BACHELOR OF MECHANICAL ENGINEERING (AUTOMOTIVE) WITH HONOURS

PROGRAMME SPECIFICATION

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

The programme is offered on full-time basis and is based on a 2-Semester per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) to eighteen (18) credit hours per semester. Assessment is based on course works and final examinations given throughout the semester.

General Information

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

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses		
	(u) General	10	
	(v) Language	8	16.4%
	(w) Entrepreneurship	2	
	(x) Co-Curriculum	3	
ii.	Programme Core	96	68.6%
iii.	Programme Electives	21	15.0%
	Total	**140**	**100%**
Classification of courses for engineering programme			
A	Engineering Courses		
	(u) Lecture/Project/ Laboratory	94	
	(v) Workshop/Field/Design Studio	0	75%
	(w) Industrial Training	5	
	(x) Final Year Project	6	
	Total Credit Hours for Part A	**105**	
B	Non-Engineering		
	(u) Applied Science/Mathematic/Computer	12	
	(v) Management/Law/Humanities/Ethics/Economy	12	25%
	(w) Language	8	
	(x) Co-Curriculum	3	
	Total Credit Hours for Part B	**35**	
Total credit hours for Part A and B		**140**	**100%**

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 five (5) Professional Skills Certification (PCS) courses in UTM
- Other condition as specified.

AREAS OF STUDY

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

(a) Automotive Technology

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

(b) Vehicle Structure

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

(c) Vehicle Dynamic

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

(d) Vehicle Powertrain

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

(e) Automotive Electrical and Instrumentation System

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

(f) Automotive Production Technology

Automotive production covers the fundamental aspects of automotive production processes which emphasize on casting, forming and the challenging issues such as Quality Lean Manufacturing and Automation.

(g) Automotive Engineering Design

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

(h) Engine Turbocharging

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

turbocharger-engine matching to achieve better engine performances.

(i) Internal Combustion Engine

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

CAREER PROSPECTS

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

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

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

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

MOBILITY PROGRAMME (OUTBOUND)

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

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

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

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

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

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

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

COURSE MENU

YEAR 1 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1203	Statics*	3	
SEMM 1503	Engineering Drawing	3	
SEMM 1911	Experimental Methods	1	
SEMM 1921	Introduction to Mechanical Engineering	1	
SEEU1002	Electrical Technology	2	
SSCE 1693	Engineering Mathematics I	3	
UHLB 1112	English Communication Skills	2	
UHIS 1022	Philosophy and Current Issues (for Local Student Only)	2	
UHIS 1022 OR UHMS 1182	Philosophy and Current Issues OR Appreciation of Ethics and Civilisations (for International Students Only)		
	Total	**17**	

YEAR 1 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 1013	Programming for Engineers	3	
SEMM 1113	Mechanics of Solids I *	3	SEMM 1203
SEMM 1213	Dynamics*	3	SEMM 1203
SEMM 1513	Introduction to Design	3	SEMM 1503
SEEU 2012	Electronics	2	SEEU 1002
UHMT 1012	Graduate Success Attributes	2	
UHMS 1182	Appreciation of Ethics and Civilisations (for Local Students Only)	2	
UHLM 1012	Malay Language for Communication 2 (for International Students Only)	2	
	Total	**18**	

Subject to changes
*** Core Courses – minimum passing grade is C (50%)**
Notes: L – Lecture, T – Tutorial, P/S – Practical/Studio

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

YEAR 2 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 2223	Mechanics of Machines and Vibration*	3	SEMM 1213
SEMM 2323	Mechanics of Fluids II*	3	SEMM 2313
SEMM 2433	Applied Thermodynamics and Heat Transfer*	3	SEMM 2413
SEMM 2613	Materials Science	3	
SEMM 2713	Manufacturing Processes	3	
SSCE 1793	Differential Equations	3	SSCE 1693
	Total	**18**	

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**	**CREDIT**	**PRE-REQUISITE**
SEMM 3023	Applied Numerical Methods	3	SEMM 1013, SSCE 1793
SEMM 3233	Control Engineering	3	SEMM 1213**, SSCE 1793**
SEMM 3523	Components Design	3	SEMM 2123**, SEMM 1513
SEMM 3931	Laboratory II	1	SEMM 2921
SEMV 3012	Automotive Technology	2	
UBSS 1032	Introduction to Entrepreneurship	2	
UKQF 2xx2	Co-curriculum and Service-Learning Elective	2	
	Total	**16**	

YEAR 3 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3033	Finite Element Methods	3	SEMM 2123**
SEMM 3183	Industrial Engineering	3	
SEMV 3413	Internal Combustion Engines	3	SEMM 2413, SSCE 1793
SEMV 3512	Automotive Engineering Design I	2	
SEMV 3941	Laboratory III	1	SEMM 3931
UHLB 3132	Professional Communication Skills	2	UHLB 2122
SSCE 2193	Engineering Statistics	3	
	Total	**17**	

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

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

YEAR 4 : SEMESTER 1			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 3622	Materials Technology	2	SEMM 2613**
SEMM 3823	Engineering Management, Safety and Economics	3	
SEMM 4912	Undergraduate Project I	2	SEMM 2123**, SEMM 2433**, SEMM 2223**, SEMM 2323**
SEMV 4212	Automotive Electronics & Instrumentation	2	SEMV 3012, SEMM 3242
SEMV 4213	Vehicle Dynamics	3	
SEMV 4523	Automotive Engineering Design II	3	SEMV 3512
UXXX 2xx2	Generic Skills or Knowledge Expansion Cluster Elective	2	
	Total	**17**	

YEAR 4 : SEMESTER 2			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
SEMM 4902	Engineering Professional Practice	2	Must be at least 3rd year
SEMM 4924	Undergraduate Project II	4	SEMM 4912
SEMV 4793	Automotive Production Technology	3	SEMV 3012, SEMM 2713
SEMV 4xx3	Elective	3	
SEMV 5xx3	PRISMS Elective		
UHLX 1112	Foreign Language Elective	2	
UKQT 3001	Extra-Curricular Experiential Learning	1	Completed three extracurricular experience programmes
	Total	**15**	

Subject to changes
**** Minimum grade D- (30%) in the pre-requisite courses**
Notes: L – Lecture, T – Tutorial, P/S – Practical/Studio

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112	UHLB 2122	UHLB 3132
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exemption*	Compulsory	Compulsory

* Eligible students are required to apply for UHLB 1112 course credit exemption. The credit exemption form (UTM.E/3.8) is provided at the academic office.

ELECTIVE COURSES

Choose one (1) from the elective courses:

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

PRISMS ELECTIVE COURSES

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

GRADUATION CHECKLIST

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

NO	COURSE CODE	COURSE NAME	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (/) IF PASSED
		MECHANICAL ENGINEERING COURSES			
1	SEMM 1013	Programming for Engineers	3	3	
2	SEMM 1113	Mechanics of Solids I	3	3	
3	SEMM 1203	Statics	3	3	
4	SEMM 1213	Dynamics	3	3	
5	SEMM 1503	Engineering Drawing	3	3	
6	SEMM 1513	Introduction to Design	3	3	
7	SEMM 1911	Experimental Methods	1	1	
8	SEMM 1921	Introduction to Mechanical Engineering	1	1	
9	SEMM 2123	Mechanics of Solids II	3	3	
10	SEMM 2223	Mechanics of Machines & Vibration	3	3	
11	SEMM 2313	Mechanics of Fluids I	3	3	
12	SEMM 2323	Mechanics of Fluids II	3	3	
13	SEMM 2413	Thermodynamics	3	3	
14	SEMM 2433	Applied Thermodynamics & Heat Transfer	3	3	
15	SEMM 2613	Materials Science	3	3	
16	SEMM 2713	Manufacturing Processes	3	3	
17	SEMM 2921	Laboratory I	1	1	
18	SEMM 3023	Applied Numerical Methods	3	3	
19	SEMM 3033	Finite Element Methods	3	3	
20	SEMM 3233	Control Engineering	3	3	
21	SEMM 3523	Component Design	3	3	
22	SEMM 3622	Materials Technology	2	2	
23	SEMM 3813	Industrial Engineering	3	3	
24	SEMM 3823	Engineering Management, Safety & Economics	3	3	
25	SEMM 3915	Industrial Training	5	HL	
26	SEMM 3931	Laboratory II	1	1	
27	SEMM 4902	Engineering Professional Practice	2	2	
28	SEMM 4912	Undergraduate Project I	2	2	
29	SEMM 4924	Undergraduate Project II	4	4	
30	SEMV 3012	Automotive Technology	2	2	
31	SEMV 3413	Internal Combustion Engines	3	3	

32	SEMV 3512	Automotive Engineering Design I	2	2	
33	SEMV 3941	Laboratory III	1	1	
34	SEMV 4212	Automotive Electronics & Instrumentation	2	2	
35	SEMV 4213	Vehicle Dynamics	3	3	
36	SEMV 4523	Automotive Engineering Design II	3	3	
37	SEMV 4793	Automotive Production Technology	3	3	
38	SEMV 4xx3	Elective	3	3	
	SEMV 5xx3	PRISMS Elective			
TOTAL CREDIT FOR MECHANICAL ENGINEERING COURSES (A)			**101**	**96**	
ELECTRICAL COURSES (School of Electrical Engineering)					
1	SEEU1002	Electrical Technology	2	2	
2	SEEU2012	Electronics	2	2	
TOTAL CREDIT FOR ELECTRICAL COURSES (B)			**4**	**4**	
MATHEMATICS COURSES (Faculty of Science)					
1	SSCE 1693	Engineering Mathematics I	3	3	
2	SSCE 1793	Differential Equations	3	3	
3	SSCE 1993	Engineering Mathematics II	3	3	
4	SSCE 2193	Engineering Statistics	3	3	
TOTAL CREDIT FOR MATHEMATICS COURSES (C)			**12**	**12**	
UNIVERSITY GENERAL COURSES					
CLUSTER 1: APPRECIATION OF PHILOSOPHY, VALUE & HISTORY					
1	UHIS 1022	Philosophy and Current Issues (for Local Students Only)	2	2	
	UHIS 1022 OR UHMS 1182	Philosophy and Current Issues OR Appreciation of Ethics and Civilizations (for International Students Only)			
2	UHMS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	2	
	UHLM 1012	Malay Language 2 (for International Students)			
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	Entrepreneurship 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 EXHANCEMENT					
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 science	2	2	
8.	UHIS 2072	Sustainable Economy	2	2	
9.	UHIS 2082	Practice and Concept of Halal Management	2	2	
10.	UHII 2092	Philosophy of Islamic Art	2	2	
11.	UHII 2102	Islam and Health	2	2	
12.	UHII 2132	Islamic Entrepreneurship	2	2	
13.	UETS 2142	Sustainable Energy	2	2	
CLUSTER 4: CO-CURRICULUM & SERVICE LEARNING					
1	UKQX xxx2	Co-curriculum & Service-Learning Elective	2	2	
2	UKQE 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 CERTIFICATION (PCS)

- **Students are required to enrol and pass FIVE (5) PCS courses, in order to be eligible to graduate**
- **Please refer to page FE 8 in UG Academic Handbook, for more information about PCS courses.**

Compulsory PCS Courses (Enrol all 4 courses)			
1	GSPX XXXX	Design Thinking for Entrepreneur	
2	GSPX XXXX	Talent and Competency Management	
3	GSPX XXXX	Faculty Engineering Safety Pass (FESP) *Module 1 – Compulsory for SKM, SKT and SKE students* *Module 2 – Compulsory for SKA, SC, SKBSK students*	
4	GSPX XXXX	English Communication Skills for Graduating Students (ECS)	
Elective PCS Courses (Choose 1 only)			
1	GSPX XXXX	Data Analytic for Organization	
2	GSPX XXXX	Writing	
3	GSPX XXXX	Construction Measurement (Mechanical & Electrical Works)	
4	GSPX XXXX	Professional Ethics and Integrity	
5	GSPX XXXX	More elective courses to be added in future	

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 specially to solve flow measurement, mass or volumetric flow rate, momentum in flow and loss in pipe network. Lastly, some basic dimensional analysis and similarities will be introduced. At the end of the course, the student should be able to demonstrate an ability to analyze whether statically, dynamically or kinematically problems related directly to fluids.

SEMM 2323 Mechanics of Fluids II

This course is designed to enhance the basic knowledge that has been developed in the first stage of Fluid Mechanics and expose the students in analysing hydrodynamically the flow field. It will emphasize on the analysis and the importance of ideal, boundary layer, and compressible flow in a practical engineering application. The course will also provide the analysis of flow through fluid machines such as pump and turbine. At the end of the course, students should be able to demonstrate and apply the theory to solve problem related to 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 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 3915 Industrial Training

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

SEMM 3931 Laboratory II

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

SEMM 3941 Laboratory III

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

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

SEMV 3012 Automotive Technology

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

SEMV 3413 Internal Combustion Engine

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

SEMV 3512 Automotive Engineering Design I

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

engineering design books.

SEMV 3941 Laboratory III
This course is introduced in the third year of the study of Mechanical Engineering, three hours per week and experimental based course. It is divided into two parts; experimental work at Mechanics of Machine Laboratory and problem-based-learning (PBL) based laboratory (module). Students have to produce a short report for the experimental work as same to experimental work at year 2. But for the module, it is based on PBL concept. Students have to plan and design their experimental work from beginning until the end based on the title and objective that have been given by the lecturer. Students will be grouped into 5 to 6 for each module. Generally, every group has to conduct two experimental works and two modules. At the end of the session, students have to submit two short reports and two formal reports.

SEMV 4212 Automotive Electronics and Instrumentation
This course gives students an exposure to electronic and instrumentation systems typically used in automotive vehicles. It covers the basics of transducers and their uses in automotive instrumentation systems. The interface between transducers and microcontrollers are also covered for automotive applications. Major electronic systems in automotive vehicles (e.g. starting and charging system, electric, hybrid and autonomous vehicle systems) are also introduced and discussed in the course.

SEMV 4213 Vehicle Dynamics
This course introduces students to the fundamentals of vehicle dynamics such as vehicle axis system, equation of motions, moments and products of inertia, body/chassis stiffness and vibrations. Students will be taught the knowledge to develop equation of motions of vehicle dynamics model and to analyze its performance in terms of ride, comfort & handling behavior.

SEMV 4523 Automotive Engineering Design II
In this problem-based learning course, students need to develop and fabricate (in group) one mechanical-automotive engineering system which involves both mechanical and electronic system integrations, which its specifications had been determined in Automotive Engineering Design 1. The main aim of this course is for the students to experience how to deliver an automotive system project involving the latest automotive technology, which emphasizes more on detailed engineering analysis and system fabrication. Students will have to go through the process of applying various techniques and scientific principles (which they have learnt in prerequisite subjects) in order to achieve their goals. At the end of the semester, the students are required to produce one automotive system which comprises an integration between both mechanical and electronics systems.

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

ELECTIVES

SEMV 4413 Engine Turbocharging

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

SEMV 4123 Vehicle Structure

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

SEMV 4423 Vehicle Powertrain

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