Bachelor of Engineering (Mechanical-Industrial)

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)

(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**
PO1		
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		
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		
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.

Intended Learning Outcomes	Teaching and Learning Methods	Assessment
PO4		
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.
PO5		
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.
(b) Generic Skills		
PO6		
Apply professional engineering practice and solutions to complex mechanical and industrial engineering problems related to societal, health, safety, legal and cultural issues with full responsibility and integrity Keywords: **The Engineer and Society**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO7		
Evaluate the sustainability and impact of professional engineering work in the solutions of complex mechanical and industrial 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.

Intended Learning Outcomes	Teaching and Learning Methods	Assessment
PO8		
Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice; Keywords: **Ethics**	Lectures, tutorials, seminars, group projects and industrial training.	Industrial training and group project reports.
PO9		
Communicate effectively on complex mechanical and industrial engineering activities both orally and in writing; Keywords: **Communication**	Seminars, assignments and final year projects.	Report and theses.
PO10		
Work productively as an individual, and as a member or leader in a team that may involve multi-disciplinary settings; Keywords: **Team Working**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO11		
Undertake lifelong learning and manage information including conducting literature study; Keywords: **Life Long Learning**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.
PO12		
Demonstrate and apply knowledge on finance and management principles and acquire entrepreneurship skill; Keywords: **Project Management, Finance & Entrepreneurship**	Lectures and project assignments.	Demonstrations, reports, tests, examinations and presentations.

14. Classification of Courses			
No.	**Classification**	**Credit Hours**	**Percentage**
i.	Programme Core	90	64.3
ii.	Programme Electives	27	19.3
iii.	Compulsory University Courses	23	16.4
Total		**140**	**100**
Classification of courses for engineering programme			
A	Engineering Courses	117	83.6
	Total credit hours for Part A	**117**	
B	Non-Engineering	23	16.4
	Total credit hours for Part B	**23**	
Total credit hours for Part A an B		**140**	**100**
15. Total Credit Hours to Graduate		**140**	

Award Requirements

To graduate, students must:

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

Entry Requirements

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

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

   University General Requirements:

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

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

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

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

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

   Programme Specific Requirements

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

      a) Mathematics T / Further Mathematics

      b) Physics or Chemistry

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

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

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

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

General University Requirements

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

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

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

Programme Specific Requirements

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

   a) Mathematics / Engineering Mathematics

   b) Physics / Engineering Physics or Chemistry / Engineering Chemistry

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

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

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

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

General University Requirements

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

or

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

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

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

or

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

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

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

Programme Specific Requirements

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

or

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

or

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

or

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

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

or

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

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

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

Note:

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

their applications.

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

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	3	3	
SEMM 1203	Statics*	3	1	0	3	
SEMM 1503	Engineering Drawing	1	0	6	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	
ULAB 1122	Academic English Skills	3	0	0	2	
UICI 1012/UHAK 1022	Islamic and Asian Civilisation/Malaysian Studies 3#	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	1	0	3	3	SEMM 1503
SKEU 1002	Electrical Technology	2	1	0	2	
SSCE 1793	Differential Equations	3	1	0	3	SSCE1693
UHAK 1012	Graduate Success Attributes	2	0	0	2	
UHAS 1172/ULAM 1012	Malaysian Dynamics/Malay Language for Communication 2#	2	0	0	2	
		Total			18	

YEAR 2: SEMESTER 1						
CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMM 2123	Mechanics of Solids II*	3	1	0	3	SEMM 1113
SEMM 2223	Mechanics of Machines and 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
ULAB 2122	Advanced Academic English Skills	3	0	0	2	ULAB 1122
UICL 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 2433	Applied Thermodynamics and Heat Transfer*	3	1	0	3	SEMM 2413
SEMM 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	

YEAR 3: SEMESTER 1						
CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMM 2713	Manufacturing Processes	3	1	0	3	
SEMM 3233	Control Engineering	3	0	0	3	SEMM 1213**, SSCE 1793**
SEMM 3931	Laboratory II	0	0	3	1	SEMM 2921
SEMI 3813	Work Design and Productivity	3	0	0	3	
SEMI 3823	Quality System	3	0	0	3	
UHAK 1032	Introduction to Entrepreneurship	2	0	0	2	
UKQX xxx2	Co-curriculum and Service Learning Elective	0	0	3	2	
		Total			17	

YEAR 3: SEMESTER 2						
CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMM 3023	Applied Numerical Methods	3	0	0	3	SEMM 1013, SSCE 1793
SEMM 3242	Instrumentation	1	0	3	2	SKEU 2012**
SEMM 3523	Component Design	2	0	3	3	SEMM 2123**,SEMM 1513
SEMM 3941	Laboratory III	0	0	3	1	SEMM 3931
SEMI 3833	Production Planning and Control	3	0	0	3	
SEMI 3843	Engineering Economy and Accounting	3	0	0	3	
ULAB 3162	English for Professional Purposes	3	0	2	2	ULAB 1122, ULAB 2122
		Total			17	

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

YEAR 4: SEMESTER 1						
CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMM 4533	System Design	2	0	3	3	SEMM 3523
SEMM 4912	Undergraduate Project I	0	0	6	2	SEMM 2123**, SEMM 2223**, SEMM 2323**, SEMM 2433**
SEMI 4813	Industrial System Simulation	3	0	0	3	
SEMI 4823	Operations Research	3	0	0	3	
SEMI 48x3	Industrial Engineering Elective	3	0	0	3	
UHAK 2xx2/ UICL 2XX2	Elective Cluster 2@3	2	0	0	2	
		Total			16	

YEAR 4: SEMESTER 2						
CODE	COURSE	L	T	P/S	CREDIT	PRE-REQUISITE
SEMM 4902	Engineering Professional Practice (Academic Service Learning)	1	0	3	2	Must be 3rd year
SEMM 4924	Undergraduate Project II	0	0	12	4	SEMM 4912
SEMI 4833	Safety and Engineering Management	3	0	0	3	
SEMI 4843	Facility Design	3	0	0	3	
ULAX 1112	Language Skills Elective (Foreign Language)	2	0	0	2	
UKQE 3001	Extra Curricula Experiential Learning	1	0	0	1	
		Total			15	

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 (semester 1) and UHAS 1172 (semester 2).
** Minimum grade D- (30%) in the pre-requisite courses
Obtained minimum of 80 credits

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

Elective Courses

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

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

GRADUATION CHECKLIST

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

NO	COURSE CODE	COURSE NAME	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (/) IF PASSED
MECHANICAL ENGINEERING COURSES					
1	SEMM 1013	Programming for Engineers	3	3	
2	SEMM 1113	Mechanics of Solids I	3	3	
3	SEMM 1203	Statics	3	3	
4	SEMM 1213	Dynamics	3	3	
5	SEMM 1503	Engineering Drawing	3	3	
6	SEMM 1513	Introduction to Design	3	3	
7	SEMM 1911	Experimental Methods	1	1	
8	SEMM 1921	Introduction to Mechanical Engineering	1	1	
9	SEMM 2123	Mechanics of Solids II	3	3	
10	SEMM 2223	Mechanics of Machines & Vibration	3	3	
11	SEMM 2313	Mechanics of Fluids I	3	3	
12	SEMM 2323	Mechanics of Fluids II	3	3	
13	SEMM 2413	Thermodynamics	3	3	
14	SEMM 2433	Applied Thermodynamics & Heat Transfer	3	3	
15	SEMM 2613	Materials Science	3	3	
16	SEMM 2713	Manufacturing Processes	3	3	
17	SEMM 2921	Laboratory I	1	1	
18	SEMM 3023	Applied Numerical Methods	3	3	
19	SEMM 3233	Control Engineering	3	3	
20	SEMM 3242	Instrumentation	2	2	
21	SEMM 3523	Component Design	3	3	
22	SEMM 3915	Industrial Training	5	HL	

23	SEMM 3931	Laboratory II	1	1	
24	SEMM 3941	Laboratory III	1	1	
25	SEMM 4533	System Design	3	3	
26	SEMM 4902	Engineering Professional Practice	2	2	
27	SEMM 4912	Undergraduate Project I	2	2	
28	SEMM 4924	Undergraduate Project II	4	4	
29	SEMI 3813	Work Design & Productivity	3	3	
30	SEMI 3823	Quality System	3	3	
31	SEMI 3833	Production Planning & Control	3	3	
32	SEMI 3843	Engineering Economy & Accounting	3	3	
33	SEMI 4813	Industrial System Simulation	3	3	
34	SEMI 4823	Operations Research	3	3	
35	SEMI 4833	Safety & Engineering Management	3	3	
36	SEMI 4843	Facility Design	3	3	
37	SEMI 4xx3	Industrial Engineering Elective	3	3	
		TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)	**101**	**96**	
ELECTRICAL COURSES (School of Electrical Engineering)					
1	SKEU 1002	Electrical Technology	2	2	
2	SKEU 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	UICI 1012	Islamic & Asian Civilization (for local students only)	2	2	
	UHAK 1022	Malaysian Studies 3 (for international students only)			
2	UHAS 1172	Malaysian Dynamics (for local students only)	2	2	
	ULAM 1012	Malay Language for Communication 2 (for international students only)			
CLUSTER 2: GENERIC SKILLS					
1	UHAK 1012	Graduate Success Attributes	2	2	
2	UHAK 2xx2	Generic Skills Elective#	2	2	
CLUSTER 3: KNOWLEDGE EXPANSION					
1	UICL 2302	Thinking of Science & Technology	2	2	
2	UICL 2xx2	Knowledge Expansion Elective#	2	2	
CLUSTER 4: CO-CURRICULUM & SERVICE LEARNING					
1	UKQX xxx2	Co-curriculum & Service Learning Elective	2	2	
2	UKQE 3001	Extra Curricular Experiential Learning	1	1	
CLUSTER 5: LANGUAGE SKILLS					
1	ULAB 1122	Academic English Skills	2	2	
2	ULAB 2122	Advanced Academic English Skills	2	2	
3	ULAB 3162	English for professional Purposes	2	2	

4	ULAX 1112	Language Skills Elective (Foreign Language)	2	2	
CLUSTER 6: ENTREPRENEURSHIP					
1	UHAK 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 either UHAK 2xx2 or UICL 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 FOR B. ENG (MECHANICAL - INDUSTRIAL)

CORE COURSES

SEMM 1013 Programming for Engineers

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

SEMM 1113 Mechanics of Solids I

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

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

SEMM 1203 Statics

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

SEMM 1213 Dynamics

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

SEMM 1503 Engineering Drawing

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

SEMM 1513 Introduction to Design

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

SEMM 1911 Experimental Methods

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

Based on the given experimental data, students are also expected to conduct statistical analysis of results and write the experimental outcome in a report.

SEMM 1921 Introduction to Mechanical Engineering

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

SEMM 2123 Mechanics of Solids II

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

SEMM 2223 Mechanics of Machines and Vibration

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

SEMM 2313 Mechanics of Fluids I

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

and similarities will be introduced. At the end of the course, the student should be able to demonstrate an ability to analyze whether statically, dynamically or kinematically problems related directly to fluids.

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

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

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

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

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

SEMM 2921 Laboratory I
This course is introduced in the second year of the Mechanical Engineering programme involving two hours per week session and experimental based courses. It consists of six laboratories; Strengths of Materials Laboratory, Materials Science Laboratory, Mechanics

of Machines Laboratory, Electrical Laboratory and Fluid Laboratory. Students will be grouped into 5 to 6 people for each experiment. It is based on the theory that have been learned in the particular courses at the same semester. In general, every student has to carry out a total of twelve experiments. At the end of the session, students have to submit a report for each experiment and will be evaluated based on this report.

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

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

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

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

SEMM 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 total, every student has to carry out twelve experiments. At the end of the session, students have to submit a

report for each experiment and will be evaluated based on this report.

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

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

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

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

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

SEMI 3813 Work Design and Productivity

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

SEMI 3823 Quality System
This course emphasizes on the importance of quality and productivity in industrial and operation systems. The principles of quality Improvement strategies and quality management systems such as Total Quality Management, Six Sigma, Lean Sigma, ISO 9000, ISO 14000 are highlighted. Statistical process control (SPC) techniques such as seven basic tools, variable and attribute control charts, process capability studies, acceptance sampling and reliability are covered. Students are required to work in groups to integrate the quality and statistical engineering tools in solving case studies problems.

SEMI 3833 Production Planning and Control
This course is designed to expose students to the several theories and principles in Production Planning and Control (PPC) either in manufacturing or service sectors. It discusses issues on forecasting, capacity and aggregate planning, scheduling, inventory control and also computerized manufacturing system such as Manufacturing Requirement Planning (MRP), Demand Requirement Planning (DRP) and Enterprise Resources Planning (ERP). Besides that, it also introduces basic lean concept as part of the latest issues in manufacturing system. At the end of the course, students should be able to apply 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.

SEMI 3843 Engineering Economy and Accounting
This course is designed to equip students to acquired engineering economy and accounting concepts, principles and methods. The focus of this course is to provide understanding on engineering economic principles and methods and to apply it in engineering field. The course has two parts. Part 1 is designed to teach students to formulate cash-flow, perform analysis on engineering economic problems and evaluate between alternative of engineering investment/projects to make decision. Part 2 is designed to teach students to perform cost estimates using traditional and current costing techniques in production process, prepare simple financial statement and interpret financial performance of business firms for decision and control.

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

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

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

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

ELECTIVE COURSES

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

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

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

optimisation and total productive maintenance.

SEMI 4883 Supply Chain Management and Sustainability

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