sujud
Ext : 57045
Email : dewi@mail.fkm.utm.my

Sahana binti Nasiff @ Musa
Ext : 57046
Email : sahana@mail.fkm.utm.my

Administrative Assistant (Clerical/Operation) N19

Che Ernie Nor Atikah binti Che Zainal Abidin
Ext : 57057
Email : ernie@mail.fkm.utm.my

Hayati binti Mukamar
Ext : 57033
Email : mhayati@mail.fkm.utm.my

Lokman Hakeem bin Hashim
Ext : 57058
Email : lokman@mail.fkm.utm.my

Maimanah binti Ibrahim
Ext : 57066
Email : mai@mail.fkm.utm.my

Norafidah binti Mohd. Mohedin
Ext : 57041
Email : norafida@mail.fkm.utm.my

Nurul Aida binti Junaidi
Ext : 57071
Email : aida@mail.fkm.utm.my

Nur Juniza binti Kusnin
Ext : 57059
Email : juniza@mail.fkm.utm.my

Nurulhasanah binti Ismail
Ext : 57039
Email : nurulhasanah@mail.fkm.utm.my

Razlan Syah bin Yussoff
Ext : 57070
Email : razlan@mail.fkm.utm.my

Sabirah binti Sarpan
Ext : 57058
Email : sabirah@mail.fkm.utm.my

Siti Norayuni binti Misman
Ext : 57064
Email : norayuni@mail.fkm.utm.my

Siti Nurarbaiyah binti Mohamad
Ext : 57056
Email : nurarbaiyah@mail.fkm.utm.my

Suhaiza binti Yaacob
Ext : 57065
Email : suhaiza@mail.fkm.utm.my

General Assistant Office N11

Abd. Malek bin Sulieman
Ext : 57066
Email : amalek@mail.fkm.utm.my

Muhammad Nursyarifuddin bin A.Wahid
Ext : 57047
Email : mnusyarifuddin@mail.fkm.utm.my

Mohd. Yunos bin Hj. Mohd. Yusof
Ext : 57066
Email : myunus@mail.fkm.utm.my

Assistant Engineer J29

Mohd Faisz bin Yang Ahmad
Ext : 34782
Email : faisz@mail.fkm.utm.my

Audio Visual Room

Assistant Engineer J29

Adam bin Md. Tap
Ext : 34616
Email :
adam@mail.fkm.utm.my

General Assistant Office N11

Zam Zam bin Wahid
Ext : 34616
Email : zamzam@mail.fkm.utm.my

Resource Centre (Mini Library)

Library Assistant S22

Azami bin Adam
Ext : 34710
Email : azamiadam@utm.my

General Assistant Office N11
Zaiful bin Basri
Ext : 34710
Email : zaifulbasri@utm.my

TECHNICAL STAFF

COMPUTER LABORATORY

1.	Md. Fabilah bin Mat Isa	- Asst. Vocational Training Officer DV36
2.	Rafidah bt Mohamad	- Asst. Information Technology Officer F29
3.	Mohd. Shah bin Sahri	- Asst. Engineer J29
4.	Halimah binti A. Razak	- Asst. Engineer J29
5.	Mohamed Hafis bin Samsualdin	- Asst. Engineer J29
6.	Mohd. Khairul Afnan bin Kasim	- Asst. Engineer J29
7.	Mohd. Idzham Iqbal bin Abd. Rani	- Asst. Engineer J29
8.	Azmi bin Mat Zin	- Office Assistant N11

TEACHING LABORATORIES

Laboratory Manager's Office

1.	PM Dr. Mohamed Ruslan bin Abdullah	- Laboratory Manager/Assoc. Prof
2.	Mohamed A'tif bin Mohamed Roznan	- Engineer J41
3.	Khairulnisan bin Azmi	- Assistant Engineer J29
4.	Ruzita binti Mohamed Salleh	- Admin. Asst. (Clerical/Operation) N22
5.	Ahmad Faizal bin Harun	- Asst. Engineer J29
6.	Mohd. Faisz bin Yang Ahmad	- Asst. Engineer J29
7.	Haizelfitri bin Mahat	- Office Assistant N11

Thermodynamics Laboratory

1.	Suhaimi bin Ishak	- Asst. Engineer J29
2.	Mohamad Hanafi bin Long	- Asst. Engineer J29
3.	Abdul Halim bin Abdul Rahman	- Asst. Engineer J29

Combustion Laboratory

1.	Suhaimi bin Ishak	- Asst. Engineer J29
2.	Rossli bin Ismail	- Asst. Engineer J29
3.	Darulhilmi bin Darsani	- Asst. Engineer J29

Fluid Laboratory

1.	Sahlan bin Sadiron	- Asst. Engineer J29
2.	Nuruljannah bt Alias	- Asst. Engineer J29

Mechanics of Machine Laboratory

1.	Mohd Azri bin Abd Samian	- Asst. Engineer J29

Mechanics of Materials & Structures Laboratory

1.	Fadli Shah bin Abd. Kadir	- Asst. Engineer J29
2.	Mior Ramli bin Mior Sarip	- Asst. Engineer J29
3.	Mohd. Zakaria bin Awang	- Asst. Engineer J29
4.	Mohd. Hidir bin Hashim	- Asst. Operational N11

Systems & Control Laboratory

1.	Abd. Rahim bin Mohamad	- Asst. Engineer J29
2.	Ahmad Faizal bin Harun	- Asst. Engineer J29

Design Studio (Studio Room)

1.	Suriati binti Kasim	- Asst. Engineer J29

Electrical Laboratory

1.	Abd. Rahim bin Mohamad	- Asst. Engineer J29

Experimental Techniques Laboratory

1.	Hamidah binti Hasan	- Asst. Engineer J29

Fabrication & Design Laboratory

1.	Mohd. Iskandar bin Jema'in	- Asst. Engineer J29
2.	Mohd Zarieth Hafiz bin Mat Hussain	- Asst. Engineer J29

Foundary Laboratory

1.	Abd. Saleem bin H. Kunyoo	- Asst. Engineer J29
2.	Wan Mohd. Mazian bin Wan Abdullah	- Asst. Engineer J29

Machine Shop Laboratory

1. Mohamad Syawal Fitri bin Jamalludin - Asst. Vocational Training Officer DV19
2. Abd. Rased bin Majid - Asst. Engineer J29
3. Norzaidatul Akmal bt Mat Yasin - Asst. Vocational Training Officer DV29
4. Mohd. Salim bin Salleh - Asst. Operational N11

Metal Forming Laboratory

1. Syahrizam bin Abdul Rahman - Asst. Engineer J29
2. Mohd. Zuwairi bin Abdul Rahman - Asst. Operational N11

Industrial Engineering Laboratory

1. Khalid bin Sukhairi - Asst. Engineer J29
2. Zakaria bin Abd. Talip - Asst. Operational N11

Vibration & Noise Laboratory

1. Elfandy bin Jamaludin - Asst. Engineer J29
2. Mohd. Nurfairuz bin Azman - Asst. Engineer J29
3. Mior Ramli bin Mior Sarip - Asst. Engineer J29

Metrology Laboratory

1. Khalid bin Sukhairi - Asst. Engineer J29

Central Store

1. Mohd. Shukri bin Ramli - Asst. Engineer J29
2. Kunumon bin Rayin Kutty - Asst. Operational N11

Composite Laboratory

1. Mohd. Zuwairi bin Abdul Rahman - Asst. Operational N11

LABORATORIES OF EXCELLENCE

Aeronautical Laboratory

1. Ir. Dr. Wan Khairuddin bin Wan Ali - Head of Laboratory/Professor
2. Abd. Basid bin Abd. Rahman - Engineer J44
3. Johari bin Haron - Asst. Engineer J29
4. Zurueng bin Ajim - Asst. Engineer J29
5. Abd. Khalid bin Lipot - Asst. Engineer J29
6. Mohd. Mahathir bin Mohmad - Asst. Engineer J29
7. Sallahuddin bin Jema'in - Asst. Engineer J29
8. Mohd. Akmal Hisyam bin Mohamad - Asst. Engineer J29

Production Laboratory

1. Khidzir bin Zakaria - Head of Laboratory/Lecturer
2. Sukari bin Mamat - Asst. Vocational Training Officer DV30
3. Siti Norasikin bt Sharip - Asst. Vocational Training Officer DV29
4. Mohd Khalaaf bin Mohd Kamal - Asst. Engineer DV21
5. Azizi bin Safar - Asst. Engineer J29
6. Mohamed Ali bin Duki - Asst. Engineer J29
7. Roslin bin Yasak - Asst. Vocational Training Officer DV22
8. Roslan @ Iskandar bin Ismail - Asst. Vocational Training Officer DV22
9. Siti Norbiha bt A. Aziz - Asst. Vocational Training Officer DV29

Material Science Laboratory

1.	Dr. Norhayati Ahmad	- Head of Laboratory/Senior Lecturer
2.	Ayub bin Abu	- Asst. Engineer J29
3.	Jefri bin Samin	- Asst. Engineer J29
4.	Faezah binti Zianalabiden	- Asst. Engineer J29
5.	Adnan bin Ali	- Asst. Engineer J29
6.	Siti Farahwahida bt Md. Nor	- Asst. Engineer J29
7.	Nor Hafizan bin Hussin	- Asst. Operational N11

Automotive Laboratory

1.	Dr. Zul Hilmi bin Che Daud	- Head of Laboratory/Senior Lecturer
2.	Shamsuri bin Ehsan	- Asst. Engineer J29
3.	Mohamed Reduan bin S.M. Samsudin	- Asst. Engineer J29
4.	Muhammad Abdul Sadid bin Sidik	- Asst. Engineer J29
5.	Husaini bin Mohamad Maskak	- Asst. Engineer J29
6.	Suhaiman bin Tumean	- Asst. Operational N11

CENTRES OF

EXCELLENCE Institute of

Vibration & Noise

1.	Ir. Dr. Mohd. Salman Leong	- Director/Professor
2.	Mohammad Ali bin Hussin	- Asst. Operational N11
3.	Mohd Hafizzi bin Md Idris	- Research Officer Q41
4.	Mohd. Fakhrurrazi bin Kamarulzaman	- Asst. Operational N11
5.	Noraliza binti Omar	- Asst. Engineer J29
6.	Siti Rohana bt Mustaffa	- Admin. Asst. (Clerical Operation) N19

ACKNOWLEDGEMENT

THE FACULTY'S ADMINISTRATION WOULD LIKE
TO THANK ALLTHOSE INVOLVED IN THEPUBLICATION OF THIS
FACULTY OF MECHANICAL ENGINEERING
UNDERGRADUATE HANDBOOK 2017/2018

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COMMITTEE MEMBERS

- Dr. Foo Jin Hoe (Chairperson)
- Assoc. Prof. Dr. Nazri bin Kamsah
- Dr. Nik Ahmad Ridhwan bin Nik Mohd
- Dr. Siow Chee Loon
- Dr. Jafri bin Mohd. Rohani
- Dr. Norhayati binti Ahmad
- Dr. Mohd. Azman bin Abas
- Dr. Shaharil bin Mad Saad
- Mr.. Khairull Azmi bin Ishak (Deputy Registrar)
- Ms. Enna Fasihah bin Fadilah (Assistant Registrar)
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- Mr.. Razlan Syah bin Yusoff (Secretariat)
- Mrs. Rahimah binti Mazlan (Secretariat)
- Mrs. Norafidah binti Mohedin (Secretariat)