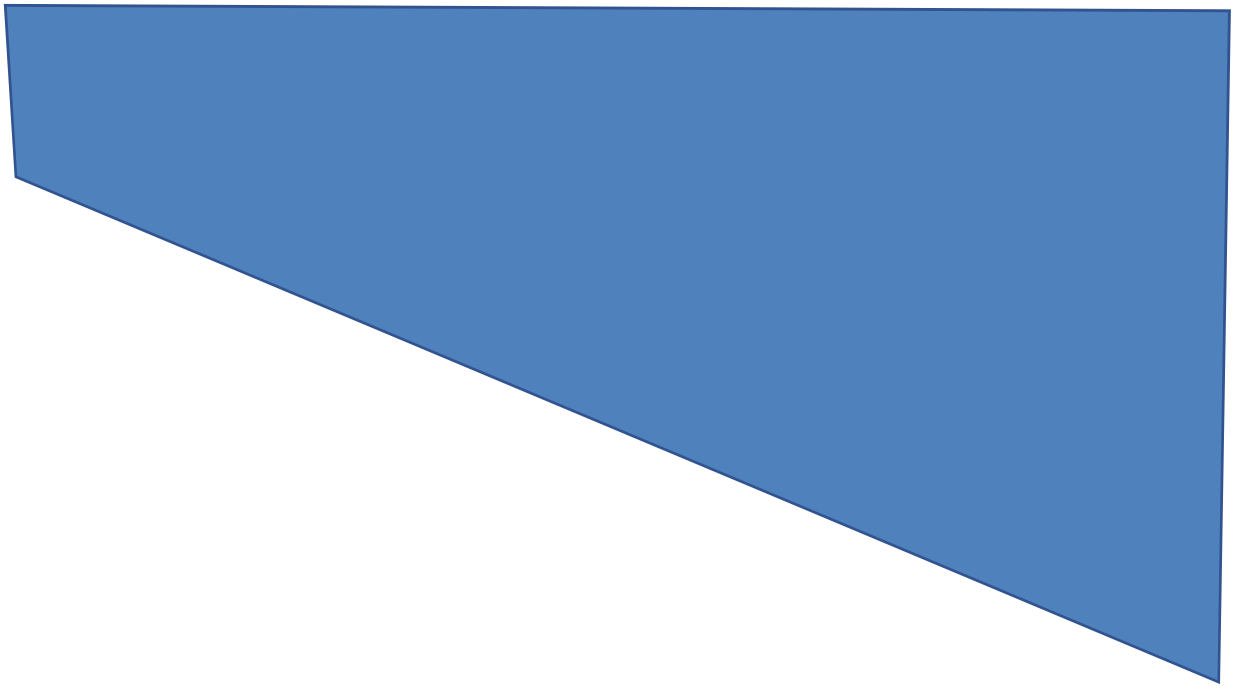
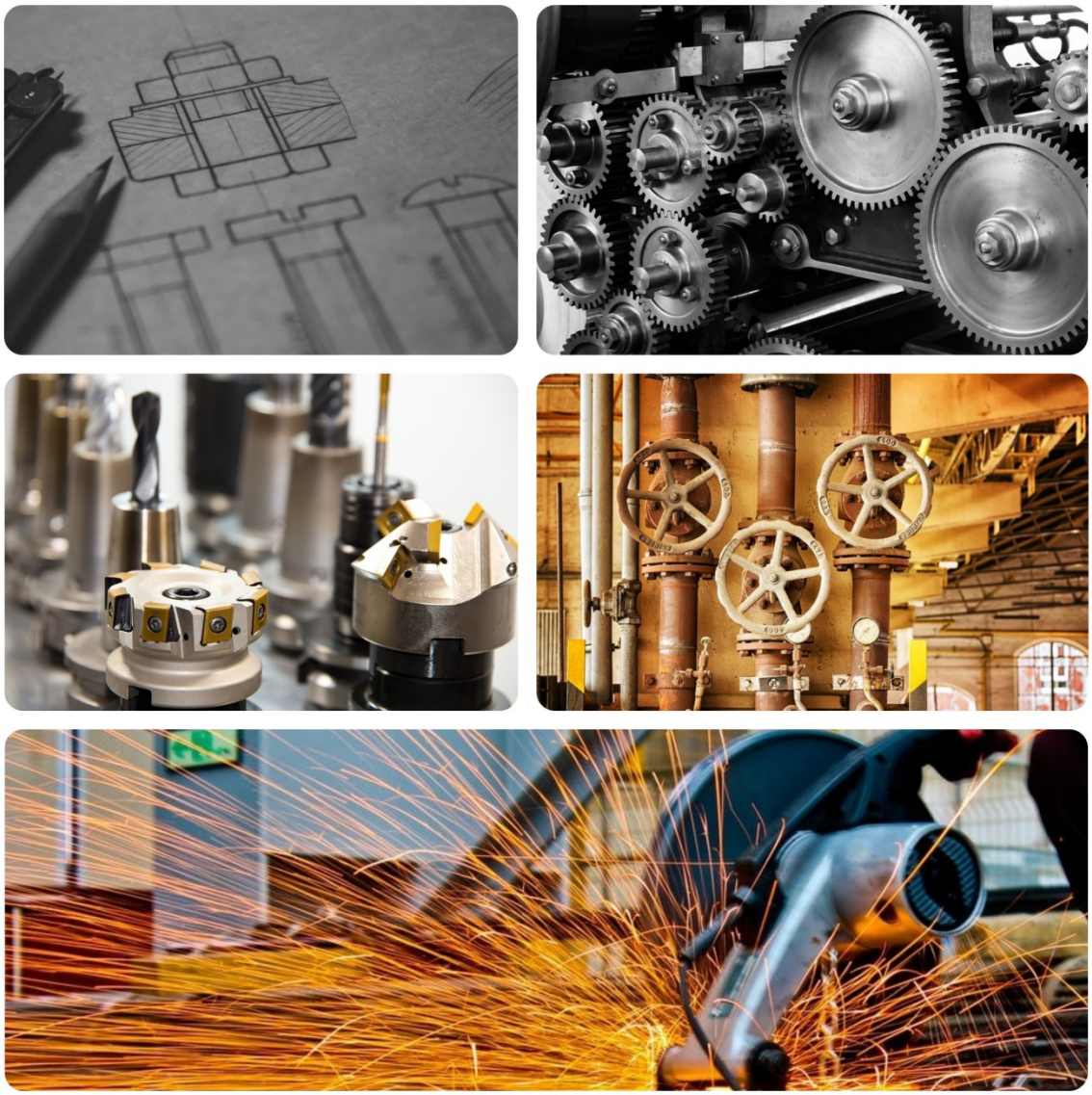


School of Mechanical Engineering (SME)

Faculty of Engineering



Bachelor Of Engineering (Mechanical)

ADMINISTRATION TEAM

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

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

BACHELOR OF ENGINEERING (MECHANICAL)
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)**	

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

(a) Technical Knowledge and Competencies

Intended Learning Outcomes	Teaching and Learning Methods	Assessment
PLO1		
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.
PLO2		
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.
PLO3		

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.
PLO4		
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**
PLO5		
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.
PLO6		

Apply professional engineering practice and solutions to complex mechanical engineering problems related to societal, health, safety, legal and cultural issues with full responsibility and integrity; Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PLO7		
Evaluate the sustainability and impact of professional engineering work in the solutions of complex mechanical engineering problems in societal and environmental contexts; Keywords: **Environment and Sustainability**	Tutorials, laboratory works, group assignments and projects, final year project presentations and problem-based learning.	Group reports, learning logs/diaries and oral presentations.
PLO8		
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.
PLO9		
Communicate effectively on complex mechanical engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PLO10		

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.
PLO11		
Undertake lifelong learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PLO12		
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.	School Core Courses	78	55.7
ii.	Programme Core Courses	27	19.3
iii.	Elective Courses	12	8.6
iv.	University courses	23	16.4

	Total	**140**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	83.6
	Total credit hours for Part A	**117**	
B	Non-Engineering	23	16.4
	Total credit hours for Part B	**23**	
	Total credit hours for Part A and B	**140**	**100**
15.	**Total Credit Hours to Graduate**	**140**	

AREAS OF STUDY

Mechanical Engineering programme makes up the core of the engineering studies in the School 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.

Award Requirements

To graduate, students must:

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

Entry Requirements

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

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

   University General Requirements:

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

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

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

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

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

Programme Specific Requirements

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

a) Mathematics T / Further Mathematics

b) Physics or Chemistry

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

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

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

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

General University Requirements

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

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

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

Programme Specific Requirements

i. Obtained a **CGPA of 2.80**; and Passed with a **Grade B- (2.67)**

in two (2) of the following subjects:

a) Mathematics / Engineering Mathematics

b) Physics / Engineering Physics or Chemistry / Engineering Chemistry

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

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

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

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

General University Requirements

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

or

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

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

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

or

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

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

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

Bahasa Melayu/Bahasa Malaysia, July Paper.

Programme Specific Requirements

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

or

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

or

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

or

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

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

or

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

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

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

Note:

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

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

Programme Educational Objectives (PEO)

After having exposed to 3 to 5 years working experience, our graduates should become professionals who demonstrate the following competencies:

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

Programme Learning Outcomes (PLOs)

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

Code	Intended Learning Outcomes
PLO1	Acquire and apply fundamental knowledge of mathematics, science and engineering principles to solve complex mechanical engineering problems; Keywords: **Engineering Knowledge**
PLO2	Identify, formulate and analyse complex mechanical engineering problems; Keywords***:*** **Problem Analysis**

PLO3	Design solutions for complex mechanical engineering problems that fulfil health, safety, societal, cultural and environmental needs; Keywords: **Design/Development of solutions**
PLO4	Investigate complex mechanical engineering problems using research-based knowledge and methods to produce conclusive results; Keywords: **Investigation**
PLO5	Use modern engineering and information technology (IT) tools in complex mechanical and engineering activities, with an understanding of the limitations; Keywords: **Modern Tools Usage**
PLO6	Apply professional engineering practice and solutions to complex mechanical engineering problems related to societal, health, safety, legal and cultural issues with full responsibility and integrity Keywords: **The Engineer and Society**
PLO7	Evaluate the sustainability and impact of professional engineering work in the solutions of complex mechanical engineering problems in societal and environmental contexts Keywords: **Environment & Sustainability**
PLO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. Keywords: **Ethics**
PLO9	Work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**
PLO10	Work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**
PLO11	Undertake lifelong learning and manage information including conducting literature study; Keywords: **Life Long Learning**

PLO12	Demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill ; Keywords: **Project Management, Finance & Entrepreneurship**

PROFESSIONAL SKILLS CERTIFICATE (PSC)

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

1. How to Get Yourself Employed (HTGYE)
2. ISO 9001: 2008 Quality Management System Requirement (ISO)
3. Occupational Safety and Health Awareness (OSHA)
4. How to Manage Your Personal Finance (HTMYPF)
5. Test of English Communication Skills for Graduating Students (TECS):
   (i) TECS 1001 (Paper I – Oral Interaction)
   (ii) TECS 1002 (Paper II - Writing)

MOBILITY PROGRAMME (OUTBOUND)

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

1. Study Abroad / Student Exchange

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

2. Research Internship Abroad

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

3. Global Outreach Programme (GOP)

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

4. International Invitation Programme

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

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

5. Summer School Abroad

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

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

COURSE MENU

YEAR 1: SEMESTER 1						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	0	0	3	
SEMM 1203	Statics*	3	1	0	3	
SEMM 1503	Engineering Drawing	2	0	3	3	
SEMM 1911	Experimental Methods	1	0	0	1	
SEMM 1921	Introduction to Mechanical Engineering	1	0	0	1	
SSCE 1693	Engineering Mathematics I	3	1	0	3	
UHLB 1112	English Communication Skills	3	0	0	2	
UHIS 1012	Islamic and Asian Civilization (Local student)	2	0	0	2	
UHMS 1022	Malaysian Studies 3 (International Student)	2	0	0	2	
		Total			**18**	

YEAR 1 : SEMESTER 2						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 1113	Mechanics of Solids I*	3	1	0	3	SEMM 1203
SEMM 1213	Dynamics*	3	1	0	3	SEMM 1203
SEMM 1513	Introduction to Design	2	0	3	3	SEMM 1503
SEEU 1002	Electrical Technology	2	1	0	2	

SSCE 1793	Differential Equations	3	1	0	3	SSCE 1693
UHMT 1012	Graduate Success Attributes	2	0	0	2	
UHMS 1172	Malaysian Dynamics (Local Student)	2	0	0	2	
UHLM 1012	Malay Language For Communication 2 (International Student)	2	0	0	2	
		Total			**18**	

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

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

YEAR 2 : SEMESTER 1

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMM 2123	Mechanics of Solids II*	3	1	0	3	SEMM 1113
SEMM 2223	Mechanics of Machines & Vibration*	3	1	0	3	SEMM 1213
SEMM 2313	Mechanics of Fluids I*	3	1	0	3	SEMM 1203, SEMM 1013**
SEMM 2413	Thermodynamics*	3	1	0	3	
SEMM 2921	Laboratory I	0	0	2	1	SEMM 1911
UHLB 2122	Academic Communication Skills	3	0	0	2	UHLB 1112
UHIT 2302	Thinking of Science and Technology	2	0	0	2	
		Total			**17**	

YEAR 2 : SEMESTER 2

CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMM 2323	Mechanics of Fluids II*	3	1	0	3	SEMM 2313
SEMM 2423	Applied Thermodynamics*	3	1	0	3	SEMM 2413
SEMM 2613	Materials Science	3	1	0	3	
SEEU 2012	Electronics	2	0	0	2	SEEU 1002
SSCE 1993	Engineering Mathematics II	3	1	0	3	SSCE 1693
UKQF 2xx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			**16**	

Subject to changes
* Core Courses – minimum passing grade is C (50%)

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

YEAR 3 : SEMESTER 1						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 2713	Manufacturing Processes	3	1	0	3	
SEMM 3023	Applied Numerical Methods	3	0	0	3	SEMM 1013, SSCE 1793
SEMM 3233	Control Engineering	3	0	0	3	SEMM 1213**, SSCE 1793**
SEMM 3242	Instrumentation	1	0	3	2	SEEU 2012**
SEMM 3931	Laboratory II	0	0	2	1	SEMM 2921
SSCE 2193	Engineering Statistics	3	1	0	3	
UBSS 1032	Introduction to Entrepreneurship	2	0	0	2	

		Total	**17**	

YEAR 3 : SEMESTER 2						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 3033	Finite Element Methods	3	0	0	3	SEMM 1113**
SEMM 3253	Mechatronics	2	0	3	3	SEMM 1013**, SEEU 2012**
SEMM 3443	Heat Transfer	3	0	0	3	SEMM 2413**, SSCE 1793**
SEMM 3523	Component Design	2	0	3	3	SEMM 2123**, SEMM 1513
SEMM 3813	Industrial Engineering	3	0	0	3	
SEMM 3941	Laboratory III	0	0	3	1	SEMM 3931
UHLB 3132	Professional Communication Skills	3	0	2	2	UHLB 1122, UHLB 2122
		Total			**18**	

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

Subject to changes
* Core Courses – minimum passing grade is C (50%)

Obtained minimum of 80 credits

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

YEAR 4 : SEMESTER 1						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 3823	Engineering Management, Safety and Economics	3	0	0	3	
SEMM 4533	System Design	2	0	3	3	SEMM 3523
SEMM 4912	Undergraduate Project I	0	0	6	2	SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2423**
SEMX 4xx3	Elective I	3	0	0	3	
SEMX 4xx3	Elective II	3	0	0	3	
UxxX 2xx2	Generic Skills or Knowledge Expansion Cluster Elective	2	0	0	2	
		Total			**16**	

YEAR 4 : SEMESTER 2						
CODE	**COURSE**	**L**	**T**	**P/S**	**CREDIT**	**PRE-REQUISITE**
SEMM 4902	Engineering Professional Practice	1	0	3	2	
SEMM 4924	Undergraduate Project II	0	0	12	4	SEMM 4912
SEMX 4xx3	Elective III	3	0	0	3	
SEMX 4xx3	Elective IV	3	0	0	3	

UHLX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQT 3001	Extra Curricular Experiential Learning	0	0	3	1	Completed three extracurricular experience programmes
		Total			**15**	

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

Subject to changes
* Core Courses – minimum passing grade is C (50%)
# University general course for international student only

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

LIST OF COURSES FOR SEMM PROGRAMME

Areas	Code	Courses	Credit
SCHOOL CORE COURSES Total Credit = 78	SEMM 1013	Programming for Engineers	3
	SEMM 1113	Mechanics of Solids I	3
	SEMM 1203	Statics	3
	SEMM 1213	Dynamics	3
	SEMM 1503	Engineering Drawing	3
	SEMM 1513	Introduction to Design	3
	SEMM 1911	Experimental Methods	1
	SEMM 1921	Introduction to Mechanical Eng.	1
	SEMM 2123	Mechanics of Solids II	3
	SEMM 2223	Mechanics of Machines & Vibration	3

	SEMM 2313	Mechanics of Fluids I	3
	SEMM 2323	Mechanics of Fluids II	3
	SEMM 2413	Thermodynamics	3
	SEMM 2423	Applied Thermodynamics	3
	SEMM 2613	Materials Science	3
	SEMM 2713	Manufacturing Processes	3
	SEMM 2921	Laboratory I	1
	SEMM 3023	Applied Numerical Methods	3
	SEMM 3233	Control Engineering	3
	SEMM 3242	Instrumentation	2
	SEMM 3523	Components Design	3
	SEMM 3823	Engineering Management, Safety and Finance	3
	SEMM 3931	Laboratory II	1
	SEMM 4902	Engineering Professional Practice	2
	SEEU 1002	Electrical Technology	2
	SEEU 2012	Electronics	2
	SSCE 1693	Engineering Mathematics I	3
	SSCE 1793	Differential Equations	3
	SSCE 1993	Engineering Mathematics II	3
	SSCE 2193	Engineering Statistics	3
	SEMM 3033	Finite Element Methods	3

PROGRAMME CORE COURSES **Total Credit = 27**	SEMM 3253	Mechatronics	3
	SEMM 3443	Heat Transfer	3
	SEMM 3813	Industrial Engineering	3
	SEMM 3915	Industrial Training	5
	SEMM 3941	Laboratory III	1
	SEMM 4533	System Design	3
	SEMM 4912	Undergraduate Project I	2
	SEMM 4924	Undergraduate Project II	4
UNIVERSITY COURSES **Total Credit = 23**	UHLB 1122	Academic English Skills	2
	UHLB 2122	Advanced Academic English Skills	2
	UHLB 3162	English for Professional Purposes	2
	UHLB 1112	Language Skills Elective (Foreign Language)	2
	UHMT 1012	Graduate Success Attributes	2
	UBSS 1032	Introduction to Entrepreneurship	2
	UHIT 2302	Thinking of Science and Technology	2
	UHIS 1012/ UHMS 1022	Islamic and Asian Civilization (Local Student)/ Malaysian Studies 3(International Student) #	2
	UHMS 1172/ UHLM 1012	Malaysian Dynamics (Local Student)/ Malay Language for Communication 2 (International Student)#	2
	UxxX 2xx2	Generic Skills or Knowledge Expansion Cluster Elective	2
	UKQT 3001	Extra Curricular Experiential Learning	1

	UKQF 2xx2	Co-curriculum and Service Learning Elective	2

ELECTIVE COURSES

Areas	Code	Elective Courses
Area 1: Mechanical Engineering	SEMM 4113	Plasticity & Application
	SEMM 4123	Structural Analysis
	SEMM 4133	Failure of Engineering Components & Structures
	SEMM 4143	Mechanics of Composite Materials
	SEMM 4153	Applied Stress Analysis
	SEMM 4163	Surface Mount Technology
	SEMM 4213	Mechanical Vibration
	SEMM 4233	Mechanisms & Linkage
	SEMM 4243	Advanced Control
	SEMM 4253	Industrial Automation
	SEMM 4273	Robotics
	SEMM 4293	Noise
	SEMM 4313	Turbo-Machinery
	SEMM 4323	Fluid Power
	SEMM 4333	Computational Fluid Dynamics

	SEMM 4343	Hydraulic Machine & Pipe System
	SEMM 4353	Lubrications
	SEMM 4413	Internal Combustion Engine
	SEMM 4423	Power Plant Engineering
	SEMM 4433	Refrigeration & Air Conditioning
	SEMM 4443	Thermal Fluid System Design
	SEMM 4453	Combustion
	SEMM 4463	Energy and Environment
	SEMM 4513	Computer Aided Design
Area 2: Materials	SEMM 4633	Materials Selection
	SEMB 4613	Materials Characterization
	SEMB 4623	Corrosion & Corrosion Control
	SEMB 4643	Non-Destructive Testing
	SEMB 4653	Surface Engineering
	SEMB 4663	Advanced and Functional Materials
	SEMB 4673	Materials Processing
	SEMB 4683	Nanomaterials
	SEMB 4693	Modeling in Materials Engineering
Area 3:	SEMP 3713	CAD/CAM
	SEMP 4013	Additive Manufacturing
	SEMP 4033	Sustainable Manufacturing

Manufacturing	SEMP 4753	Non-conventional Machining
	SEMP 4763	Quality Engineering and Metrology
	SEMP 4783	Casting Technology
	SEMP 4793	Product Design and Manufacture
Area 4: Industrial	SEMI 4813	Industrial System Simulation
	SEMI 4823	Operation Research
	SEMI 4843	Facilities Design
	SEMI 4853	Quality Engineering
	SEMI 4873	Reliability and Maintenance
	SEMI 4883	Supply Chain Management and Sustainability

dyna:Mech@UTM

dyna:Mech is an initiative by the School 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 School of Mechanical Engineering at UTM will stop at nothing to ensure its program is always the best in Malaysia to produce outstanding engineers in the country.

GRADUATION CHECKLIST

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

NO	COURSE CODE	COURSE NAME	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (/) IF PASSED
MECHANICAL ENGINEERING COURSES					
1	SEMM 1013	Programming for Engineers	3	3	
2	SEMM 1113	Mechanics of Solids I	3	3	
3	SEMM 1203	Statics	3	3	
4	SEMM 1213	Dynamics	3	3	
5	SEMM 1503	Engineering Drawing	3	3	
6	SEMM 1513	Introduction to Design	3	3	
7	SEMM 1911	Experimental Methods	1	1	
8	SEMM 1921	Introduction to Mechanical Engineering	1	1	
9	SEMM 2123	Mechanics of Solids II	3	3	
10	SEMM 2223	Mechanics of Machines & Vibration	3	3	
11	SEMM 2313	Mechanics of Fluids I	3	3	
12	SEMM 2323	Mechanics of Fluids II	3	3	

13	SEMM 2413	Thermodynamics	3	3	
14	SEMM 2423	Applied Thermodynamics	3	3	
15	SEMM 2613	Materials Science	3	3	
16	SEMM 2713	Manufacturing Processes	3	3	
17	SEMM 2921	Laboratory I	1	1	
18	SEMM 3023	Applied Numerical Methods	3	3	
19	SEMM 3033	Finite Element Methods	3	3	
20	SEMM 3233	Control Engineering	3	3	
21	SEMM 3242	Instrumentation	2	2	
22	SEMM 3253	Mechatronics	3	3	
23	SEMM 3443	Heat Transfer	3	3	
24	SEMM 3523	Component Design	3	3	
25	SEMM 3813	Industrial Engineering	3	3	
26	SEMM 3823	Engineering Management, Safety & Economics	3	3	
27	SEMM 3915	Industrial Training	5	HL	
28	SEMM 3931	Laboratory II	1	1	
29	SEMM 3941	Laboratory III	1	1	
30	SEMM 4533	System Design	3	3	
31	SEMM 4902	Engineering Professional Practice	2	2	
32	SEMM 4912	Undergraduate Project I	2	2	
33	SEMM 4924	Undergraduate Project II	4	4	
34	SEMX 4xx3	Elective I	3	3	
35	SEMX 4xx3	Elective II	3	3	
36	SEMX 4xx3	Elective III	3	3	
37	SEMX 4xx3	Elective IV	3	3	
TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (School of Electrical Engineering)					
1	SEEU 1002	Electrical Technology	2	2	
2	SEEU 2012	Electronics	2	2	

TOTAL CREDIT FOR ELECTRICAL COURSES (B)			**4**	**4**	
MATHEMATICS COURSES (Faculty of Science)					
1	SSCE 1693	Engineering Mathematics I	3	3	
2	SSCE 1793	Differential Equations	3	3	
3	SSCE 1993	Engineering Mathematics II	3	3	
4	SSCE 2193	Engineering Statistics	3	3	
TOTAL CREDIT FOR MATHEMATICS COURSES (C)			**12**	**12**	
UNIVERSITY GENERAL COURSES					
CLUSTER 1: APPRECIATION OF PHILOSOPHY, VALUE & HISTORY					
1	UHIS 1012	Islamic & Asian Civilization (for local students only)	2	2	
	UHMS 1022	Malaysian Studies 3 (for international students only)			
2	UHMS 1172	Malaysian Dynamics (for local students only)	2	2	
	UHLM 1012	Malay Language for Communication 2 (for international students only)			
CLUSTER 2: GENERIC SKILLS					
1	UHMT 1012	Graduate Success Attributes	2	2	
2	UHMT 2012	Leadership	2	2	
3.	UHMS 2022	Critical and Creative Thinking	2	2	
4.	UHMS 2032	The Human side of Knowledge Management	2	2	

5.	UHMS 2042	Development and Global Issues	2	2	
6.	UHMT 2042	Guidance & Counselling	2	2	
7.	UHMT 2062	Psychology of Adjustment	2	2	
8.	UBSS 2072	Fundamentals of Intellectual Property Law	2	2	
9.	UBSS 2082	Law for Entrepreneurs	2	2	
10.	UBSS 2092	Entrepreneuship and Enterprise Development	2	2	
11.	UBSS 2102	Social Entrepreneurship	2	2	
12.	UHMS 2112	Engineering Communication	2	2	
13.	UHMS 2122	Human Communication	2	2	
14.	UHMT 2132	Professional Ethics	2	2	
15.	UMJT 2142	Professional Ethics, Safety and Health (Ningen Ryoku)	2	2	
CLUSTER 3: KNOWLEDGE EXPANSION					
1.	UHIT 2302	Science and Technology Thinking	2	2	
2.	UHIT 1022	Science, Technology and Mankind	2	2	
3.	UHII 2012	Al-Qur'an and Human Civilization	2	2	
4.	UHIT 2032	Life Institutions and Sustainable Development	2	2	
5.	UHIZ 2042	Future Studies	2	2	
6.	UHIT 2052	Family Law	2	2	
7.	UHIZ 2062	World Scinece	2	2	
8.	UHIS 2072	Sustainable Economu	2	2	

9.	UHIS 2082	Practice and Concept of Halal Management	2	2	
10.	UHII 2092	Philosophy of Islamic Art	2	2	
11.	UHII 2102	Islam and Health	2	2	
12.	UHII 2132	Islamic Entrepreneurship	2	2	
13.	UETS 2142	Sustainable Energy	2	2	
CLUSTER 4: CO-CURRICULUM & SERVICE LEARNING					
1	UKQF 2xx2	Co-curriculum & Service Learning Elective	2	2	
2	UKQT 3001	Extra Curricular Experiential Learning	1	1	
CLUSTER 5: LANGUAGE SKILLS					
1	UHLB 1112	English Communication Skills	2	2	
2	UHLB 2122	Academic Communication Skills	2	2	
3	UHLB 3132	Professional Communication Skills	2	2	
4	UHLB 1032	Introductory Academic English	2	2	
5	UHLB 1042	Intermediate Academic English	2	2	
6	UHLA 1112	Arabic Language	2	2	
7	UHLJ 1112	Japanese Language 1	2	2	
8	UHLC 1112	Mandarin Language I	2	2	
9	UHLF 1112	French Language	2	2	
10	UHLN 1112	Persian Language	2	2	
11	UHLJ 1122	Japanese Language for Communication I	2	2	

12	UHLM 1112	Malay Language for Communication	2	2	
CLUSTER 6: ENTREPRENEURSHIP					
1	UBSS 1032	Introduction to Entrepreneurship	2	2	
TOTAL CREDIT FOR UNIVERSITY GENERAL COURSES (D)			**23**	**23**	
TOTAL CREDIT TO GRADUATE (A + B + C + D)			**140**	**135**	
Note: # Choose one elective either from Cluster 2 (Generic Skills) or Cluster 3 (Knowledge Expansion) for UxxX 2xx2					
OTHER COMPULSORY COURSES					
PROFESSIONAL SKILLS CERTIFICATE (PSC)					
1	GLL 1001	How To Get Yourself Employed			
2	GLL 1029	ISO 9001:2008 Quality Management System Requirement			
3	GLL 1040	Occupational Safety, Health and Environment			
4	GLL 1041	How to Manage Your Personal Finance			
5	Test of English Communication Skills (TECS)				
	TECS 1001	Oral Interaction			
	TECS 1002	Writing			

COURSE SYNOPSIS

CORE COURSES

SEMM 1013 Programming for Engineers

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

operations, data structures, plotting and model building.

SEMM 1113 Mechanics of Solids I

The course provides students with the knowledge to determine the strength and stiffness of engineering structures being used. The structures that will be used in this course are bars, pins, bolts, shafts and beams and the types of applied loadings are axial forces, deformations due to the change in temperature, torsional loads, transverse loads and combination of these loads. At the end of the course, students should be able to determine the mechanical properties of the materials with respect to their strength and stiffness. Students should be able to calculate stresses, strains and deformations in structures due to various types of loading conditions. In addition, they should be able to solve problems related to statically determinate and indeterminate structures.

SEMM 1203 Statics

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

SEMM 1213 Dynamics

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

SEMM 1503 Engineering Drawing

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

SEMM 1513 Introduction to Design

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

SEMM 1911 Experimental Methods

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

SEMM 1921 Introduction to Mechanical Engineering 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. This course introduces students to the field of mechanical engineering. It raises the student's awareness to the importance and necessity of developing habits of systematic analysis in solving engineering problems. It introduces the UTM graduate attributes and highlights the importance of both technical and generic skills to mechanical engineers. It also provides students

with a clear overview of different fields within mechanical engineering and a description of the mechanical engineer's work and professional responsibilities. It discusses the education requirements for today's mechanical engineers as well as exposes the students to the skills required for an engineering entrepreneur.

SEMM 2123 Mechanics of Solids II

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

SEMM 2223 Mechanics of Machines and Vibration

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

SEMM 2313 Mechanics of Fluids I

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

SEMM 2323 Mechanics of Fluids II

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

SEMM 2413 Thermodynamics

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

SEMM 2423 Applied Thermodynamics

The aim of this course is to teach second-year mechanical engineering students on the application of thermodynamics principles to evaluate the performance criteria of various thermal systems. These include the reciprocating air-compressor, internal combustion engines, vapour power plants, gas turbine plants and refrigeration systems. Also, principles of conservation of mass and energy are applied to various air-conditioning processes to assess the properties changes and energy transfer during the processes.

SEMM 2433 Applied Thermodynamics & Heat Transfer

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

SEMM 2613 Materials Science

This course introduces students to the fundamentals of materials science and engineering with emphasis on atomic bonding, crystal structures and defects in metals. It will introduce students to the various classes of materials including metals, ceramics, polymers and composites and their fundamental structures. The course

will also provide basic diffusion mechanisms, metal solidification phase diagrams and heat treatment processes. At the end of the course, students should be able to apply the knowledge of atomic bonding and crystal structures to predict the physical and mechanical behaviour of materials, and use the principles of phase diagrams and heat treatments to the design of materials and their properties.

SEMM 2713 Manufacturing Processes

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

SEMM 2921 Laboratory I

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

SEMM 3023 Applied Numerical Methods

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

SEMM 3033 Finite Element Methods

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

SEMM 3233 Control Engineering

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

SEMM 3242 Instrumentation

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

SEMM 3253 Mechatronics

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

SEMM 3443 Heat Transfer

In this course, conduction, convection and radiation, the three basic modes of heat transfer will be covered. Emphasis will be on developing a physical and analytical understanding of the three modes of heat transfer, as well as its applications. Students will develop an ability 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.

SEMM 3523 Components Design

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

SEMM 3622 Materials Technology
This course introduces students to the basic concepts required to understand and describe the mechanical behaviour and failure mechanism of metals. It will emphasise on the concept of stress intensity factor and fracture mechanics to predict failure of materials and provide understanding on conditions under which fatigue and creep occur. The course will also introduce students to the theory of electromechanical corrosion in metallic materials, 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.

SEMM 3623 Materials Engineering
This course is designed to introduce students to the concept of fracture mechanics and how engineering materials respond to mechanical loads. The failure behaviour of engineering materials will cover fracture, fatigue, creep, wear and corrosion. The course will also provide students with knowledge of how to conduct failure analysis and determine the root cause of failure under different mechanical loading. The mechanical behaviour of polymeric materials, ceramics and composites will also be covered as well examples of case studies of selecting engineering materials for specific product designs.

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

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

SEMM 3931 Laboratory II
This course is introduced in the third year of Mechanical Engineering programme involving two hours per week and experimental based courses. It consists of six laboratories; Strength of Materials Laboratory, Thermodynamics Laboratory, Materials Science Laboratory, Mechanics of Machines Laboratory, Electrical Laboratory and Fluids Laboratory. Students will be grouped into 5 to 6 for each experiment. It is based on the theory learned in the particular courses at the same semester. In general, every student 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.

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

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

SEMM 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.

SEMM 4902 Engineering Professional Practice
This course introduces students to engineering ethics and an engineer's responsibilities towards safety, health and welfare of the public. It emphasizes on the engineer as a professional man, engineers & society, code of ethics and professional conduct, standards, laws and regulations pertaining to professional engineering practice. The course will also introduce students to organize, in a group, a community service activities in a planned and structured manner. At the end of the course, students should be able to demonstrate and apply engineering professional ethics in their career as an engineer.

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

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

ELECTIVE COURSES

SEMM 4113 Plasticity and Applications
This course addresses the background of metal under plastic behavior and their possible generalizations under combined stresses. It aims to enhance the student's knowledge and understanding of the plastic behaviour of materials under various loading conditions particularly in 3D state of stresses. Plastic behavior due to variety hardening rules and their characteristics has been extended to comprehend the deformation of structures under loading and unloading states. The course also provides an opportunity to examine in-depth plastic bending and torsion behaviour of metal with hardening rules. For inclusion of safety design aspect, the yield and failure criteria analysis for evaluating plastic behavior has also been introduced. To enhance student's understanding on theory to practice aspect, plasticity analysis of beam and frame is included to fundamentally analyze a complicated structure. It also deals with the current technologies and analyses in various applications namely sheet metal forming, blanking, stamping, cup-drawing, indentation, stretching and drawing over a radius, wire drawing, extrusion and pultrusion processes. For practical purposes, students will be given chances to visit metal stamping industry via technical visit. Commercial finite element software will be introduced in this course to simulate any plasticity problems. At the end of the course, the student should be able to analyze and state the loading and unloading behavior of metal materials with the hardening rules. They should also be able to analyze the plastic bending and torsion, the stresses and strains in 3-D as well as apply the yield and failure criteria analysis for plastic applications. From engineer point of view, they should have a capability to present, differentiate and enlighten various processes using established technologies

SEMM 4123 Structural Analysis
This course builds upon the materials covered in Solid Mechanics I and II, to develop an understanding of structural behaviour. Matrix analysis methods are used as the basis for modern, computer-based structural analysis. Analytical techniques are used to analyze trusses, beams, frames, flat plates and curved shells.

SEMM 4133 Failure of Engineering Components and Structures
This course presents a systematic approach in performing failure analysis of engineering components and structures. It reviews basic engineering knowledge of the mechanics of materials, fracture mechanics and engineering materials for applications to failure analysis. Cases studies involving different types of failures including static overload, low and high cycle fatigue, creep and creep rupture, buckling of slender structures and fatigue crack growth are considered. Rationale and justification on the proposed causes of failure are critically discussed. Writing of failure analysis report is coached. (Optional) Computational approach (FE simulation) for relevant cases is introduced.

SEMM 4143 Mechanics of Composite Materials
This course introduces students to some major views and theories in the area of composite materials especially in the polymer based composite learning with emphasis on the types of materials, production methods, failure analysis and the mechanics of laminated composites. It will examine some key issues in the mechanics of laminated composites with special focus on the stress-strain relationship and interaction to the extensional, coupling and bending stiffness matrices in promoting learning. Sandwich structures and interlaminar fracture toughness will also be included in this syllabus. The course will also provide a visit to industries dealing with polymer based composite materials in order the students to understand more regarding the practical sides of the subject.

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

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

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

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

SEMM 4243 Advanced Control
The course shall cover the essential and basic theory of design and analysis of control system that are not covered by SKMM3233. It shall cover the followings: Cascade compensation using lead and lag compensator, non-linear system analysis, discrete system and state-space analysis. MATLAB and Simulink software package shall be taught and used as a tool in solving control engineering problems throughout the course.

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

SEMM 4273 Robotics
This course is designed to enable the students at undergraduate level to develop the necessary insight into the area of robotics. It will examine the fundamental elements of robot system related to anatomy and configuration, robot main components, programming feature and methods and robot's performance specifications. The students are expected to acquire analytical skills through the analyses of robot manipulators related to their kinematics, statics and dynamics which typically constitute the important prerequisites to designing the mechanical structure, planned trajectory path and control aspects. The robot control topic that is included in the later section provides a platform for the students to explore various control algorithms that address the stability, accuracy and robustness of the systems. Particular emphasis is laid on the mathematical modelling and simulation of the control schemes. A number of case studies pertaining to selected robotic systems are expected to further strengthen the students understanding and insight into the actual systems.

SEMM 4293 Noise
This course prepares the future engineers with the physical principles of noise together with the tools and analysis techniques for noise measurements. Students will be taught on the physics of sound, measurement instrumentations, analysis techniques, sound/noise inside room & enclosure, transmission of sound/noise through structure and outdoor sound/noise. Students will also be introduced and exposed to the typical noise measurement instrumentations available in the noise laboratory. International and domestic noise regulations are also highlighted. The project/s assigned to students during this course requires understanding on the basic principles of noise along with the use of noise measurement instrumentations and data analysis. At the end of this course, students should understand thoroughly all the underlying physical principles of noise and should be able to measure and analyse noise levels whenever required.

SEMM 4313 Turbo-Machinery
This course is designed to provide students a fairly broad treatment of the fluid mechanics of turbomachinery. Emphasis is placed on the more utilitarian equipment, such as compressors, blowers, fans, pumps and wind turbines that will be encountered by most mechanical engineers as they pursue careers in industry. The course covers the basic fundamentals of fluid mechanics needed to develop and manipulate the analytical and empirical relationships and concepts used in turbomachinery, analysis of flow through several fluid machines, selection of fluid machine type that best suited for a specified task and preliminary estimation of speed, size, and perhaps other performance characteristics. At the end of the course, students should be able to compare and chose fluid machines for various operations.

SEMM 4323 Fluid Power System
This course introduces the theory and practical aspects of hydraulic and pneumatic systems, and their related issues. Students will be exposed to the function and operation of each system components, all related symbols and construction of circuits. Students will be able to carry out calculations to determine the size of components and their performance. Basic knowledge from this course will be able to guide students in order to select appropriate components, design simple circuits, handle and maintain the actual system in industrial sectors. Safety aspect as well as act and regulations in relation to hydraulic and pneumatic systems are introduced to highlight and promote safe and healthy working conditions.

SEMM 4333 Computational Fluid Dynamics
This course introduces students to fundamentals and practical skills of Computational Fluid Dynamics (CFD). The governing equations of fluid flow and their mathematical classification are introduced. The course will also provide the basic concept of CFD and numerical procedures such as Finite Difference Method (FDM) and Finite Volume Method (FVM). Student are also exposed to practical issues associated with the implementation of the use of CFD codes, such as turbulence modeling, boundary conditions, and the importance of verification and validation. At the end of the course, students should be able to demonstrate and apply the theory to solve problem related to complex flow of fluids using open source and commercial CFD codes.

SEMM 4343 Hydraulics Machines and Pipes System
This course is designed to enhance the basic knowledge that has been developed in Mechanics of Fluids 1 through the understanding on the principle of open channel flow and its flowrates calculation. Basic elements of water flow in pipes which are applied to practical problems in pipelines and networks for steady, quasi-steady and unsteady flow are emphasized. Students will be exposed with the flow distribution analysis through the use of Hardy-Cross method, pressure wave analysis, water hammer analysis, pump operation and pipe system analysis. This course will also cover the analysis of various pump type such as centrifugal pump, axial pump and positive displacement pump. At the end of this course, students should be able to demonstrate an ability to analyse problems related directly to fluids in hydraulic machines and pipe systems.

SEMM 4353 Lubrication
The principle aim of this course is to provide students with an understanding of physical principles of the classic theory of hydrodynamic lubrication as a basis for bearing design; application to simple thrust and journal bearings and pads of various geometries; and hydrostatic lubrication. Students will be introduced to types of hydrodynamics bearings and bearing operation; properties of lubricant; theory of steady state hydrodynamic lubrication; hydrostatic and squeeze film lubrication applied to slider and journal bearings, bearing design with side leakage; and thermal balance.

SEMM 4413 Internal Combustion Engines
This course is intended to provide students an introduction, terminology, definition, and operating characteristics of internal combustion engines (ICE). It covers all topics needed for a basic engineering knowledge of the design, operation, analysis and performance of ICE. Principles of all types of ICE are covered including spark ignition (gasoline), compression ignition (diesel), four-stroke, and two-stroke engines. On top of that, students will be equipped with basic knowledge and understanding of engine heat transfer, frictions and lubrication. Moreover, an introduction on fuel-cell, hybrid and other alternative fuels are also covered.

SEMM 4423 Power Plant Engineering
The study of power plant technology is one of the important fields of engineering science. Power plant technology problems are of great importance in many branches of engineering such as mechanical, chemical, nuclear and electrical. In this course economizers, steam generators, fuel and combustion, gas turbines, combined cycles and environmental consideration will be covered in detail. The emphasis will be laid on both analytical techniques and physical understanding of the subjects.

SEMM 4433 Refrigeration and Air Conditioning
Refrigeration is the process of removing heat from an enclosed space, or from a substance, and moving it to a place where it is unobjectionable. The primary purpose of refrigeration is lowering the temperature of the enclosed space or substance and then maintaining that lower temperature. Probably the most widely-used current applications of refrigeration are for the air conditioning of private homes and public buildings, and the refrigeration of foodstuffs in homes, restaurants and large storage warehouses. The importance of refrigeration system and air conditioning system in domestic, commercial and industrial sectors, for both comfort and process applications, cannot be over emphasized. Advances in electronics, communications, computers,

medicine, etc. demand stringently controlled air conditions. Food refrigeration from small domestic refrigerators to large cold storages is important to avoid spoilage, thus prolonging its shelf life. Thus, refrigeration and air conditioning system play an important role in this modern world.

SEMM 4443 Thermal Fluid System Design
The course first reviews fundamentals of fluid mechanics, thermodynamics and heat transfer which are necessary basis for design of thermal fluid systems - heat exchanging devices. Cooling and heating components require fast and accurate design procedure towards effective and efficient systems considering global concerns towards our sustainable environment. The course provides a systematic approach in the basic principles, component identification and description, solution approach, modeling, and optimization (where applicable) of general macro-to-micro design of heat exchanging devices in the present and future applications. This is followed by the theory and design of specific heat exchangers. Heat exchangers are vital in power producing plants, process and chemical industries, and in heating, ventilating, air- conditioning, refrigeration systems, and cooling of electronic systems. This course provides a systematic approach to the understanding on the design, selection and analysis of heat exchangers with focus on the selections, thermo-hydraulic designs, design processes, ratings, and operational problems of various types of heat exchangers.

SEMM 4453 Combustion
Students will be exposed to the concepts and the basic combustion processes. Various aspects of combustion such as the thermodynamics of combustion, the chemical kinetics, transport phenomena, Rankine-Hugoniot theory, Chapman-Jouguet waves, deflagration, detonation, diffusion flames, premixed flames, flammability, ignition and quenching will be discussed. Chemical processes that lead to various emissions and pollutant formation as well as strategies for mitigation the pollutants produced from combustion process will be stressed at later part of this course. Students will also explore various practical aspects of combustion processes.

SEMM 4463 Energy and Environment
Energy is the basic input to build, operate and maintain all kinds of engineering infrastructures and services. Energy is also appeared as a major actor for contemporary local and global-level environmental and societal challenges. Engineers, as being the major stockholders of energy, should have sufficient knowledge on how to protect the environment in building-up and maintaining of infrastructure for operating various engineering production, operation and services. This course provides training to the students in perceiving environmental and societal consequences causing from handling of energy in infrastructures, products, and services. The course also gives lessons to the engineering students on how to protect the environment through the stat-of-the art practices such as energy efficiency, alternative energy, emission accounting, emerging technologies etc. The course focuses on issues that are multidisciplinary in nature, and therefore, the course is well suited to the students of all branch of mechanical, electrical, chemical, and environmental engineering. After successful completion of this course, students would be able to apply the acquired knowledge to work out environmental implications in dealing with energy related services, and play appropriate role to serve the environmental and societal interests by minimizing the negative impacts.

SEMM 4513 Computer Aided Design
This course is designed for students to gain knowledge on what is going on behind the screen of Computer Aided Design Software. This understanding makes the learning curve of new CAD software shorter as the students may be using other CAD software later when they work. Furthermore, the course will also expose the students on the capability of the programming within CAD software. With the programming knowledge, students will be able to model as well as using the programming to integrate engineering knowledge to CAD.