Faculty of Mechanical Engineering

FACULTY OF MECHANICAL ENGINEERING

INTRODUCTION

TheFaculty of Mechanical Engineering is situated in Royal town of Pekan in the state of Pahang. It is located at the waterfront facing the South China Sea, approximately 270 km to the east of the capital city of Kuala Lumpur. The university was established more than a decade ago and has since made big strides as a research and learning institution, equipped with high-end facilities and driven by capable faculties.

The Facultyof Mechanical Engineering offers 8 academic programmes whose development in academic and research activities are coordinated by 7 focus groups. The overall students enrollment is 1200, and 85% of the studentspopulation are in the undergraduate programmes. The faculty is manned by 120 academic and technical supporting staffs.

The faculty iscurrently embarking on Research and Development activities in the area of automotive, combustion, hybrid engine, NVH, robotic, CAD/CAM, CNC, products design and development as well as materials engineering and sustainable energy. This faculty aspires tobe the centre of reference for automotive and manufacturing engineers, especially in the east coast region.

The latest updated information regarding our faculty is available at: http://fkm.ump.edu.my/

VISION & MISSION

Vision

“To be a world class competency-based mechanical engineering faculty”

Mission

“We are dedicated to produce mechanical engineers with high-level professionalism in global context. We are committed to the advancement of teaching, research and development in innovative engineering and technology to promote national growth”.

FACULTY’S OBJECTIVE

The main objective of the faculty is to provide the programmes offered through the conduct of excellence in learning, teaching, research and consultancy services.

PROGRAMMES OFFERED

There are a total of 2degree programmesand one diploma programmeoffered by the faculty for the 2013/2014academic session, as follows:

- Bachelor of Mechanical Engineering
- Bachelor of Mechanical Engineeringwith Automotive Engineering
- Bachelor Automotive Engineering (Dual Degree)
- Diploma of Mechanical Engineering

PROGRAMS'EDUCATIONAL OBJECTIVES (PEO) & PROGRAM OUTCOME (PO)

Programme Educational Objectives (PEO)

After a series of strategic planning sessions, theFaculty of Mechanical Engineering has decided to adopt the following ProgrammeEducational Objectives for theBachelor of Mechanical Engineering programme,as stated below:

The Bachelor of Mechanical Engineering programmestrives to produce graduates with the following twoattributes:

PE01: Graduates are competent, responsible and practise professionalism in theglobal context.

PE02: Graduates are knowledgeable and capable to apply the evolving technology in mechanical engineering field.

Programme Outcome (PO)

Programme outcomes are specific statements of graduates' knowledge, skills and attitudes that are evident in the programme objectives achievements. Consistent with faculty's Vision and Mission, the following is the list of12 ProgrammeOutcomes for the Bachelor of Mechanical Engineering programme.

The Bachelor of Mechanical Engineering program ensures that its students attain:

PO1 An ability to apply the fundamental knowledge of mathematics, science, and mechanical engineering;

PO2 An ability to design and conduct experiments for thermal, fluid and mechanical systems, as well as to analyze and interpret results;

PO3 An ability to design a system, component, or process to meet desired needs include costing, manufacturability, environmental, societal, ethical, sustainability and other constraints;

PO4 An ability to function as a successful team member on multi-tasking and multi-disciplinary issues;

PO5 An ability to identify, formulate and solve well-defined and open-ended mechanical engineering problems;

PO6 An ability to understand and practice professional as well asethical responsibilities;

PO7 An ability to communicate effectively;

PO8 An ability to recognize and apply knowledge to solve mechanical engineering issues in a global, economic, environmental, and societal context;

PO9 An ability to recognize the needs and motivation to engage in life-long learning;

PO10 An ability to apply knowledge of current and contemporary issues;

PO11 An ability to use the techniques, skills, and modern engineering tools necessary for mechanical engineering practice;

PO12 An ability to acquire entrepreneurship knowledge.

Although the Faculty of Mechanical Engineering has decided on the above twelve ProgrammeOutcomes, efforts are continuously made to expand the ProgrammeOutcomes based on feedbacks from our working graduates and consultations with stakeholders.

FACULTY MANAGEMENT

Assoc. Professor Dr. Rizalman bin Mamat
Dean
Ph.D.(Fuel & Energy), University of Birmingham, UK
M.Eng. (Solid Propulsion), UTM
B.Eng. Mechanical-Aeronautical Engineering, UTM
Phone Number:+609-4245020
Email: rizalman@ump.edu.my

DEPUTY DEAN

Professor Dr. Hj. Shahrani bin Anuar
Deputy Dean (Academics & Students Development Affairs)
Ph.D. (Fluidized Bed Combustion), Ohio State University, Columbus, USA
M.Sc.(Mechanical Engineering), Syracuse University, New York,USA
B.Sc. (Mechanical Engineering), Strathclyde,Universityof Glasgow, Scotland
Phone Number: +609-4246308
Email: shahrani@ump.edu.my

Dr. Mahadzir bin Ishak @ Muhammad
Deputy Dean (Research & Post Graduate Studies)
Ph.D. Industrial Science (Design & Production Processes) Ibaraki University, Japan
M.Eng. Ecosystem Engineering, Tokushima University, Japan
B.Eng. Mechanical Engineering, Ehime University, Japan
Phone Number:+609-4246307
Email: mahadzir@ump.edu.my

HEADS OF PROGRAMMES

Dr. Mohd Fairusham bin Ghazali
Head of Mechanical Programme
Ph.D, Mechanical, University of Sheffield
M.Sc. Thermal Power & Fluid Engineering, University of Manchester, UK
B.Eng. Mechanical Engineering, UiTM
Phone Number:+609-4246305
Email: fairusham@ump.edu.my

Ir. Dr. Hj. Nik Mohd Zuki bin Nik Mohamed
Head of Automotive Programme
Ph.D. Mechanical Engineering (Manufacturing), Bradford University, UK
M.Sc. Manufacturing Systems Engineering, UPM
B. Sc. Mechanical Engineering, Widener University, USA
Phone Number:+609-4246301
Email: nikzuki@ump.edu.my

Dr. Syarifah Nur Aqida binti Syed Ahmad
Head of Diploma Programme
Ph.D.Mechanical Engineering, Dublin City University, Ireland
Master inMechanical Engineering, UTHM
B.Sc. Mechanical Engineering, UTM
Phone Number:+609-4246302
Email: aqida@ump.edu.my

Hazami bin Che Hussin
Head of Technical
Master of Manufacturing System Engineering, UPM
B.Eng. Mechanical - Material Engineering, UTM
Phone Number:+609-4246306
Email: hazami@ump.edu.my

ASSISTANT REGISTRAR

Mohd Shahri bin Mohd Akhir
Assistant Registrar
BBA (Hons) Marketing, UiTM
Phone Number: +609-4246288
Email:shahri@ump.edu.my

LIST OF ACADEMIC STAFF

Professors

Professor Ir. Dr. Yusoffbin Ali
Ph.D. (Mechanical Engineering), University of Leeds, UK
M.Sc.(Traffic & Transport Planning), University of Birmingham, UK
B.Sc. Mechanical Engineering (Hons.), Brighton Polytechnic, UK
Phone Number:+609-4246351
Email: yusoffali@ump.edu.my

Professor Dato' Dr. Hj. Rosli bin Abu Bakar
Ph.D. (Diesel Engine & Combustion), Hanyang University, Korea
M.Sc.(Mechanical Engineering), Hanyang University, Korea
B.Sc. (Mechanical Engineering), Hanyang University, Korea
Phone Number:+609-4246276
Email: rosli@ump.edu.my

ProfessorDr. Abdul Ghaffar bin Abdul Rahman
Ph.D. (Mechanical Engineering), University of Sheffield, UK
M.Eng.(Mechanical), University of Sheffield, UK
B.Eng. Mechanical (Hons), University of Sheffield, UK
Phone Number:+609-4246342
Email: ghaffar@ump.edu.my

ProfessorIr. Dr. Hassan bin Ibrahim
Ph.D. (Thermal Engineering), University of Manchester Institute of Science & Technology, UK
M. App. Sc. in Mechanical Engineering (Heat Transfer), University of Ottawa, Canada
Sarjana Teknik (Ir.), Bandung Institute of Technology, Indonesia
Phone Number:+609-4246347
Email: drhassan@ump.edu.my

Professor Dr. Hj. Shahrani bin Anuar
Ph.D. (Fluidized Bed Combustion), Ohio State University, Columbus, USA
M.Sc.(Mechanical Engineering), Syracuse University, New York, USA
B.Sc. (Mechanical Engineering), Strathclyde University of Glasgow, Scotland
Phone Number:+609-4246278
Email: shahrani@ump.edu.my

Associate Professors

Assoc. Professor Dr. Rizalman bin Mamat
Ph.D.(Fuel & Energy), University of Birmingham, UK
M.Eng. (Solid Propulsion), UTM
B.Eng. Mechanical-Aeronautical Engineering, UTM
Phone Number:+609-4246275
Email: rizalman@ump.edu.my

Assoc. Professor Dr. Tuan Mohammad Yusoff Shah bin Tuan Ya
Ph.D. (Mechanophysics Engineering), Osaka University, Japan
M.Eng. Sc. (Computational Engineering), University of New South Wales, Australia
B.Eng. (Aeronautical Engineering), Salford University, UK
Phone Number:+609-4246343
Email: tmyusoff@ump.edu.my

Assoc. ProfessorDr. Md Mustafizur Rahman
Ph.D. (Mechanical & Materials), UKM
M.Sc. Engineering (Mechanical Engineering), BUET, Bangladesh
B.Sc. Engineering (Mechanical Engineering), BUET, Bangladesh
Phone Number:+609-4246239
Email: mustafizur@ump.edu.my

Assoc. Professor Dr. Khairi Yusuf
Ph.D. (Mechanical Engineering), Toyohashi University of Technology, Aichi, Japan
M.Sc. (Mechanical Engineering), Bandung Institute of Technology, Indonesia
B.Eng. (Mechanical Engineering), Bandung Institute of Technology, Indonesia
Phone Number:+609-4246278
Email: khairi@ump.edu.my

Senior Lecturers

Dr. Abdul Adam bin Abdullah
Ph.D. Ecosystem Engineering (Diesel Spray and Combustion), Tokushima University, Japan
M.Eng. (Mechanical Engineering), Tokushima University, Japan
B.Eng (Mechanical Eng.), Akita University, Japan
Phone Number:+609-4246201
Email: adam@ump.edu.my

Dr. Ahmad Syahrizan bin Sulaiman
Ph.D. Metallurgy & Materials, University of Birmingham, UK
B.Eng. (Hons) Manufacturing Engineering & Management, University of Strathclyde, UK
Phone Number:+609-4246206
Email: syahrizan@ump.edu.my

Ir. Dr. Akhtar Razul bin Razali
Ph.D, Manufacturing, University of Strathclyde, UK
M.Eng. Mechanical Engineering, UTHM
B.Eng. Mechanical Engineering, UTM
Phone Number: 609-4246214
Email: akhtar@ump.edu.my

Dr. Gan Leong Ming
Ph.D, Mechanical Engineering (Automotive), UMP
M.Eng. Automotive, UTM
B.Eng. Mechanical-Automotive Engineering, UTM
Phone Number: +609-4246313
Email: ming@ump.edu.my

Dr. Kumaran a/l Kadirgama
Ph.D. (Mechanical & Automotive), UNITEN
Master in Manufacturing Engineering), UNITEN
B. Engineering (Mechanical Engineering), UNITEN
Phone Number:+609-4246232
Email: kumaran@ump.edu.my

Dr. Mahadzir bin Ishak@Muhammad
Ph.D. Industrial Science (Design & Production Processes) Ibaraki University, Japan
M.Eng. Ecosystem Engineering, Tokushima University, Japan
B.Eng. Mechanical Engineering, Ehime University, Japan
Phone Number:+609-4246235
Email: mahadzir@ump.edu.my

Dr. Mohd Fairusham bin Ghazali
Ph.D, Mechanical, University of Sheffield
M.Sc. Thermal Power & Fluid Engineering, University of Manchester, UK
B.Eng. Mechanical Engineering, UiTM
Phone Number :+609-4246320
Email: fairusham@ump.edu.my

Dr. Syarifah Nur Aqida binti Syed Ahmad
Ph.D. (Mechanical & Automotive) Dublin University, Ireland
Master inMechanical Engineering, UTHM
B.Sc. Mechanical Engineering, UTM
Phone Number:+609-4246280
Email: aqida@ump.edu.my

Dr. Zakri bin Ghazalli
Ph.D, Production System, Okayama University Japan
M.Sc. (Mechanical Engineering), USM
B.Eng. (Mechanical Engineering), Kyushu Institute of Technology, Japan
Phone Number:+609-4246340
Email: zakri@ump.edu.my

Dr. Gigih Priyandoko
Ph.D. (Mechanical-Applied Mechanics), UTM
M.Eng. (Electrical), University Technology of Bandung, Indonesia
B.Eng. (Electrical),Univarsitas Brawijaya
Phone Number:+609-4246219
Email: gigih@ump.edu.my

Dr. Ir. Hj. Nik Mohd Zuki bin Nik Mohamed
Ph.D. Mechanical Engineering (Manufacturing), Bradford University, UK
M.Sc. Manufacturing Systems Engineering, UPM
B. Sc. Mechanical Engineering, Widener University, USA
Phone Number:+609-4246314
Email:nikzuki@ump.edu.my

Dr. Mohamad Firdaus bin Basrawi
Dr. (Eng.) in Cold Region, Environment and Energy Engineering, Kitami Institute of Technology
ME in Mechanical Engineering, Kitami Institute of Technology
BE in Mechanical Engineering, Kitami Institute of Technology
Phone Number:+609-4246350
Email: mfirdausb@ump.edu.my

Dr. Siti Rabiatull Aisha binti Idris
Ph.D Eng. Mechanical (Microelectronics), UTM
M.Eng. Mechanical (Microelectronics), UTM
B.Eng. (Materials), UTM
Phone Number:+609-4246349
Email: aisha@ump.edu.my

Dr. Ahmed Nurye Oumer
PhD Mechanical Engineering , UTP
MSc Mechanical Engineering, Addis Ababa University,
BSc Mechanical Engineering, Addis Ababa University,
Phone Number : +609-4246259
Email: nurye@ump.edu.my

Dr. Dandi Bactiar
Ph.D. (Mechanical Engineering), UPM
M.Sc. (Mechanical Engineering), UPM
B.Eng./Ir. (Mechanical Engineering), University of Syiah Kuala, Aceh, Indonesia
Phone Number : +609-4246357
Email: dandi@ump.edu.my

Dr. Januar Parlaungan Siregar
Ph.D. (Mechanical Engineering), UPM
M.Sc. (Mechanical Engineering), UPM
B.Eng./Ir. (Mechanical Engineering), Universitas Trisakti, Indonesia
Phone Number : +609-4246282
Email: januar@ump.edu.my

Dr. Yuli Panca Asmara
Ph.D. (Mechanical Engineering-Corrosion), UTP
M.Eng. (Corrosion), UMIS, UK
B.Eng. (Mechanical),ITS, Indonesia
Phone Number: +609-4246355
Email: ypanca@ump.edu.my

Fadhlur Rahman bin Mohd Romlay
M.Sc. Mechanics & Materials Engineering, UKM
B.Sc. (Hons) Mechanical Engineering, UKM
Phone Number:+609-4246218
Email: fadhlur@ump.edu.my

Mohd Shahrir bin Mohd Sani
M.Sc. Manufacturing System Engineering, UPM
B. Eng. Mechanical Engineering, UTM
Phone Number: +609-4246235
Email: mshahrir@ump.edu.my

Lecturers

Ir. Mohd Rashidi bin Maarof
M.Eng. Mechanical Engineering (Advanced Manufacturing Technology), UTM
B.Eng. Mechanical Engineering, UTM
Phone Number: +609-4246323
Email: mrashidi@ump.edu.my

Hj. Amirruddin bin Abdul Kadir
M.Eng. (Manufacturing System Engineering), UPM
M.Sc. (Quality and Productivity Improvement), UKM
B.Eng. (Mechanical & MaterialsEngineering), UKM
Phone Number: +609-4246203
Email: amiruddin@ump.edu.my

Ahmad Nasser bin Mohd Rose
M.Sc. Manufacturing System Engineering, University of Warwick, UK
B.Eng. Manufacturing Engineering, University of Sunderland, UK
Phone Number: 609-4246348
Email: nasser@ump.edu.my

Ahmad Basirul Subha bin Alias
M.Eng (Mechanical), University of Adelaide, Australia
B.Eng. Mechanical Engineering, UTM
Phone Number:+609-4246205
Email: subha@ump.edu.my

Amir bin Aziz
M.Eng. (Solid Propulsion), UTM
B.Eng (Mechanical), UTM
Phone Number:+609-4246208
Email: amiraziz@ump.edu.my

Azim bin Mohd Arshad
M.Eng. (Mechanical Engineering), Oita University, Japan
B.Eng. (Mechanical Engineering), Oita University, Japan
Phone Number:+609-4246213
Email: azim@ump.edu.my

Che Ku Eddy Nizwan bin Che Ku Husin
M.Sc. (Mechanical & Materials), UKM
B.Eng. (Hons) Engineering (Mechanical & Materials), UKM
Phone Number: 609-4246217
Email: eddy@ump.edu.my

Idris bin Mat Sahat
M.Eng. (Mechanical), UTM
B. Eng. (Mechanical) UTM
Phone Number: 609-4246223
Email: idriss@ump.edu.my

Jasri bin Mohamad
M.Eng. (Manufacturing), UKM
B.Sc. (Mechanical Engineering), University of Toledo, USA
Phone Number: 609-4246226
Email: jasri@ump.edu.my

Lee Giok Chui SMP, KMN
M.Sc. (Manufacturing System Engineering), University of Warwick, England,
B.Sc. (Hons) Mechanical Engineering with Specialisation in Engineering Management,
University of Glasgow, Scotland.
Phone Number: 609-4246233
Email: gclee@ump.edu.my

Luqman Hakim bin Ahmad Shah
M.Eng. Mechanical Engineering (Quantum Energy), Tohoku University
B.Eng. Mech. Engineering (Quantum Science), Tohoku University
Phone Number: 609-4246234
Email: luqmanhakim@ump.edu.my

Miminorazeansuhaila binti Loman
M.Sc. (Mechanical & Materials Engineering), UKM
B.Eng. (Mechanical), UKM
Phone Number: 609-4246240
Email: miminorazean@ump.edu.my

Mohd Azrul Hisham bin Mohd Adib
M.Eng. (Mechanical Engineering), UTM
B.Eng. (Hons) Mechanical Engineering (Mechanical), UTM,
Phone Number: +609-4246246
Email: azrul@ump.edu.my

Mohd Zaidi bin Sidek
M.Eng. Manufacturing System, UKM
B.Eng. Mechanical & Materials, UKM
Phone Number: 609-4246284
Email: zaidisidek@ump.edu.my

Muhammad Ammar bin Nik Mu'tasim
M.Eng. (Mechanical), UTM
B.Eng. (Mechanical), UMP
Phone Number: 609-4246264
Email: ammar@ump.edu.my

Muhammad Hatifibin Haji Mansor
M.Eng. (Mechanical), UTM
B.Eng. (Mechanical Engineering), UMP
Phone Number: 609-4246265
Email: hatifi@ump.edu.my

Nasrul Azuan bin Alang
M.Eng.(Mechanical),UKM
B.Eng. Mechanical Engineering, UTM
Phone Number: 609-4246266
Email: azuan@ump.edu.my

Nasrul Hadi bin Johari
M.Eng. (Mechanical), UTM
B.Eng. Mechanical and Automotive, UMP
Phone Number:+609-4246267
Email: nhadi@ump.edu.my

Norhaida binti Abd Razak
M.Eng. (Mechanical), UKM
B.Eng. Mechanical Engineering, UNITEN
Phone Number: 609-4246271
Email: norhaida@ump.edu.my

Nur Azhani binti Abd Razak
M.Eng. Sc. (Manufacturing Engineering & Management), University of New South Wales, Australia
B.Eng. Mechanical Engineering, KUiTTHO
Phone Number:+609-4246273
Email: azhani@ump.edu.my

Nurazima binti Ismail
M.Eng. (Structural Integrity), UKM
B.Eng. (Mechanical), UKM
Phone Number:+609-4246272
Email: nurazima@ump.edu.my

Salwani binti Mohd Salleh
Master of Engineering Management, UPM
B.Eng. Manufacturing Engineering, UIAM
Phone Number:+609-4246334
Email: salwani@ump.edu.my

Mohd Fadhlan bin Yusof
M.Sc. (Mechanical Engineering), UKM
B.Eng. (Hons) Mechanical Engineering (Mechanical), UTM
Phone Number:+609-4246319
Email: fadhlan@ump.edu.my

Zulkifli bin Ahmad@Manap
M.Sc. (Mechanical Engineering), UKM
B.Eng. (Hons) Mechanical Engineering, UTM
Phone Number:+609-4246286
Email: kifli@ump.edu.my

At- Tasneem bt Mohd Amin
M.Sc. (Mechanical Engineering), UKM
B.Eng. Mechanical Engineering, UM
Phone Number:+609-4246211
Email: tasneem@ump.edu.my

Lecturers on Study Leave

Ir. Zamri bin Mohamed
Pursuing Ph.D., Royal Melbourne Institute of Technology, Australia
Master of Manufacturing Systems Engineering, UPM.
BSc (Mechanical Eng. & Applied Mechanics),
University of Pennsylvania, Philadelphia, USA
Email: zamrim@ump.edu.my

Mohd Ruzaimi bin Mat Rejab
Pursuing Ph.D., University of Liverpool, UK
M.Eng. Mechanical Engineering, UTM
B.Eng. Mechanical Engineering, UTM
Email: ruzaimi@ump.edu.my

Muhamad bin Mat Noor
Pursuing Ph.D, University of Southern Queensland, Australia
M.Sc. (Mechanical/ Manufacturing System Engineering), UPM
B.Eng. (Hons) Agricultural Engineering (Power & Machinery), UPM
Email: muhamad@ump.edu.my

Rosdi bin Daud
Pursuing Ph.D., UTM
M.Sc. (Advanced Manufacturing Technology), University of Portsmouth, UK
B.Eng. (Mechanical Engineering), UKM
Email:rosdidaud@ump.edu.my

Asnul Hadi bin Ahmad
Pursuing Ph.D, Dublin City University, Ireland
M.Eng. Manufacturing Systems, UPM
B.Eng. Manufacturing Engineering (Manufacturing Process), UTEM
Email: asnul@ump.edu.my

Azizuddin bin Abd Aziz
Pursuing Ph.D, Kyushu University, Japan
M.Sc. Mechanical Engineering, UPM
B.Eng. Mechanical Engineering, UTM
Email: azizuddin@ump.edu.my

Dayangku Noorfazidah binti Awang Shri
Pursuing Ph.D, University of Tsukuba, Japan
M.Eng. (Mechanical-Material), UTM
B.Sc. Engineering, Material Science & Engineering, University of Michigan, USA
Email: noorfazidah@ump.edu.my

Devarajan a/l Ramasamy
Pursuing Ph.D, USM
M.Eng. Mechanical Engineering, UTM
B.Eng. Mechanical (Aeronautical), UTM
Email: deva@ump.edu.my

Hadi bin Abdul Salaam
Pursuing Ph.D, UMP
M.Eng. (Mechanical), UTM
B.Eng. Manufacturing Engineering (Manufacturing Process), UTEM
Email: hadisalaam@ump.edu.my

Juliawati binti Alias
Pursuing Ph.D, University of Manchester
M.Eng. (Mechanical), UTM
B.Eng. Mechanical Engineering, UKM
Email: juliawati@ump.edu.my

Mahendran a/l Samykano
Pursuing Ph.D, North Carolina A&T State University, USA
Master in Manufacturing System Engineering, UPM,
B.Eng. (Hons) Mechanical Engineering, KUiTTHO
Email: mahendran@ump.edu.my

Mas Ayu binti Hassan
Pursuing Ph.D., UTM
M.Eng. Mechanical Engineering (Advanced Manufacturing Technology), UTM
B.Eng. Mechanical Engineering (Manufacturing), UTHM
Email: maszee@ump.edu.my

Mohamed Reza Zalani bin Mohamed Suffian
Pursuing Ph.D, UMP
M.Eng. (Manufacturing), UM
B.Eng (Mechanical Engineering), USM
Email: mdreza@ump.edu.my

Mohd Akramin bin Mohd Romlay
Pursuing Ph.D, UKM
M.Sc.(Mechanical Engineering), UKM
B. Eng.(Hons) Mechanical-Automotive, UTM
Email: akramin@ump.edu.my

Mohd Fadzil Faisae bin AB Rashid
Pursuing Ph.D, Cranfield University, UK
M.Eng. (Manufacturing), UMP
B.Eng. Mechanical-Industrial Engineering, UTM
Email: ffaisae@ump.edu.my

Mohd Firdaus bin Hassan
Pursuing Ph.D, University of Manchester
M.Eng. (Mechanical), UTM
B.Eng. Mechanical Engineering, UKM
Email: firdaus@ump.edu.my

Mohd Fadzil bin Abdul Rahim
Pursuing Ph.D, UMP
M.Eng. (Automotive), UMP
B.Eng. (Mechanical), UMP
Email: mfadzil@ump.edu.my

Mohd Hafizi bin Zohari
Pursuing Ph.D, University of Southern Queensland, Australia
M.Eng. (Mechanical), UKM
B.Eng. Mechanical Engineering, UKM
Email: hafizi@ump.edu.my

Mohd Razali bin Hanipah
Pursuing Ph.D, New Castle University, UK
M.Eng. (Mechanical), UTP
B.Eng. Mechanical-Automotive, UTM
Email: mohdrazali@ump.edu.my

Mohd Yusof bin Taib
Pursuing Ph.D, UMP
M. Eng. Mechanical Engineering, UTM
B.Eng. Mechanical Engineering, UTM
Email: myusof@ump.edu.my

Muhamad Zuhairi bin Sulaiman
Pursuing Ph.D, Osaka University, Japan
M.Eng. (Mechanical), UTM
B.Eng. Mechanical &Manufacturing Engineering, UNIMAS
Email: zuhairi@ump.edu.my

Nik Mohd Izual bin Hj. Nik Ibrahim
Pursuing Ph.D, Kyushu University, Japan
M.Eng. (Automotive), UMP
B.Eng. Mechanical-Automotive, UTM
Email: izual@ump.edu.my

Nurul Shahida binti Mohd Shalahim
Pursuing Ph.D, Universiti Malaya
M.Eng. Mechanical Engineering, USM
B.Industrial Technology (Quality Control & Instrumentation), USM
Email :shahida@ump.edu.my

Ramli bin Junid
Pursuing Ph.D, University of Manchester,UK
M.Eng. (Advanced Manufacturing Technology), University of South Australia
B.Eng. Manufacturing Engineering, UTEM
Email: ramli@ump.edu.my

Siti Haryani binti Tomadi

Pursuing Ph.D, UKM
M. Eng. (Manufacturing System) (UKM)
B. Eng Mechanical (UiTM),
Email : sharyani@ump.edu.my

Wan Azmi bin Wan Hamzah
Pursuing Ph.D, UMP
M.Eng. (Mechanical), UKM
B.Eng. Mechanical Engineering, UTM
Email: wanazmi@ump.edu.my

Wan Sharuzi bin Hj. Wan Harun
Pursuing Ph.D, Kyushu University, Japan
M.Eng (Advanced Manufacturing Technology), UTM
B.Eng (Mechanical Enginneering & Manufacturing Systems), UNIMAS
Email: sharuzi@ump.edu.my

Tutors

Mohamad Zairi bin Baharom
B.Eng. (Hons) Mechanical Engineering (Industrial),UTM
Phone Number:+609-4246317
Email: mohamadzairi@ump.edu.my

Rosmazi bin Rosli
B.Eng. (Hons) Mechanical Engineering with Automotive Engineering, UMP
Phone Number:+609-4246333
Email: rosmazi@ump.edu.my

Wan Anuar bin Wan Hassan
B.Eng. (Hons) Mechanical Engineering, UMP
Phone Number: 609-4242313
Email: wananuar@ump.edu.my

Tutors on Study Leave

Mohd Shahmi bin Junoh @ Yacob
Pursuing Master, University of Applied Sciences Bonn-Rhein – Seig, Germany
B. Eng. (Mechatronic), IIUM
Email: shahmi@ump.edu.my

Ngui Wai Keng
Pursuing Ph.D, UTM
B.Eng. (Hons) Mechanical Engineering, UTHM
Email: waikeng@ump.edu.my

TECHNICAL STAFF

Senior Vocational Training Officers

Mohd. Fazli bin Ismail
B.Eng. (Hons) Mechanical Engineering, USM
Phone Number: +609-4246249
Email: fazliismail@ump.edu.my

Rusli bin Ghani
B.Tech. (Tool & Die), UTHM
Phone Number: +609-4246277
Email: rusli@ump.edu.my

Vocational Training Officers

Hazami bin Che Hussin
Master of Manufacturing System Engineering, UPM
B.Eng. Mechanical - Material Engineering, UTM
Phone Number: +609-4246221
Email: hazami@ump.edu.my

Muhammad Adib bin Shaharun
B.Eng. (Mechanical Engineering), UKM
Phone Number: +609-4246263
Email:adib@ump.edu.my

Jamiluddin bin Jaafar
Master of Manufacturing System Engineering, UPM
B.Eng. (Hons) Mechanical, UTM
Phone Number: +609-4246225
Email: jamiluddin@ump.edu.my

Junaedi Irwan bin Wan Abdul Halim
B. Eng. Mechanical Engineering, UTM
Phone Number: +609-4246228
Email: junaedi@ump.edu.my

Mohammad Khalid bin Wahid

Master of Manufacturing System Engineering, UPM
B.Eng. Mechanical UTM
Phone Number: +609-4246242
Email: khalid@ump.edu.my

Mohd Adib bin Mohd Amin
Master of Manufacturing System Engineering, UPM
B.Eng. Mechanical, UM
Phone Number: +609-4246244
Email: madib@ump.edu.my

Mohd Sazali bin Salleh
Master of Manufacturing System Engineering, UPM
B. Eng. Mechanical KUiTTHO
Phone Number: +609-4246254
Email: msazali@ump.edu.my

Mohd Tarmizy bin Che Kar
Master of Manufacturing System Engineering, UPM
B.Eng. Mechanical Industry, UTM
Phone Number: +609-4246255
Email: tarmizy@ump.edu.my

Muhamad Imran bin Mohmad Sairaji
B.Eng. Mechanical, UTM
Phone Number: +609-4246261
Email: mimran@ump.edu.my

Zulfika bin Anuar
B.Eng. Mechanical, UNITEN
Phone Number: +609-4246285
Email: zulfika@ump.edu.my

Senior Assistant Vocational Training Officers

Aziha bin Abdul Aziz
Dip. Teknologi (Tool & Die), GMI
Phone Number: +609-4246212
Email: aziha@ump.edu.my

Assistant Vocational Training Officers

Asmizam bin Mokhtar
Dip. Teknologi (Moulding), GMI
Phone Number: +609-4246209
Email:asmizam@ump.edu.my

Khairul Azha bin A. Jalal
Dip. Kejuruteraan Elektrik (Instrumentasi), UiTM
Phone Number: +609-4246230
Email: khairulazha@ump.edy.my

Mohd Aminuddin bin Ayob
Dip. in Automotive Technology, MFI
Phone Number: +609-4246245
Email: aminuddin@ump.edu.my

Muhamad Rozikin bin Kamaluddin
Dip. Pengajar Vokasional (Pengeluaran), CIAST
Phone Number: +609-4246243
Email: rozikin@ump.edu.my

Mohd Rizal bin Mat Ali
Dip. Pengajar Vokasional (Welding), CIAST
Phone Number: +609-4246253
Email: mohdrizal@ump.edu.my

Mohd Idzwanrosli bin Mohd Ramli
Dip. in Automotive Maintenance Technology, MFI
Phone Number: +609-4246256
Email: idzwan@ump.edu.my

Mahdhir bin Mohd Yusof
Bachelor of Information Technology& Management (Hons),OUM
Phone Number: +609-4246236
Email: mahdhir@ump.edu.my

Nor Sa'adah bt Noor Azmi
Dip. in Production Technology, GMI
Phone Number: +609-4246269
Email: saadah@ump.edu.my

Zahari Annuar bin Zakaria
Dip. InMechatronic Technology Engineering, ADTEC
Phone Number: +609-4246283
Email: zannuar@ump.my

Khairizd Azuwar bin Safie'
Dip.in Mechanical Engineering, UTM
Phone Number: +609-4246229
Email: azuwar@ump.edu.my

Mohd Padzly bin Radzi

Dip. in Engineering Mechanical-Manufacturing
(Politeknik Port Dickson)
Phone Number: +609-4246251
Email: padzly@ump.edu.my

Nizam bin Abdullah
Dip. Mechanical Engineering, UTM
Phone Number: +609-4246268
Email; zam@ump.edu.my

Mohd Fauzibin Mustafa
Dip. in Mechanical Engineering, UiTM
Phone Number: +609-4246248
Email: mdfauzi@ump.edu.my

Muhd Hafietz bin Yusoff
SKM, Jentera Berat
Phone Number: +609-4246258
Email: mhafietz@ump.edu.my

ADMINISTRATIVE STAFF

Assistant Registrar

Mohd Shahri bin Mohd Akhir
B.BA (Hons) Marketing, UiTM
Phone Number: +609-4246288
Email: shahri@ump.edu.my

Assistant Administrative Officer

Norshalawati binti Mat Yusof
Bachelor of Corporate Admin (Hons), UiTM
Phone Number: +609-4246293
Email: shalawati@ump.edu.my

Mohamad Faizal bin Mohamed Zahri
Dip. InMarketing, Politeknik Kota Bharu
Phone Number: +609-4246292
Email: mdfaizal@ump.edu.my

Office Secretary

Zainab binti Daud
Dip. of Secretarial Science, UiTM
Phone Number: +609-4246294
Email: zainab@ump.edu.my

AdministrativeAssistants

Nur Sufiah binti Jamaludin
Dip. in Office Management & Technology, UiTM
Phone Number: +609-4246295
Email:nursufiah@ump.edu.my

Nurul Azreen binti Zainal Abidin
Dip.in Computer Science, KIPSAS
Phone Number: +609-4246296
Email:azreen@ump.edu.my

Nurul Ashikin binti Mohd Khalil
Cert. in Data Processing, POLISAS
Phone Number: +609-4246297
Email:ashikinmk@ump.edu.my

Suhaida binti Mohamad Salleh
Dip. inOffice Management, UiTM
Phone Number: +609-4246298
Email:suhaidams@ump.edu.my

General Office Assistants

Mohd Zaki bin Mohd Ali
Sijil Pelajaran Malaysia
Phone Number: +609-4246299
Email:zakiali@ump.edu.my

AUTOMOTIVE ENGINEERING CENTRE

Assistant Registrar

Syarifah Ikhmar Afzan binti Syed Abd Rahman
B.TM (Hons) Tourism Management, UUM
Phone Number: +609-4246289
Email:afzan@ump.edu.my

Research Officers

Danial bin Mohamed
Bachelor in Mechanical Engineering, UiTM
Phone Number: +609-4246291
Email:danial@ump.edu.my

Rosidah binti Norsat
B.Eng. Mechanical, UiTM
Phone Number: +609-4246290
Email:rosidahnorsat@ump.edu.my

AdministrativeAssistant

Kamarliah binti Selamat
Dip. In Multimedia, Cosmopoint College of Technology
Phone Number: +609-4246344
Email:kamarlia@ump.edu.my

BACHELOR IN MECHANICAL/ AUTOMOTIVE/ ENGINEERING ACADEMIC SESSION 2013/2014

COURSE	YEAR 1		YEAR 2		YEAR 3		LI	YEAR 4	
	COURSE CODE	COURSE NAME	COURSE CODE	COURSE NAME	COURSE CODE	COURSE NAME		COURSE CODE	COURSE NAME
FACULTY COURSE	BMM 1532	STATICS (TUTORIAL)	BMM2613	COMPUTER AIDED DESIGN (CAD)	BMM2582	STRENGTH OF MATERIALS 2	BMM3996: INDUSTRIAL TRAINING	BMM3513	HEAT TRANSFER
	BMM1523	ENGINEERING MATERIALS	BMM1533	STRENGTH OF MATERIALS 1	BMM2523	THERMODYNAMICS 2		BMM3521	ENGINEERING FLUID MECHANICS LAB
	BMM2433	ELECTRICAL & ELECTRONIC TECHNOLOGY	BMM1553	DYNAMICS	BMM2543	FLUID MECHANICS 2		BMM3531	ENGINEERING THERMODYNAMICS LAB
	BMM1312	COMPUTER PROGRAMMING	BMM3011	ENGINEERING & SOCIETY	BMM3623	MECHANICAL DESIGN		BMM4623	MECHANICAL SYSTEMS DESIGN
	BMM1021	OCCUPATIONAL SAFETY & HEALTH	BMM2021	QUALITY ENVIRONMENT MANAGEMENT SYSTEM (QEMS)	BMM3613	AUTOMATIC CONTROL		BM*4**3	ELECTIVE 1
	BMM1811	MECHANICAL LAB 1	BMM3643	MANUFACTURING PROCESESS	BMM3633	INDUSTRIAL ENGINEERING		BM*4**3	ELECTIVE 2
	BMM1821	MECHANICAL LAB 2	BMM3532	MEASUREMENT AND INSTRUMENTATION SYSTEM	BMM3562	FINITE ELEMENT METHOD		BM*4**3	ELECTIVE 3
	BMM2513	THERMODYNAMICS 1	BMM1511	ENGINEERING MECHANICS LAB 1	BMM3553	MECHANICAL VIBRATION		BM*4**3	ELECTIVE 4
	BMM2533	FLUID MECHANICS 1			BMM4022	PROJECT MANAGEMENT		BMM4912	FINAL YEAR PROJECT 1
					BMM3611	MANUFACTURING PROCESSES LABORATORY		BMM4924	FINAL YEAR PROJECT 2
					BMM2521	ENGINEERING MECHANICS LAB 2			
92	19	TOTAL CREDIT YEAR 1	17	TOTAL CREDIT YEAR 2	24	TOTAL CREDIT YEAR 3	6	26	TOTAL CREDIT YEAR 4
36	**UNIVERSITY COURSE** : UQB1**1 CO. CURICULUM 1, UQ*2**1 CO.CURICULUM 2, BUM 2123 APPLIED CALCULUS, BUM2133 ORDINARY DIFFERENTIAL EQUATIONS, BUM2313 NUMERICAL METHODS, BUM2413 APPLIED STATISTICS UHL2312 TECHNICAL ENGLISH, UHL2322 TECHNICAL WRITING, UHL2332 ACADEMIC REPORT WRITING UHR1012 ISLAMIC AND ASIA CIVILIZATION, UHR2012 ISLAMIC INSTITUTIONS, UHM2022 ETHNIC RELATIONS, UHE3**2 ELECTIVE SOCIAL SCIENCE, UHF11*1 FOREIGN LANGUAGE LEVEL 1, UHF21*1 FOREIGN LANGUAGE LEVEL 2, UHS1021 SOFTSKILLS 1, UHS2021 SOFTSKILLS 2 UGE2002TECHNOPRENEURSHIP									
128	**TOTAL CREDITS FOR GRADUATION**								

ELECTIVE COURSE FOR BACHELOR IN MECHANICAL/ AUTOMOTIVE ENGINEERING ACADEMIC SESSION 2013/2014

Elective Subjects for Mechanical Engineering (BMM)
BMM4703 Hydraulics and Pneumatics
BMM4723 Mechanism Design
BMM4733 Power Plant Technology
BMM4753 Renewable Energy Resources
BMM4763 Fatigue Design and Analysis
BMM4773 Materials Characterization
BMM4783 Computational Fluid Dynamics (CFD)
BMM4793 Welding And Joining Technology
BMM4703 Corrosion Science And Engineering
BMM4713 Ergonomics
BMI4713 Production Planning Control
BMI4743 Design for Manufacturing& Assembly (DFMA)
BMI4733 Quality Engineering

Elective Subjects for Mechanical Engineering with Automotive Engineering (BMA)
BMA4703 Automotive Technology
BMA4713 Internal Combustion Engine
BMA4723 Vehicle Dynamics
BMA4733 Automotive Design and Styling
BMA4743 Road Vehicle Aerodynamics (RVAD)

*The above information are subject to amendment of the Senate from time to time.

CURRICULUM STRUCTURE FOR DEGREE PROGRAMMEIN MECHANICAL ENGINEERING 2013/2014

BMM1532
Statics
Credit Hour: 2
Prerequisite: None

Synopsis
An introduction to solving engineering static problem.
Outline syllabus: force vector, equilibrium of particle and rigid body, friction effect on rigid body equilibrium, structural analysis, frame and machines, centroids, center of gravity and moment of inertia.

Course Outcome
By the end of semester, students should be able to:
CO1: Analyze equilibrium of particle.

CO2: Analyze equilibrium of rigid body involve structure, frame and machine.

CO3: Analyze equilibrium of rigid body involve friction

CO4: Determine the centroids and moment of Inertia, of cross sectional area of beams

BMM1523
Engineering Materials
Credit Hour: 3
Prerequisite: None

Synopsis
This course introduce students to the fundamentals of engineering materials which includes its application, atomic bonding, crystal structure, mechanical and physical properties, corrosion and degradation mechanism, microstructure analysis, phase diagram, ferrous and non-ferrous alloys, polymer and advanced materials and issues in economic, environmental, societal of materials engineering.

Course Outcome
By the end of semester, students should be able to:

CO1: Explain the classification of engineering materials and describe its applications.

CO2: Analyse and evaluate the mechanical, physical and chemical properties engineering materials.

CO3 Analyse and explain metal alloys microstructure, phase diagram and heat treatment processes.

CO4: Analyse and explain ferrous and non-ferrous alloys microstructure, strengthening mechanism and its applications.

CO5: Analyse and define the polymeric materials and advanced materials classification.

BMM1312
Computer Programming
Credit Hour: 2
Prerequisite: None

Synopsis
This course introduces students to Computers and Computing Fundamentals, Programme Structure, Printing, Comments, Variables, Arithmetic Operations, Math Functions, Input/ Output, Control Structure, Looping, Functions, Numeric Arrays, User Friendly Interface and their application on solving engineering problems. C programming language is utilized in this course.

Course Outcome

By the end of semester, students should be able to:

CO1 Recognize about computing fundamentals and construct a simple and straightforward manner C programmes.

CO2 Construct C programmes with the most suitable variables, perform correct arithmetic operations and mathematical functions.

CO3 Construct C programmes with the desired input/ output.

CO4 Construct C programmes with

control structure and looping.

CO5 Construct C programmes with functions and numeric arrays.

BMM1021
Occupational Safety & Health
Credit Hour: 1
Prerequisite: None

Synopsis
This course introduces OSH in Malaysia, identification, types and inspection of industrial hazard, analysis and control of industrial hazard, mechanical hazard, chemical hazard, physical hazard, psycho-social hazard, industrial hygiene and diseases, accident causation phenomenon, accident investigation and analysis, managing safety and health, and industrial safety and health regulation.

Course Outcome
By the end of semester, students should be able to:

CO1: Understand the OSHA regulation and implementation in Malaysia.

CO2: Identify the industrial hazards.

CO3: Discuss the industrial hygiene programmes.

CO4: Analyze the accident phenomenon.

CO5: Apply the safety and health management.

BMM1811
Mechanical Laboratory 1
Credit Hour: 1
Prerequisite: None

Synopsis
This course introduces students with safe working habits, identify common materials used in metal fabrication, reading blueprints, identification, care & use basic measuring instruments, layout methods & basic hand tools. Emphasis is placed on operation of drill press, lathe & pedestal grinder.

Course Outcome
By the end of semester, students should be able to:

CO1: To practice the fundamentals of safety, drawing interpretation and measurement.

CO2: To apply benchwork and drilling operation.

CO3: To perform various basic turning operations.

BMM1821
Mechanical Laboratory 2
Credit Hour: 1
Prerequisite: None

Synopsis
This course introduces student basic application of the dial indicator, gauge block, gauges, measuring instruments, milling machines and processes, CNC milling simulator operation and surface grinding machines and processes.

Course Outcome
By the end of semester, students should be able to:

CO1: Implement the appropriate techniques when handling basic measuring equipment and instruments.

CO2: Safely perform various basic milling operations.

CO3: Safely perform surface grinding process.

BMM1511
Engineering Mechanics Lab 1
Credit Hour: 1
Prerequisite: BMM1523 Engineering Materials and BMM1532 Statics

Synopsis
This lab introduces the engineering materials and statics principles through practical experiments. The covered topics for engineering materials experiments comprise steel microstructure microscopy, Brinell hardness test, Vickers hardness test, rapid quenching and tempering of plain carbon steel, creep test and impact test. The statics experiments covered are forces resolutions in basic roof truss and crane jib, momentsapplication in bell crank lever, precision friction measurement and friction forces on an inclined plane.

Course Outcome
By the end of semester, students should be able to:

CO1: Determine Vickers hardness and Brinell hardnessvalues for different materials, calculate the ultimate tensile strength by using the empirical formulas and compare the testing results.

CO2: Determine the typical phenomena of creep responses at different creep rate and temperature-dependent creep behavior and determine fracture toughness and characteristics of metals from impact test.

CO3: Measure the friction with increased precision, friction coefficient for different materials combination and friction on inclined plane.

CO4: Determine the distribution of forces in simple girder structure and central force system and investigate the lever principle and application of moment on a crank with varied transmission ratio.

CO5: Determine the property and structural changes ofseveral plain carbon and low alloy steels at different heat treatment.

BMM1533
Strength of Materials 1
Credit Hour: 3
Prerequisite: BMM1532 Statics

Synopsis
This course introduces the concept of stress, stress and strain under axial loading, torsion, pure bending, analysis and design of beams for bending,

shearing stresses in beam and thin-walled members and transformations of stress and strain.

Course Outcome
By the end of semester, students should be able to:

CO1: Analyze the stresses and strains problems in structural members.

CO2: Analyze the circular and noncircular member problems which are subjected to twisting couples or torques.

CO3: Analyze the stresses and strains problems in members subjected to pure bending and transverse loading.

CO4: Analyze and design of beams for bending.

BMM1553
Dynamics
Credit Hour: 3
Prerequisite: BMM1532 Statics

Synopsis
This course introduces kinematics (motion of rigid body) inclusive of absolute and relative motion (displacement, velocity and acceleration) and dynamics (forces, work, energy, inertia and momentum).Students will also be exposed to a mini project using Working Model 2D software.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the kinematics (motion of rigid body) inclusive of absolute and relative motion (displacement, velocity and acceleration) and dynamics (forces, work, energy, inertia and momentum).

CO2 Understand and analyze the linkage mechanisms.

CO3 Solve the problems of mechanical system using the theories in kinematics and linkage mechanism.

CO4 Model a working mechanical system to transmit motion or load.

BMM2021
Quality and Environmental Management System
Credit Hour: 1
Prerequisite: None

Synopsis
The objective of this course is to analyse the philosophy and implementation of Quality Management, Total Quality Management and the Environmental Management. In Total Quality Management, students shall be exposed to the four Quality components, namely; Quality Planning, Quality Control, Quality Assurance and Quality Improvement. In Environmental Management, students will examine the impact of environmental issues on organizational structure and operations from a management perspective with a focus on how environmental concerns create both threats and opportunities, and how they affect organizational strategic management. Through project

assignments, students will be exposed to "real world" problems through the development of case studies and the application of techniques and processes selected by class members.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the relevance of the course and understand an overview of Quality Management, Total Quality Management, Environmental Management and Corporate Social Responsibility.

CO2 Understand key management concepts and application of management tools; including Deming's management principles, ISO 9000, and PDCA.

CO3 Understand global and local environmental Issues and the design of Environmental Management System and Corporate Social Responsibility.

CO4 Understand Sustainable Energy and Environmental Practices, Malaysian Environmental Act and Regulations, and ISO 14000.

CO5 Integrate the knowledge gathered throughout the course to design Total Quality Management and Environmental Management System in an organization/workplace.

BMM2433
Electrical & Electronics Technology
Credit Hour: 3
Prerequisite: None

Synopsis
This course introduces fundamental of electric circuit, circuit network analysis, electromagnetism, transformer, inductance and capacitance. The electronics technology covers operational amplifiers, diodes, bipolar junction transistor (BJT), and digital logic circuits.

Course Outcome
By the end of semester, students should be able to:

CO1 Identify the principle of electrical circuits.

CO2 Apply the circuit network analysis.

CO3 Analyze the electromagnetism, transformer, inductance and capacitance

CO4 Analyze and solve the operational amplifier, diodes and BJT problems.

CO5 Analyze and solve the logic circuits problem and design of logic circuit.

BMM2513
Thermodynamics 1
Credit Hour: 3
Prerequisite: None

Synopsis
This course focuses on the understanding fundamental and application of thermodynamics knowledge in various engineering systems. The subject covers the concepts of thermodynamics laws and entropy, and analysis of energy, heat engines, refrigerators and heat pumps.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand and apply Thermodynamics concept and statements of Thermodynamics law.

CO2 Understand and evaluate properties of pure, simple compressible substances and ideal gases.

CO3 Understand and analyze the concept of 1st law in closed system.

CO4 Understand and analyze the concept of 1st law in open system.

CO5 Understand and evaluate entropy change in 2nd law.

BMM2533
Fluid Mechanics 1
Credit Hour: 3
Prerequisite:None

Synopsis
The objective of the course is to introduces knowledge and understanding about principle, properties and basic methods of fluid mechanics, and provide some understanding and analysis of some problems related to fluid mechanics. The subject covers topics such as concept of pressure and flow with its application, stability of floating bodies, and fluid in motion analysis, fluid momentum analysis, flow measurement devices, fluid friction in piping system and dimensional analysis. The students are also expected to do mini projects dealing with problems regarding the course outcomes.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand and be able to solve fluid statics problems.

CO2 Understand and be able to solve some problems in fluid in motion continuum concept.

CO3 Understand and be able to solve problems in fluid friction in pipes.

CO4 Understand and be able to solve some problems in fluid flow measurement.

CO5 Understand and be able to apply the concept of dimensional analysis

BMM2613
Computer Aided Design
Credit Hour: 3
Prerequisite: None

Synopsis
This course introduces engineering drawing, fundamentals of drawing, introduction to CAD software, 2D & 3D drawing command, coordinate system, organizing the drawing and CAD drawing setting.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the fundamentals of drawing and information in CAD.

CO2 Apply 2D drawing using CAD software.\

CO3 Apply 3D drawing using CAD software.

CO4 Design mechanical engineering product using CAD software.

BMM2582
Strength of Material 2
Credit Hour: 2
Prerequisite: BMM1533 Strength of Materials 1

Synopsis
This course introduces students to analyze shearing stresses in beams and thin-walled members, transformations of stress and strain state, stresses under combined loadings on rectangular and round members, deflection of beams, buckling of columns.

Course Outcome
By the end of semester, students should be able to:

CO1 Analyse shearing stresses in beams and thin-walled members.

CO2 Analyse transformations of stress and strain.

CO3 Evaluate state of stresses under combined loadings.

CO4 Evaluate beam deflection problems.

CO5 Evaluate buckling of columns.

BMM2521
Engineering Mechanics Laboratory 2
Credit Hour: 1
Prerequisite: BMM1533 Strength of Materials and BMM1553 Dynamics

Synopsis
This laboratory course introduces students to basic properties of material and kinetics and kinematics of particles and rigid bodies through a series of experiments. Students will conduct experiments of tensile, compression, torsion, fatigue, bending moment, shearing stress, transformations of stress and strain in material lab. Experiments on dynamic aspect include projectile, pendulum, inertia in rotational motion and

rolling disc on an incline plane. Students will learn experimental technique, data collection, analysis of results and presentations of results.

Course Outcome

By the end of semester, students should be able to:

CO1 Determine the common properties of material under tension and compression.

CO2 Determine the common properties of material under torsion and cyclic loading.

CO3 Determine the effect of bending moment and shearing force on a bar.

CO4 Investigate the effect of free-flight projectile motion in gravitational field through an experiment and determination ofconservation of energy through pendulum experiment.

CO5 Determine planar kinetics of rigid bodies utilizing force and acceleration principles and planar kinematics of rigid bodies on inclined plane through experiments.

BMM2523 (y2)
Thermodynamics 2
Credit Hour: 3
Prerequisite:BMM2513
Thermodynamics 1

Synopsis

This course focuses on the application of the thermodynamics knowledge in various engineering systems. The subject covers the gas and vapour power cycles, refrigeration and heat pump systems, the complete air conditioning system, and the concepts of chemical reactions in combustion.

Course Outcome

By the end of semester, students should be able to:

CO1 Understand and apply the concepts in various problems involving gas power cycles.

CO2 Understand and apply the concepts in various problems involving vapour power cycles.

CO3 Understand and apply the concepts in various problems involving mechanical vapour compression cycles.

CO4 Understand and apply the concepts in various problems involving air conditioning processes.

CO5 Understand and apply the concepts in various problems involving the combustion processes.

BMM2543 (y2)
Fluid Mechanics 2
Credit Hour: 3
Prerequisite: BMM2533 Fluid Mechanics 1

Synopsis
This course introduces the flow over immersed body, boundary layer analysis, compressible fluids flow, application in pumps and turbines.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand and solve flow over immersed bodies and boundary layer problems.

CO2 Understand and solve compressible flow problems.

CO3: Understand and analyze pumps and pump systems problems.

CO4 Understand and Analyze turbine problems.

BMM3011 (y3)
Engineer and Society
Credit Hour: 1
Prerequisite: None

Synopsis
This course introduces the history of science and technology; the engineering profession and the role and responsibilities of mechanical engineers. Students are reminded of their future responsibilities through abiding closely the code of ethics, code of conduct and code of practice well laid out for engineers. The course incudes narration of the status and growth of selected local industry, job opportunities in both government and private sectors, the law that governs the engineering profession, the importance of engineering societies and organisations, as well as exposure to the route to become a professional engineer. Throughout the course students are exposed to the challenges that future engineers face in this changing world with regards to environment and sustainability, and entrepreneurial opportunities that they could identify in meeting and coping up with these challenges.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the engineering profession and the overall role of engineers to society.

CO2 Understand the code of ethic, code of conduct, code of practice, public responsibility and professional liabilities.

CO3 Understand the local industries development and the government development plans and programmes, as well as challenges and job opportunities in both public and private sectors.

CO4 Understand the Malaysian Government and Legal System; Acts and Laws that govern the engineers; as well as the route to become a professional engineer.

CO5 Understand the extra responsibility that

engineers shall face related to development against sustainability, and identification of entrepreneurial opportunities.

BMM3643
Manufacturing Processes
Credit Hour: 3
Prerequisite: BMM 1523 Engineering Material

Synopsis
This course introduces students to industrial manufacturing processes used for converting raw materials into finished products. Various processes, machinery, and operations will be examined with emphasis placed on understanding engineering materials and processing parameters that influence design considerations, product quality, and production costs. Sustainable manufacturingprocess will be discussed in student project presentation.

Course Outcome
By the end of semester, students should be able to:

CO1 Distinguish between all types of metal & polymer solidification processes.

CO2 Distinguish between forming of metals,plastics, ceramics and composite materials using sheet, bulk or powder raw materials.

CO3 Compare the major types of material removal processes and relate to the surface roughness and metrology analysis.

CO4 Explain the joining processes and surface treatments.

CO5 Develop and present a process flow to manufacture a conceptual product by considering the element of sustainability in manufacturing process.

BMM3532
Measurement & Instrumentation System
Credit Hour: 2
Prerequisite: None

Synopsis
This course introduces the principles of measurement, signal analysis and provides the students hands-on laboratory experiences with a variety of transducers and instruments (including 'virtual instruments'). Students are also exposed how to write substantial, professional, computer-generated technical reports.

Course Outcome
By the end of semester, students should be able to:

CO1 Describe the basic element in measurement and instrumentation system.

CO2 Understand the basics of signal analysis in

measuring signal from transducers.

CO3 Design the virtual instrumentation system to acquire data from transducer and analyze the data in Time and Frequency Domain.

CO4 Write a report that describes accurately and efficiently how a laboratory experiment was performed, presents the results and discusses the significance of the results obtained.

BMM3623
Mechanical Design
Credit Hour: 3
Prerequisite: BMM2582 Strength of Materials 2

Synopsis
This course covers introduction to design of machine elements, static and fatigue failure theories, as well as analysis of the implementation of machine components. Design of machine elements includes shafts, keys, bearings, gears, springs, screws and fasteners, as well as bolted and permanent joints. Students are guided how to select rolling bearings, use sealing elements, and apply lubrication on the speed reducer.Design of flexible mechanical elements includes belts and chains, clutches, brake and coupling. Open-ended design projects are assigned.

Course Outcome
By the end of semester, students should be able to:

CO1 Analyze the components to prevent premature failure due to static and dynamic service loads.

CO2 Design of shafts, springs, permanent and non-permanent joints.

CO3: Design of bearing and flexible elements such as brakes, clutches, belts and pulleys.

CO4 Design of gears.

CO5 Design an open ended project.

BMM3613
Automatic Control
Credit Hour: 3
Prerequisite: BMM 1553 Dynamics, BMM 1123 Engineering Mathematics 2

Synopsis
This course introduces linear, time-invariant (LTI) control system modeling, analysis and design. The covered topics are frequency domain modeling of mechanical, electrical and electro-mechanical systems; time response analysis, frequency response analysis, stability analysis and steady-state analysis. Control system design and analysis using PID controller technique.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the basic control system concepts and illustrate the required control system into block design process.

CO2 Develop frequency domain transfer function of linear time invariant (LTI) control systems for electrical, mechanical and electromechanical systems

CO3 Solve the transient response, steady-state response and system stability of LTI control system.

CO4 Solve control system compensators to achieve specified control system performances utilizing root-locus technique.

CO5 Design and analysis control system to achieve specified control system performances.

BMM3633
Industrial Engineering
Credit Hour: 3
Prerequisite: None

Synopsis
This course introduces Industrial engineering, productivity, facilities planning, facilities design, work study, human factors engineering, introduction to production planning and control, inventory management, total quality management system and quality control.

Course Outcome
By the end of semester, students should be able to:

CO1 Analyze the productivity in an organization by using productivity concept and fundamentals.

CO2 Select and apply the best layout based on the layout designprocedure location and basic layout design by taking intoaccount the impact of sustainable environment.

CO3 Design working environment based on work study and humanfactor engineering concept.

CO4 Analyze production planning, control and inventory management activities based on given cases.

CO5 Evaluate solutions for given cases based on total quality management systems.

BMM3562
Finite Element Methods
Credit Hour: 2
Prerequisite: BMM1533 Strength of Materials 1

Synopsis
This course covers the basics of Finite Element Method, some related mathematics and continuum mechanics, theory of Finite Element Method (FEM), application of FEM to solving solid mechanics, structural and scalar field problems, and finite element analysis of real world problems using FE software.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the basics of FEM in mechanical

engineering and its importance in industrial application.

CO2 Formulate and solve FE equations for structural problems, scalar field problems, and solid mechanics problems.

CO3 Set up an appropriate FE model of real world problems and analyze the resulting system using FE software.

BMM3553
Mechanical Vibrations
Credit Hour: 3
Prerequisite: BMM1553 Dynamics

Synopsis
This course introduces the fundamental of vibration, free vibration response for single, two and multi-degree of freedom, harmonically excited vibration response for single and two DOF system and some applications of vibrations in engineering.

Course Outcome
By the end of semester, students should be able to:

CO1 Describe the vibrational elements and dynamic characteristics of the mechanical systems and concept of resonance.

CO2 Model, formulate and obtain the solutions to vibration problems that contain free-vibration and forced-vibration analysis of one degree of freedom systems.

CO3 Model, formulate and obtain the solutions to vibration problems that contain free and forced-vibration analysis of two and multi degree of freedom systems.

CO4 Make use of instruments in measurement and analysis of vibration signatures.

BMM3611
Manufacturing Processes Laboratory
Credit Hour: 1
Prerequisite: BMM3643 Manufacturing Processes

Synopsis
This lab gives hands-on experience for students to learn about manufacturing processes through a series of laboratories with emphasis on safety requirements, engineering material and processing tools/machines. At the end of this course, laboratory activities will be evaluated based on the students' technical report.

Course Outcome
By the end of semester, students should be able to:

CO1 Identify safety awareness during manufacturing activities.

CO2 Experience hands on skill using tools, pre-processing equipment and machines for the selected processes.

CO3 Determine appropriate process setting during production activities.

CO4 Produce products based on the given design in the selected labs.

CO5 Produce technical report for the respective lab.

BMM3513
Heat Transfer
Credit Hour: 3
Prerequisite: BMM2523 Thermodynamics 2

Synopsis
The basic modes of thermal energy transfer viz., conduction, convection and radiation are introduced with emphasis on understanding the fundamental concepts to be used in solving real-life problems. The course includes the applicability of 1-D heat conduction in various geometries, the validity of one dimensional heat conduction in fins, the distinction between steady and unsteady states, the concept of boundary layer, the analogy between fluid flow and convective heat transfer, the distinction between free and forced convection, the properties of materials which are responsible for energy transfer by radiation, and the principles in the design of heat exchangers with emphasized on fundamental concepts.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the concept of conduction, convection and radiation heat transfer.

CO2 Understand and evaluate one-dimensional heat flow and in different geometries.

CO3 Understand and evaluate problems in single phase forced and free convection heat transfer.

CO4 Understand and evaluate simple radiation heat transfer.

CO5 Understand and evaluate the overall heat transfer coefficient for different kinds of heat exchangers.

BMM3521
Engineering Fluid Mechanics Laboratory
Credit Hour: 1
Prerequisite: BMM2543 Fluid Mechanics 2

Synopsis
This laboratory introduces the students to fundamental concepts of fluid mechanics experimentation, from the virtual instrumentation and data acquisition requirements to subsequent data analysis techniques. The fields of study are emphasized to include topics such as flow pattern over different immersed bodies, fluid flow determination and validation of Bernoulli's theorem, friction

losses in pipes, turbo-machinery and pump performance analysis.

Course Outcome
By the end of semester, students should be able to:

CO1 Apply fundamental concepts of virtual instrumentation and design complete measurement technique/system for laboratory experiment data collection.

CO2 Apply fundamental fluid mechanics concepts and conduct laboratory experiments.

CO3 Analyze experimental data and create complete instructor LAB SHEET.

BMM3531
Engineering Thermodynamics Laboratory
Credit Hour: 1
Prerequisite:BMM2513 Thermodynamics 1& BMM 2523 Thermodynamics 2

Synopsis
This laboratory introduces practical applications in thermodynamics and heat transfer disciplines. It cover the areas of properties of pure substance, first law and second law of thermodynamics, ideal gas law and perfect gas characteristics, gas compressors, refrigeration cycles, heat conduction, heat convection, as well as heat radiation.

Course Outcome
By the end of semester, students should be able to:

CO1 Apply the concept of sensor instrumentations and design the complete measurement technique/system for data collection during laboratory experimentations.

CO2 Devise detailed experimental methods and conduct experiments to prove thermodynamics concepts.

CO3 Devise detailed experimental methods and conduct experiments to prove heat transfer concepts.

BMM4022
Project Management
Credit Hour: 2
Prerequisite:BMM3633 Industrial Engineering

Synopsis
This course introduces the project management concepts in order to enhance the skills and managerial abilities and provide a holistic and integrative view of project management. The covered areas for project management are strategic management, organization structure and culture, project management, cost estimating as well as budgeting and project plan.

Course Outcome
By the end of semester, students should be able to:

CO1 Describe the classification and life cycle of the projects.

CO2 Describe and differentiate the project management organizational structures.

CO3 Describe and apply various frameworks and techniques of strategic plans of management.

CO4 Develop and analyze work breakdown structure (WBS) and project scheduling.

CO5 Analyze various methods for estimating project costs and project risk management.

BMM4623
Mechanical Systems Design
Credit Hour: 3
Prerequisite: BMM3623 Mechanical Design

Synopsis

This course prepares a detailed comprehensive design project considering the different stages of their design, manufacturing and assembly. The students will learn about project management, communication, documentation, working in teams, and design methodology. Design of mechanical engineering systems components includes problem definition, analysis, and synthesis, and development of a computational as well as physical model of their design. The projects challenge students to apply the knowledge and skills they learned throughout their degree programme to real-world problems. They are also trained on application of the design process to solve an engineering problem which includes interdisciplinary parameters such as human factors, engineering economy, safety, environmental, and societal aspects of their design, etc. The students work in small teams under the close supervision of faculty members. Each team produces detailed drawings, comprehensive specifications, a presentation, and a prototype of the proposed design. They also write design reports and prepare posters describing their work. All reports are expected to meet professional standards.

Course Outcome

By the end of semester, students should be able to:

CO1 Design a system, component and apply knowledge of current and contemporary issues.

CO2 Analyze and optimization of the design project.

CO3 Communicate effectively and engage in life-long learning.

CO4 Practice professional, ethical responsibilities and function as a successful team member.

CO5 Utilize the techniques, skills, and modern engineering tools.

BMM4703(Elective course – BMM -1)
Hydraulic and Pneumatic
Credit Hour: 3
Prerequisite: BMM2543 Fluid Mechanics 2

Synopsis

This course introduces hydraulic system, hydraulic components, hydraulic system design, pneumatics system, pneumatic components,pneumatic system design, electro fluid power system and its design, as well as programmable logic controller (PLC) and its design.The hydraulic section will touch on introducing fluid power**,** hydraulic systems and components, as well as basic fluid-related measurements.For the hydraulic circuit design section, students will be able to design and analyze basic hydraulic and electro-hydraulic circuit using Automation Lab software. In the pneumatics section, students will be able to calculate pneumatic problems using basic gas laws,as well as explain the pneumatic systems and components.For the pneumatic circuit design section, students will be able to design and analyze basic and multiple pneumatic circuits as well as electro-pneumatic circuits using Automation Lab software.Lastly, in the programmable logic control section, students will learn to explain the components of Programmable Logic Controller (PLC) and will be able to design, analyze and integrate basic and repeated sequence of ladder diagram with hydraulic components in the Automation Lab.

Course Outcome

By the end of semester, students should be able to:

CO1 Explain, designand analyze the hydraulic system.

CO2 Explain, design and analyzethepneumatic system.

CO3 Explain and analyze electro fluid power systemwith electro components.

CO4: Design and analyzeelectro fluid power with programmable logic controller system via simulation and experimental.

BMM4723(Elective course – BMM - 2)
Mechanism Design
Credit Hour: 3
Prerequisite: BMM1553 Dynamics

Synopsis

This course introduces the fundamentals in the design of mechanisms. Theory of mechanism will be carried out in a serie of lectures and analysis and design of mechanism will be carried out in a serie of lab sessions. Topics that will be covered are mechanisms and kinematics, vector and position analysis, velocity analysis, acceleration analysis, cam design and kinematics analysis and mechanism analysis and synthesis.

Course Outcome

By the end of semester, students should be able to:

CO1 Explain mechanism by type of motion, degree

of freedom and type of elements.

CO2 Analyze the position of the links in a mechanism and the limiting position of the mechanism.

CO3 Analyze the angular velocity of a link and the velocity of any point on a link using relative velocity method

CO4 Analyze the acceleration of a point using relative acceleration method.

CO5 Design and construct the cam profile/mechanism.

BMM4733(Elective course – BMM - 3)
Power Plant Technology
Credit Hour: 3
Prerequisite: BMM2523 Thermodynamics 2, BMM2543 Fluid Mechanics 2

Synopsis

This course discusses power plant systemssuch as steam turbines, gas turbines, combined cycle power plants and sustainable energy power systems. This course also covers steam generators,fuels and combustions, economics of power generationand environmental issues related to power generation.

Course Outcome

By the end of semester, students should be able to:

CO1 Understand the sustainable energy issues in power generations.

CO2 Understand and analyze the basic process of power generation systems including sustainable power generationsystems.

CO3 Understand and analyze fuels and combustions in power plants.

CO4 Understand and analyze steam power plants and gas turbines.

CO5 Understand and analyze combined cycles and renewable energy power systems.

BMM4753(Elective course – BMM - 4)
Renewable Energy Resources
Credit Hour: 3
Prerequisite: None

Synopsis

This course introduces the need and concept of renewable energy resources including solar, geothermal, wind, biomass, ocean thermal, wave, tidal and other forms including fuel cells. Aspect of sustainability, technopreneurship and effective communication are embedded in the assignment of case studies.

Course Outcome

By the end of semester, students should be able to:

CO1 Evaluate the current and contemporary issues of renewable energy resources.

CO2 Analyzing solar and geothermal energy thermal energy conversion systems.

CO3 Evaluate the energy potential in the wind and understand the parameters involved.

CO4 Analyzing biomass conversion techniques into liquid and gaseous forms including the design of biogas digester.

CO5 Analyzing ocean energy conversion and fuel cells.

BMM4783(Elective course – BMM - 5)
Computational Fluid Dynamics (CFD)
Credit Hour: 3
Prerequisite: BMM2543 Fluid Mechanics 2, BMM1312 Computer Programming

Synopsis
This subject is to introduce thefundamentals and application of simulation of fluid mechanics phenomenon andsolving fluids problem via simulation. Holistic approaches of programmingand commercial software are essentials towards solving, analyzing and evaluating the results of fluid mechanics problem-based simulation. The objective of this subject is to provide the basic of simulation focusing on fluid problems in the form of mathematical model such as Navier-Stokes equation, and solve them numerically with the aid of programming software. The next step is to understand and utilize commercial software to solve engineering fluid problems based on actual physical shape appearance with more complex boundaries.

Course Outcome
By the end of semester, students should be able to:

CO1 Explain the fundamental concepts of CFD.

CO2 Understand and apply governing equations.

CO3 Understand and apply some of computational method.

CO4 Analyze and evaluate the simulation results of fluid problem.

BMM4793(Elective course – BMM - 6)
Welding & Joining Technology
Credit Hour: 3
Prerequisite: BMM3611 Manufacturing Process Laboratory, BMM2582Strength of Materials 2

Synopsis
This course introduces about joining and welding technology. The topic includes the overview of joining & welding processes, the fusion welding, arc physics, solid state welding, welding design, welding defects and its countermeasure. It also includes quality management system in welding and defect detection.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the fusion welding processes and arc physic.

CO2 Understand the varieties of solid state joining, brazing, soldering and modern joining techniques.

CO3 Design welded structure and analysis the welding strength.

CO4 Determine the welding metallurgy and defects of welded structure.

CO5 Determine the quality management system, welding defect and defect detection.

BMM4813(Elective course – BMM - 7)
Ergonomics
Credit Hour: 3
Prerequisite: BMM1532 Statics

Synopsis
This course introduces ergonomics study focusing on human physiological and psychological needs that cover anthropometry, biomechanics, anatomical and mechanical structure of the human body, energy utilizations and environment aspect. This course emphasizes onto productivity, health and safety of human.

Course Outcome
By the end of semester, students should be able to:

CO1 Identify ergonomics risk factor and hazards.

CO2 Illustrate the concept of human body.

CO3 Propose work station design and synthesize the influence of working environment.

CO4 Justify the overall concept of man-machine interaction environment.

CO5 Completion of ergonomics lab.

BMI4713(Elective course – BMM - 8)
Production Planning and Control
Credit Hour: 3
Prerequisite: BMM3633 Industrial Engineering

Synopsis
This course introduces production planning and control, forecasting, aggregate planning, production scheduling, Just-in-Time production, inventory management, material requirements planning. Simulation on production operation using Witness software is assigned.

Course Outcome
By the end of semester, students should be able to:

CO1: Apply quantitative, causal, and time series method to forecast the future production demand.

CO2 Apply chase demand, level demand and linear programming to determine the production schedule.

CO3 Analyze appropriate techniques to schedule the timing and sequence of operations.

CO4 Analyze two types of production control system between Just in Time and Material Requirement Planning

CO5 Analyze and determine optimum production layout by using Witness software.

BMI4733(Elective course – BMM - 9)
Quality Engineering
Credit Hour: 3
Prerequisite: BMM3633 Industrial Engineering

Synopsis
This course introduces students with basic knowledge on quality control engineering and management. It also introduces the statistical tools and techniques to monitor, control and improve product, process quality and expose students the concept of integrating human and technical aspects for managing quality itself.

Course Outcome
By the end of semester, students should be able to:

CO1 Describe fundamental knowledge on quality control, engineering, management and basic quality tools.

CO2 Evaluate frequency distribution, central tendency, dispersion and population of data by using statistical analysis method.

CO3 Construct appropriate control chart to analyze the variation in data and calculate the probability using statistical tools.

CO4 Develop control chart for non-conforming units and count of non-conformities.

BMM4803(Elective course – BMM - 10)
Corrosion Science and Engineering
Credit Hour: 3
Prerequisite: BMM1523 Engineering Material and BMM2582 Strength of Material 2

Synopsis
The course aims to investigate the fundamental causes of corrosion problems and materials failures. Emphasis is given on studying electro-chemical reactions of corrosion process, material selections and corrosion protections. In the laboratory, students shall involve with experiments to evaluate corrosion reactions, environmental failure, and basic methods for protection of materials.

Course Outcome
By the end of semester, students should be able to:

CO1 Determine specifically the fundamental concepts of electrochemistry in corrosion process.

CO2 Analyze and apply corrosion theories in industries sectors.

CO3: Analyze and apply material selection to solve various problems in several environments and conditions.

CO4 Evaluate corrosion test to calculate and analyse failure in industrial facilities.

CO5 Analyzehow to measure and predict rates of corrosion reactions, and how to design for material protection.

BMI4743(Elective course – BMM - 11)
Design for Manufacture and Assembly (DFMA)
Credit Hour: 3
Prerequisite: BMM 3643

Synopsis
This course focuses on methodologies and tools to define product development phases. It provides experience of working in teams to design high-quality competitive products. Primary goals are to improve the ability to reason about design, material and process alternatives and apply modeling techniques appropriate for different development phases.

Course Outcome
By the end of semester, students should be able to:

CO1 Understand the basic principles of design for manufacture and design for assembly.

CO2 Explain and differentiate the available DFMA techniques and guidelines.

CO3 Analyze and design parts to improve assembly and manufacturing methods.

CO4 Obtain competitive experience in real world work through class projects.

CO5 Use and apply the DFMA software in the design for manufacture and assembly technique.

BMA4703(Elective course – BMA - 1)
Automotive Technology
Credit Hour: 3
Prerequisite: None

Synopsis
This course provides the complete foundation and working principles in the automotive technology which includes workshop safety, tools, chassis, body, powertrain, auxiliary system, electrical & electronic, vehicle safety, HVAC, drivetrain, tires, suspension, steering and braking unit. In addition, significant projects are matched with fundamental topics for practical utilization of techniques,

skills and tools to solve engineering issues.

Course Outcome
By the end of semester, students should be able to:

CO1 Identify the various classifications of automobile chassis, body design, basic construction and major components and system in an automobile system, work shop OSHA, tools and equipment.

CO2 Review the operation of an automotive engine in terms of cycles, types, classification, construction and operate the engine performance testing equipment.

CO3 Distinguish the variety of automotive engine auxiliary systems, including fueling, valve train, intake, exhaust, supercharging, turbo charging, lubricating, cooling and emission control.

CO4 Examine the state-of-the-art function of automotive electrical, electronic, HVAC (heating, ventilation and air conditioning) System and Engine Management System (EMS).

CO5 Differentiate and evaluate the performance of various state-of-the-art drivetrain, differentials, tires, suspension, steering and braking system.

BMA4713(Elective course – BMA - 2)
Internal Combustion Engine
Credit Hour: 3
Prerequisite: BMM2523 Thermodynamics 2

Synopsis
This course provides the foundation and understanding of internal combustion engine which includes design, operating parameters, thermo-chemistry reaction for various combustion cycles, emission formation, effect to environment and its control method. By accomplishing significant projects such as component assembly, flow, performance, emission test, studentspossess a platform to build up professional techniques to design and conduct validating experiments.

Course Outcome
By the end of semester, students should be able to:

CO1 Analyze the engine performance and the effect of design parametric changes.

CO2 Analyze the engine performance using the fundamental principles of thermodynamic.

CO3 Analyze the engine performance using various thermodynamic cycles for ideal engines analysis.

CO4 Evaluate the engine performance using

detailed analysis and differentiate the normal and abnormal combustions, and the effect of operational parametric changes on exhaust pollutant emissions.

CO5 Identify the engine types, instrumentation and conduct actual analysis of engines.

BMM4723(Elective course – BMA 3)
Vehicle Dynamics
Credit Hour: 3
Prerequisite:

Synopsis
This course focuses on the fundamentals of vehicle dynamics, vehicle acceleration and braking performance, mechanics of pneumatic tires, vehicle ride, cornering characteristics, suspension and steering system behavior. By accomplishing a serie of laboratory exercises such as car handling, acceleration, braking, double lane change and suspension performance, students are able to build up independent skill in design, conduct and validate experiment results.

Course Outcome
By the end of semester, students should be able to:

CO1 Solve the basic vehicle motion problems and acceleration performance for different cases.

CO2 Evaluate the performance characteristics of the braking system.

CO3 Evaluate the aerodynamics, drag and rolling resistance of the tires.

CO4 Investigate the ride characteristics of the road vehicles and evaluate the performance for different cornering scenarios

CO5 Distinguish the characteristics of various suspension system designs and evaluate the performance of steering system.

BMA4733(Elective course – BMA 4)
Automotive Design and Styling
Credit Hour: 3
Prerequisite: None

Synopsis
This course introduces fundamental techniques of vehicle styling and the components associated such as sketching, rendering, surfacing, as well as model making. During the course students are exposed to techniques in automobile styling design through basic conceptual sketches, finished rendering, 2D and 3D graphics and clay model. This course also exposes students to automotive product planning, automotive packaging, engineering designs,

homologation, and automotive manufacturing and assembly.

Course Outcome
By the end of semester, students should be able to:

CO1 Create basic automotive sketches and rendering.

CO2 Express the requirements of automotive product planning, automotive packaging, engineering design, homologation, and automotive manufacturing and assembly.

CO3 Create an automotive styling project from understanding requirements to concept, sketching, rendering and model making.

CO4 Integrate automotive engineering, design and styling aspects via final critique session.

BMA4743(Elective Course – BMA 5)
Road Vehicle Aerodynamics (RVAD)
Credit Hour: 3
Prerequisite: BMM 2543

Synopsis
This course will enable students to understand the basic principles governing aerodynamics in relation to road vehicles, including the use of computational fluid dynamics software tools to solve aerodynamics problems.

Course Outcome
By the end of semester, students should be able to:

CO1 Define the fundamental of vehicle aerodynamics theories.

CO2 Apply drag coefficient and lift coefficient theory on road vehicle aerodynamics problem.

CO3 Analyze the flow field including under body flow effect and turbulence on a moving vehicle.

CO4 Analyze and evaluate the performance of a road vehicle by computational approaches.

BMM4912
Final Year Project 1
Credit Hour: 2
Prerequisite: Refer to PSM handbook (Students should have passed more than 80 Credit hours)

Synopsis
The final year project focuses on the real professional approach to engineering studies. Students will utilise their engineering knowledge and technical skill from the previous training to solve an engineering problem or project. Integration of various subject areas they have acquired throughout their mechanical engineering programme is strongly encouraged in this course.

Course Outcome
By the end of semester, students should be able to:

CO1 Plan the project development flow based on proper methods.

CO2: Assess an independent project with the minimum supervision from the project instructor.

CO3: Identify, examine, collect data, analyze and solve a research problems or scientific study.

CO4: Devise techniques in literature review and information prospection independently and build up specific knowledge and research interest in the engineering field.

CO5: Communicate during presentation and defend the research outcome at the end of the semester.

BMM4924
Final Year Project 2
Credit Hour: 4
Prerequisite: Refer to PSM handbook (Has passed more than 80 Credit hours)

Synopsis
This course is, in fact, the continuation of the Final Year Project 1. The Final Year Project is designed in two parts to ensure that the final year studentsconduct and spread their work consistently throughout the two semesters, and being evaluated at the end of both semesters. Throughout the two semesters, the students are guided and supervised closely by their respective project supervisors.

Course Outcome
By the end of semester, students should be able to:

CO1 Plan the project development flow based on proper methods.

CO2 Assess an independent project with the minimum supervision from the project instructor.

CO3 Identify, examine, collect data, analyze and solve a research problem efficiently.

CO4 Establish techniques for literature review and independently perform the ability to gather information and build up specific knowledge for report writing.

CO5 Communicate well during presentation and deliver the research outcome effectively.

BMM3996
Industrial Training
Credit Hour: 6
Prerequisite: Registered at least 70 credit hours

Synopsis:
This training exposes the students to professional skills and experience in the aspect of mechanical engineering practices. The exposure will help shape and produce future mechanical engineers with high responsibility, positive attitude and professional conduct, ready to face all challenges encountered in their future career.

Course Outcome:
By the end of semester, students should be able to:

CO1 Practice basic professional engineering skills at industry level.

CO2 Practice and relate the theory that had been learned during the involvement of real problems solving such as planning, design, construction and management of the projects.

CO3 Identify and solve practical problems that exist.

CO4 Identify the company or department structure and recognize the jobscope of specific post in the organization.

CO5 Build up interpersonal skills and professional ethics to be an excellent, motivated and responsible to the creator.

TABLE OF CURRICULUM STRUCTURE FOR DIPLOMA OF MECHANICAL ENGINEERING 2013/2014

		Code	Subject	Pre-requisite	Credit hours	Total Credit Hours
YEAR 1	0	UHL1412	Foundation English		2	4
		UHS 1021	Soft Skills 1		1	
		UQB 1011	Briged Siswa		1	
	1	UHL1422	English For Academic Skills		2	18
		UHM 1012	Islamic & Asian Civilizations I		2	
		DMM1113	Basic Mathematics		3	
		DMM1312	Computer Programming		2	
		DUF1113	Physics		3	
		DUK1113	General Chemistry		3	
		DMM1412	Engineering Drawing		2	
		DMM1911	Mechanical Technology Lab 1		1	
	2	UHL1432	English For Occupational Communication		2	19
		UHR2022	Hubungan Etnik		2	
		UHS2021	Soft Skills 2		1	
		DUM1123	Calculus		3	
		DMM1423	Electrical and Electronic Technology		3	
		DMM1512	Computer Aided Design		2	
		DMM1523	Engineering Materials	DMM1911	3	
		DMM1532	Statics		2	
		DMM1921	Mechanical Technology Lab 2		1	
YEAR 2	3	UGE1002	AsasPembudayaan Keusahawanan		2	20
		DUM2413	Engineering Statistics		3	
		DMM2633	Manufacturing Technology		3	
		DMM2412	Metrology		2	
		DMM2513	Solid Mechanics	DMM1532	3	
		DMM2523	Dynamics	DMM1532	3	
		DMM2543	Thermodynamics		3	
		DMM2931	Mechanical Technology Lab 3		1	
	4	DMM3011	Occupational Safety & Health		1	20
		DMM2533	Fluid Mechanics		3	
		DMM2632	Industrial Design		2	
		DMM3623	Hydraulics & Pneumatics Technology		3	
		DMM3673	Mechanical Design		3	
		DMM3663	CNC Technology		3	
		DMM3914	Final Year Project		4	
		DMM2941	Mechanical Tech Lab 4		1	
YEAR 3	5	DMM3999	Industrial Training		9	12
		DMM3993	Industrial Training Report		3	
	TOTAL CREDIT HOURS FOR DIPLOMA PROGRAMME				**93**	

CURRICULUM STRUCTURE FOR DIPLOMA OF MECHANICAL ENGINEERING 2013/2014

DMM1312
Computer Programming
Credit Hour: 2
Prerequisite: None

Synopsis
This course formally introduces the concept of computers, algorithms, pseudo code, problem solving, and programming languages. The programming language introduced in this course is C.

Course Outcomes
By the end of semester, students should be able to:

CO1 Interpret the computers and computing fundamentals.

CO2 Utilize C programmes structure, printing and comments and construct C programmes with the desired input/ output.

CO3 Construct C programmes with most suitable variables to perform correct arithmetic operations and math functions.

CO4 Construct C programmes with control structure and looping.

CO5 Construct C programmes with functions and numeric arrays.

DMM1412
Engineering Drawing
Credit Hour: 2
Prerequisite: None

Synopsis
To expose and implement the core engineering drawing knowledge to students. Students will learn the standard engineering drawing and its rules. This course is critical to students before they are exposed to Computer Aided Engineering, CAD course, DMM 1512 in the following semester.

Course Outcomes
By the end of semester, students should be able to:

CO1 Understand and interpret symbols of engineering drawing as a communicating language.

CO2 Draw basic shapes and tangencies and simple First/Third angle Projection.

CO3 Draw and interpret First and Third angle projections include cross-section.

CO4 Draw and interpret auxiliary view, isometric views and tolerance.

CO5 Draw and interpret simple assembled and section views in Third/First angle projection.

DMM1423
Electrical & Electronic Technology
Credit Hour: 3
Prerequisite: None

Synopsis
This course introduces the fundamentala of electric circuit, circuit network analysis, inductance and capacitance. The electronics technology involved with basic understanding of usage and application of semiconductors devices: diodes, transistor, and digital logic circuits.

Course Outcomes
By the end of semester, students should be able to:

CO1 Interpret electric series and parallel circuits.

CO2 Apply Ohm's Law and Kirchoff's Law to calculate current, voltage, resistance and power.

CO3 Calculate equivalent capacitance or inductance connected either in series or in parallel.

CO4 Describe and analyze the fundamental operation of semiconductor diodes performance.

CO5 Solve the digital electronics circuits, Boolean Algebra and design of logic circuits.

DMM1512
Computer Aided Design
Credit Hour: 2
Prerequisite: None

Synopsis
This subject is designed to teach engineering drawing to the students using Computer Aided Design Drawing (CAD) software. This will include from beginning to intermediate levels of CAD. Students should be able to draw 2D as well as 3D drawing standard upon completion of this course.

Course Outcomes
By the end of semester, students should be able to:

CO1 Explain basic knowledge in engineering drawing principles and standard practice using CAD fundamentals.

CO2 Apply knowledge and techniques to create standardised CAD related to engineering product design by using CAD software.

CO3 Define and differentiate the different functions and interfaces of other CAD software.

CO4 Able to use CAD software to produce a technical drawing of 2D and 3D components on project based.

DMM1523
Engineering Materials
Credit Hour: 3
Prerequisite: None

Synopsis
This course introduce students to the fundamentals of engineering materials which include application, atomic bonding, crystals structure, mechanical and physical properties, corrosion and degradation mechanism, microstructure analysis, phase diagram, ferrous and non-ferrous alloys, polymer and advanced materials and issues in economic, environmental, societal of materials engineering.

Course Outcomes
By the end of semester, students should be able to:

CO1	Explain the classification of engineering materials and describe its applications.
CO2	Analyse and evaluate the mechanical, physical and chemical properties engineering materials.
CO3	Analyse and explain metal alloys microstructure, phase diagram and heat treatment processes.
CO4	Analyse and explain ferrous and non-ferrous alloys microstructure, strengthening mechanism and its applications.
CO5	Analyse and define the polymeric materials and advanced materials classification.

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DMM1532
Statics
Credit Hour: 2
Prerequisite: DUF 1113

Synopsis
This course introduces students to mechanics, force vector, equilibrium of particles, force system resultants, equilibrium of rigid body, structural analysis, friction, centroids and centre of gravity and moment of inertia.

Course Outcomes
By the end of semester, students should be able to:

CO1	Solve force vector operation and resultant systems problem by using SI units and applying the Newton's Law of Motion.
CO2	Solve equilibrium of particle and rigid body problems.
CO3	Solve structural analysis problems.
CO4	Solve friction problems
CO5	Solve centroid and centre of gravity problems.

DMM1911
Mechanical Technology Laboratory 1
Prerequisite: NONE

Synopsis
This course introduces students with safe working habits, reading blueprints, identification, care and use basic measuring instruments, layout methods & basic hand tools. Emphasis is placed on operation of drill press, lathe & pedestal grinder.

Course Outcomes
By the end of semester, students should be able to:

CO1: Recognize unsafe conditions and practices in a workshop.

CO2: Practice the basic fundamentals of the use of basic measuring instruments, read and interpret blue prints.

CO3: Identify and use common hand tools.

CO4: Make correct selection and use of saws, drill and pedestal grinder.

CO5: Safely perform the various basic turning operations.

DMM 1921
Mechanical Technology Laboratory 2
Credit Hour: 1
Prerequisite: DMM1911 Mechanical Technology Laboratory 1

Synopsis
The course provides workshop practice, giving students hands-on experience of some of milling operations and surface & cylindrical grinding operations.

Course Outcomes
By the end of semester, students should be able to:

CO1: Safely perform various basic milling operations.

CO2: Safely perform the surface Grinding process.

DMM2412
Metrology
Credit Hour: 2
Prerequisite: None

Synopsis
This course covers the engineering measuring instruments such as micrometer, Vernier caliper, mechanical dial indicator, gauge block, surface plate, instruments for testing angle and gauges as well as principles of surface metrology and roundness measurement. The relationship of drawing dimensions to the measurement of parts, precision, accuracy and measurement errors are also discused.

Course Outcomes
By the end of semester, students should be able to:

CO1: Explain the fundamental of inspections and procedures by utilizing various methods and techniques.

CO2: Identify measurement errors and platform preventive or corrective actions.

CO3: Demonstrate and inspection of linear and angular measurements using various measurement instrument.

CO4: Describe and identify the principles of surface metrology and calculate surface roughness by various methods.

CO5: Describe and identify the principles of roundness measurement by using various methods.

DMM2513
Solid Mechanics
Credit Hour: 3
Prerequisite: DMM 1532 Mechanical Technology Laboratory 3

Synopsis
This course introduces the concept of stress and strain under axial loading, torsion, pure bending, analysis and design of beam for bending as well as deflection of beam.

Course Outcomes
By the end of semester, students should be able to:

CO1 Solve the simple stress problems in load-bearing structures.

CO2 Solve the stresses and strains in structural members subjected to axial loads.

CO3 Solve the circular shafts subjected to twisting couples or torques.

CO4 Solve the stresses and strains in prismatic members subjected to pure bending and transverse loading by using shear force and bending moment diagram.

CO5 Solve beam deflection problems.

DMM2523
Dynamics
Credit Hour: 3
Prerequisite: DMM 1532

Synopsis
This course introduces kinematics of particles, kinetics of particles utilizing force and acceleration principles, kinetics of particles utilizing work and energy principles, kinetics of particles utilizing impulse and momentum principles, planar kinematics of rigid bodies and planar kinetics of rigid bodies utilizing force and acceleration principles.

Course Outcomes
By the end of semester, students should be able to:

CO1 Solve kinematics of particle problems.

CO2 Solve kinetics of particles problems utilizing force-acceleration andwork-energy principles.

CO3 Solvekinetics of particles problems utilizing impulse and momentumprinciples.

CO4 Solve planar kinematics of rigid-body problems.

CO5 Solve planar kinetics of rigid body problems utilizing force and acceleration principles.

DMM2533
Fluid Mechanics
Credit Hour: 3
Prerequisite: DMM 1532 Mechanical Technology Laboratory 3

Synopsis
This course introduces properties of fluids, fluid statics, fluid in motion, flow measurement, friction in fluid flow and pumps & pumping.

Course Outcomes
By the end of semester, students should be able to:

CO1 Understand and solve fluid properties problems.

CO2 Understand and solve fluid statics problems.

CO3 Apply the concepts of fluid in motion.

CO4 Solve problems involving flow measurement and fluid friction.

CO5 Understand the concept of flow, work and pump to typical problems.

DMM2543
Thermodynamics
Credit Hour: 3
Prerequisite: NONE

Synopsis
This course includes a study of properties of a system, properties of pure substance, first law and second law of thermodynamics and entropy.

Course Outcomes
By the end of semester, students should be able to:

CO1 Apply the basic concepts and terminology of thermodynamics.

CO2 Apply thermodynamics properties of pure substances from tables of property data.

CO3 Apply the concept of heat, work and mass to typical problems.

CO4 Solve the problems involving first law & second law analysis of thermodynamics systems.

CO5 Solve the entropy changes problems for pure substances and ideal gas.

DMM2632
Industrial Design
Credit Hour: 2
Prerequisite: NONE

Synopsis
This course introduces students on how to formulate product design development problem for simple mechanical components and systems through lectures and design projects. A large portion of this class lectures will be devoted into class projects and product fabrication job.

Course Outcomes
By the end of semester, students should be able to:

CO1 Define the term of Industrial Design and express the importance of Industrial Design.

CO2 Describe the steps of identifying customer needs.

CO3 Define and construct product design specifications.

CO4 Identify and practice concept generation and concept selection process.

DMM2633
Manufacturing Technology
Credit Hour: 3
Prerequisite: NONE

Synopsis
This course provides basic principles in machining processes and machine tools, forming and shaping, joining and metal-casting processes, and non-traditional manufacturing processes used in manufacturing.

Course Outcomes
By the end of semester, students should be able to:

CO1 Explain the definition and importance of manufacturing.

CO2 Identify and compare different types of machining processes and machine toolsin manufacturing.

CO3 Distinguish various kinds of forming and shaping processes and equipment.

CO4 Explain about joining and metal-casting processes and equipment.

CO5: Analyze, compare and select appropriate processes, materials, machines, tools orequipment to manufacture an engineering product.

DMM2931
Mechanical Technology Laboratory 3
Credit Hour: 2
Prerequisite: NONE

Synopsis
To introduce and involve hands-on activities, putting knowledge and understanding into practice. The students should be able to carry out the basic knowledge of welding by several welding operations using welding equipment and using electrode, MIG, TIG and spot weld. The course also introduces students to basic application of sheet metal fabrication.

Course Outcomes
By the end of semester, students should be able to:

CO 1 Safely perform various welding operations using welding equipment.

CO 2 Understand the different types of welding procedures and method.

CO 3: Safely perform various metal fabrications.

CO 4: Understand the different types of metal fabrication procedures and methods.

DMM2941
Mechanical Technology Laboratory 4
Credit Hour: 2
Prerequisite: NONE

Synopsis
This course introduces students to apply safe working conditions, identify common materials to use in fabrication work, draw and read technical drawings, identify, care and use basic measuring instruments, layout methods and basic hand tools. Emphasis is placed upon operation of machining equipment such as drill press, lathe, milling and surface grinding. The students should also be able to carry out the knowledge of welding process and method by several welding operations using welding equipment and using electrodes, MIG, TIG and spot weld, and finally the fabrication process.

Course Outcomes
By the end of semester, students should be able to:

CO 1 Apply the technique to use machining equipment.

CO 2 Apply the technique to write technical reports

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CO 3 Apply the materials handling equipment concept and the principles of materials handling.

CO4 Apply the technique to use welding equipment.

CO5 Apply all knowledge to safely perform various processes for fabrication work.

DMM3623
Hydraulic & Pneumatics Technology
Credit Hour: 3
Prerequisite:NONE

Synopsis
This course provides the necessary information of hydraulics and pneumatics for automation application purposed. It will cover all information of hydraulics and pneumatics such as, pump, cylinders, fluid control valves and hydraulics and pneumatics circuit.

Course Outcomes
By the end of semester, students should be able to:

CO1 Design hydraulics and pneumatics circuits.

CO2 Design electro-hydraulics and electro-pneumatics circuit.

CO3 Design and simulate pneumatic/hydraulic system using PLC(Programmable Logic Controller).

DMM3663
CNC Technology
Credit Hour: 3
Prerequisite: NONE

Synopsis
This course is a study of the CNC machining technology which focuses on the understanding and application of CNC profile and 2-D contouring. A proper selection of jig needs to be considered so as not to overlap with the profile and 2-D contouring.The profile is then simulated using CNC simulator, and finally, a CNC project is developed from the simulation.

Course Outcomes
By the end of semester, students should be able to:

CO1 Explain basic CNC machine system.

CO2 Develop CNC programme manually.

CO3 Understand process planning for machining process.

CO4 Present the completed product of the machining process.

DMM3673
Mechanical Design
Credit Hour: 3
Prerequisite: None

Synopsis
This course introduces simple design processes of machine components for static and dynamic loading. Machine elements design includes screws, bolts, fasteners, welded joints, springs and shafts, as well as keys.

Learning Outcomes
By the end of semester, students should be able to:

CO1 Understand the fundamentals of machine design and applyknowledge of mechanical elements for non-permanent jointincluding screws, bolts and fasteners.

CO2 Understand and apply knowledge of welding and permanentjoints.

CO3 Understand and apply knowledge of mechanical springs.

CO4 Understand and apply knowledge of shafts, keys and coupling.

DMM3914
Final Year Project
Credit Hour: 4
Prerequisite: DMM 2513(Passed more than 60 credit hours)

Synopsis
This course involves project assignment to final year diploma students concerning selected topics related to mechanical engineering. The technical project requires a particular design of appropriate equipment/system, development of the manufacturing process, testing and analysis of the system or equipment, and preparation and presentation of the project report.

Learning Outcomes
By the end of semester, students should be able to:

CO1 Plan the project development flow based on proper methods.

CO2 Establish techniques for literature review and independently perform the ability to gather information.

CO3 Utilise technical knowledge to solve the problems and finish the project.

CO4 Communicate effectively during project presentations.

CO5 Build up specific knowledge for report writing.

DMM3999

Industrial Training
Credit Hour: 9
Prerequisite: Pass all core subjects with the status "KedudukanBaik (KB)" on current evaluation.

Synopsis
This training exposes students to professional skills and experience in aspects related to mechanical engineering practices. The exposure will help to shape and produce future technical assistants of high responsibility, positive attitude, and able to face all challenges in their career development.

Learning Outcomes
By the end of semester, students should be able to:

CO1 Practice basic professional engineering skills at industry level.

CO2 Practice and relate the theory that had been learned during the involvement of real problems solving such as planning design, construction and management of the projects.

CO3 Identify and solve practical problems that exist.

CO4 Identify the company or organizational structure and recognize the job scope of specific positions in the organization.

CO5 Build up interpersonal skills and professional ethics to become excellent, motivated and responsible to the Creator.

DMM3993
Industrial Training Report
Credit Hour: 3
Prerequisite: Pass all core subjects with the status "KedudukanBaik (KB)" on current evaluation.

Synopsis
Following the Industrial Training, this course trains the final year students to write professional reports related to the experience and exposure gathered during the Industrial Training.

Learning Outcomes
By the end of semester, students should be able to:

CO1 Practice basic professional engineering skills at industry level.

CO2 Practice and relate the theory that had been learned during the involvement of real problems solving such as planning, design, construction and management of the projects.

CO3 Identify and solve practical problems that exist.

CO4 Identify the company or organizational structure and recognize the job scope of specific positions in the organization.

CO5: Build up interpersonal skills and professional ethics to be excellent, motivated and responsible to the Creator.

LABORATORY FACILITIES

Laboratories in the faculty complement all coursesand programmes offered by the faculty, including information and computing technologies (ICT). Detailedlaboratory facilities provided by the Faculty of Mechanical Engineering are as listed below:

- **Statics and Dynamics Laboratory**
- **CAE Laboratory 1 and 2**
- **Metrology Laboratory**
- **Electric & Electronics Laboratory**
- **Automation (Hydraulics& Pneumatic) Laboratory**
- **General Machining Laboratory**
- **Mechanical Design Laboratory**
- **Thermodynamics Laboratory**
- **Welding and Fabrication Laboratory**
- **Mechanic of Materials Laboratory**
- **Fluid Mechanics Laboratory**
- **Plastics Processing Laboratory**
- **Metal Forming Laboratory**
- **CNC Machining Laboratory**
- **CIM Laboratory**
- **Noise, Vibration & Harshness Laboratory**
- **Automotive Design Laboratory**
- **Automotive Service and Maintenance**
- **Engine Performance Laboratory**
- **Vehicle System Laboratory**
- **Alternative Energy & Combustion Laboratory**
- **Industrial Engineering Laboratory**
- **Heating, Ventilation and Air Conditioning Laboratory**
- **Foundry Laboratory**

CAREER OPPORTUNITIES

The Mechanical Engineering profession is needed in almost all working fields from industrial to agricultural and medical sectors. Mechanical Engineers also assume the main role in providing technologies to serve the community and ease their everyday life. Examples of such technologies are; satellites, space ships, airplanes, ships, commercial vehicles, home utilities and healthcare products. Examples of industries and sectors that require the expertise of Mechanical Engineers are:

- Automotive industry
- Manufacturing, control system, robotic and automation industry
- Marine industry
- Petrochemicals, gas and mineral industry
- Plantations and food products industry
- Biotechnology and biomedical industry
- Service, research and development (R&D) and engineering management firm
- Aerospace and satellites industry
- Medical sector, and
- Academic sector.

Mechanical Engineering

A career in Mechanical Engineering is linked to the efficiency of usage in physical and human resources which can improve the standard and comfort of human beings' lives. Mechanical Engineers combine their knowledge in Physical Science and Engineering with their experience, wisdom and research to create and handle instruments and mechanical systems found in the industry. Engineers also design mechanical manufacturing instruments that can handle production and usage. In the Mechanical Engineering programme,students are therefore trained to assume responsibility to be able to build their ability to confront problems critically.

Graduates in this field must be able to fill available positions as technological members in the government, semi-government and private sectors. Degree holders in this field will serve as engineers who will help in planning, design and also management. They can also venture into various fields such as factories, manufacturing, design, and research.

A very important learning aspect that students of the Faculty of Mechanical Engineering, Universiti Malaysia Pahang acquire when they graduate is their conscience and awareness on the importance of energy and environment sustainability. With solid grounding in the principles and practice of Mechanical Engineering, together with special training on their role towards sustainability our graduates are ready to engage in ethical approaches to engineering with strong concern for the society they serve and the environment.

Automotive Engineering

Graduates of this programme can fulfill the needs of the professional force in the field of automotive industry. Demand for engineers in this field is on the rise due to the growth of the automotive industry in Malaysia. Graduates in this area shall have no difficulty adapting themselves to the industry as they are already in some way or other being involved in joint projects between the faculty and the automotive industry when they were still as students.

For any further inquiry, please contact:

Faculty of Mechanical Engineering
Universiti Malaysia Pahang
26600 Pekan
Pahang Darul Makmur.
Tel: +609- 4246200
Fax: +609-4246222
Website: http://fkm.ump.edu.my