UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ACADEMIC HANDBOOK SESSION 2019/2020

FOR BACHELOR DEGREE AND DIPLOMA PROGRAMMES

FACULTY OF MECHANICAL ENGINEERING
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FKM

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FOREWORD BY THE DEAN

In the name of Allah, Most Beneficial, Most Merciful
Assalamualaikum and Salam Sejahtera,

First and foremost, I would like to welcome all new students of Faculty of Mechanical Engineering (FKM) to Universiti Teknikal Malaysia Melaka (UTeM). Congratulations for being selected to be a part of our engineering programmes. You have indeed made the right decision which will prepare you to be skilled and competent engineers with commendable leadership qualities.

The main objective of this academic handbook is to be a point of reference for students to understand and get to know both the faculty and the programmes offered at the university, especially in FKM. Students are exposed to the world of knowledge, competency and skills which are blended together to develop their self-esteem in philosophy, creativity and critical thinking, as well as to strengthen their commitments in serving the country. It is also aimed to equip students to be well-prepared in facing real-world challenges to survive in their future career.

In the context of professional graduates, our faculty provides various facilities for students in developing their skills and self-competency. 'Research Power House', which aims to educate and instill research practices will prepare our graduates to pursue further studies at the postgraduate level. Our continuous effort in preparing a series of demand-driven laboratories to serve our partners from both the industry and also agencies is indeed another step forward in creating a dynamic R&D environment at FKM, in line with the national policy towards supporting the IR4.0 ecosystem. In addition, FKM also provides courses and vocational competency certificates to prepare students as work-ready graduates who will be the expert group for the workforce.

Hence, I strongly hope that this academic handbook will be beneficial to our students as a useful guide throughout their studies at FKM and UTeM. Lastly, I would like to wish all our upcoming and current students all the best in embarking their journey in this faculty.

"FKM - GEARED FOR EXCELLENCE"

Thank you.

Dr. Ruztamreen bin Jenal
Dean
Faculty of Mechanical Engineering

1 BACKGROUND OF UTeM

1.1 History

On December 1st, 2000, the Ministry of Education of Malaysia has officially approved the establishment of a new public university in the name of Kolej Universiti Teknikal Kebangsaan Malaysia (KUTKM). The establishment of KUTKM is to fulfil the needs of prospective industries on professional manpower in technical areas that not only have sound academic ability, but also competent and highly technical skilled. As the 14th public higher learning institution established in Malaysia, KUTKM has experienced many challenges and impediments in order to be a renowned university. KUTKM supports application-oriented approach and practice in its Teaching and Learning (T&L) processes.

On February 1st, 2007, KUTKM has been renamed and presently known as the Universiti Teknikal Malaysia Melaka (UTeM). From the beginning of the establishment, UTeM has upheld and maintained technical education programmes which fulfil the needs of current industries and tech-based employers. The students of UTeM come from diverse backgrounds which include science, technical and vocational streams.

1.2 Vision, Mission, Motto and Educational Goals

The vision, mission, motto and educational goals of UTeM are as follows:

1.2.1 Vision

"To Be One of the World's Leading Innovative and Creative Technical Universities"

1.2.2 Mission

UTeM is determined to lead and contribute to the wellbeing of the country and the world by:

1. Promoting knowledge through innovative teaching & learning, research and technical scholarship;
2. Developing professional leaders with impeccable moral values;
3. Generating sustainable development through smart partnership with the community and industry."

1.2.3 Motto

"Excellence Through Competency"

1.2.4 Educational Goals

1. To conduct academic and professional programmes based on relevant needs of the industries.
2. To produce graduates with relevant knowledge, technical competency, soft skills, social responsibility and accountability.
3. To cultivate scientific method, critical thinking, creative and innovative problem solving and autonomy in decision making amongst graduates.
4. To foster development and innovation activities in collaboration with industries for the prosperity of the Nation.
5. To equip graduates with leadership and teamwork skills as well as develop communication and life-long learning skills.
6. To develop technopreneurship and managerial skills amongst graduates.
7. To instill an appreciation of the arts and cultural values and awareness of healthy life styles amongst graduates.

1.3 Location

From 2001 to 2005, UTeM, which was then known as KUTKM, was located in renovated shophouses in Taman Tasik Utama, Ayer Keroh. These renovated shophouses consist of the university administrative offices, lecture halls, laboratories, staff rooms along with student accommodation.

On June 10th, 2001, KUTKM began offering academic programmes with pioneer student intake of 348 students. At present, UTeM has eight faculties and one post graduate (PG) centre that offer programmes at Diploma, Bachelor Degree or PG levels. The faculties are:

a. Faculty of Mechanical Engineering (FKM)
b. Faculty of Electronics & Computer Engineering (FKEKK)
c. Faculty of Electrical Engineering (FKE)

d. Faculty of Manufacturing Engineering (FKP)
e. Faculty of Information & Communication Technology (FTMK)
f. Faculty of Technology Management & Technopreneurship (FPTT)
g. Faculty of Mechanical & Manufacturing Engineering Technology (FTKMP)
h. Faculty of Electrical & Electronic Engineering Technology (FTKEE)
i. Centre of Graduate Studies (PPS)

UTeM has 2 campuses; which are the Main Campus at Durian Tunggal and Technology Campus at Ayer Keroh.

1.3.1 Main Campus

The Main Campus is located at the Mukim Durian Tunggal, Melaka on a piece of land that has been developed since 2001. The Faculty of Electronics & Computer Engineering and the Faculty of Electrical Engineering have commenced their operations at the Main Campus since 2005. In 2009 another three faculties, namely the Faculty of Mechanical Engineering, the Faculty of Manufacturing Engineering and the Faculty of Information & Communication Technology, started operating in the main campus. However, in 2011, Faculty of Mechanical Engineering was relocated at the Technology Campus, Ayer Keroh. In addition, Institute of Technology Management & Entrepreneurship (IPTK), Centre for Languages and Human Development (PBPI), the Sports Complex, the Student Activity Centre and students' cafeteria are completed and utilized. Sports grounds such as fields for football, hockey, tennis and various other sports facilities are also available at the Main Campus. The university administrative offices have been fully operational since?? at the Main Campus; such as the Chancellery, Registrar, Bursary, Knowledge and Communication Services Centre, Centre for Academic Excellence and Scholarship, Centre for Strategic, Quality and Risk Management, University Press, Laman Hikmah Library, Grand Hall and Sayyidina Abu Bakar Mosque.

1.3.2 Technology Campus

The Technology Campus is located in Kawasan Perindustrian Tasik Utama, Ayer Keroh which houses the Faculty of Mechanical Engineering, Faculty of Mechanical & Manufacturing Engineering Technology (FTKMP) and Faculty of Electrical & Electronic Engineering Technology (FTKEE). Most of FKM's laboratories are located at the Mechanical Engineering Laboratory Complex, Taman Tasik Utama, Ayer Keroh.

1.4 University Organization

In 2004, UTeM revamped its structure of organization. New departments were established including the Centre for Teaching & Learning (PPP), Centre for Graduate Studies (PPS), and Centre for Quality Assurance & Accreditation (PJKA) which is now known as Centre for Strategic, Quality & Risk Management (PPSKR). In 2008, several other centres were opened including Centre for Languages & Human Development (PBPI), Sports Centre, and Islamic Centre.

The university's organization consists of the University's Senate and the University Executive Council. In 2010, there are improvements on the university's structure of organization. Shown in Figure 1.1 is the current organization structure of UTeM top management with the 1st female vice chancellor of UTeM, appointed in June, 2019.

PROF. DR. RAHA BINTI ABDUL RAHIM

VICE CHANCELLOR

PROF. DATUK Ts. DR. MOHD RAZALI BIN MUHAMAD

DEPUTY VICE CHANCELLOR
(ACADEMIC & INTERNATIONAL)

PROF. DR. ZULKIFLIE BIN IBRAHIM

DEPUTY VICE CHANCELLOR
(RESEARCH & INNOVATION)

ASSOC. PROF. DR. NURULFAJAR BIN ABD MANAP

DEPUTY VICE CHANCELLOR
(STUDENT AFFAIRS)

ASSOC. PROF. Ts. MOHD RAHIMI BIN YUSOFF

ASSISTANT VICE CHANCELLOR
(DEVELOPMENT & FACILITY MANAGEMENT)

PROF. Ts. DR. GOH ONG SING

ASSISTANT VICE CHANCELLOR
(INDUSTRY & COMMUNITY)

MR. MASDZARIF BIN MAHAT

CHIEF OPERATING OFFICER

MR. KHAIRUL BIN TAIB

BURSAR

MR. MOHD ISA BIN MOHD DOM

CHIEF INFORMATION OFFICER

DATUK AZHAR BIN MOHAMED

LEGAL ADVISOR

Figure 1.1 UTeM Senior Management

The lists of departments are listed below:

a. Administration :

i. Chancellory
ii. Deputy Vice Chancellor (Academic & International) Office
iii. Deputy Vice Chancellor (Research & Innovation) Office
iv. Deputy Vice Chancellor (Student Affairs) Office
v. Assistant Vice Chancellor (Industry & Community) Office
vi. Registrar
vii. Bursary
viii. Chief Information Officer Office

b. Academic :

i. Centre for Graduate Studies
ii. Faculty of Electronics & Computer Engineering
iii. Faculty of Electrical Engineering
iv. Faculty of Mechanical Engineering
v. Faculty of Manufacturing Engineering
vi. Faculty of Information & Communication Technology
vii. Faculty of Technology Management & Technopreneurship
viii. Faculty of Mechanical & Manufacturing Engineering Technology
ix. Faculty of Electrical & Electronic Engineering Technology
x. Centre for Languages & Human Development
xi. Institute of Technology Management & Entrepreneurship

1.5 Academic Calendar

The Academic Calendar for each session can be accessed from UTeM website.
https://www.utem.edu.my/current-students/academic-calendar.html

2 BACKGROUND OF FKM

2.1 Introduction

The Faculty of Mechanical Engineering (FKM), UTeM was established after the approval was granted by the Ministry of Education Malaysia on the 22nd June 2001. The faculty administration office and lecture rooms are located in Technology Campus, Taman Tasik Utama, Ayer Keroh. A laboratory complex nearby was built to host the laboratories, workshops and lecture rooms. Complete locations of facilities can be referred in Tables 7.1-7.3. Currently, the faculty offers both undergraduate and postgraduate programmes. The undergraduate programmes offered are Diploma in Mechanical Engineering Programme, Bachelor of Mechanical Engineering and Bachelor of Automotive Engineering whilst the post graduate programmes are Master of Science by research, Master of Mechanical Engineering (Taught Course), Doctor of Philosophy (PhD) and Doctor of Engineering (D.Eng) programmes.

2.2 Vision, Mission and Objectives

In order to achieve the objectives of the Faculty, a framework of policy implementation is developed. The followings are the vision, mission and objectives of programmes offered by the Faculty.

2.2.1 Vision

To be an ideal, dynamic and innovative faculty.

2.2.2 Mission

To produce highly competent mechanical engineering graduate having good moral and ethical values.

2.2.3 Objectives

a. To offer high quality academic programmes with emphasis on practice and application oriented mechanical engineering discipline in line with the current industrial requirement and be recognized by professional bodies.
b. To produce competent mechanical engineering graduate with critical thinking, innovative and have the ability to solve problem either in group or individual in the process of fulfilling the national human capital requirement.
c. To upgrade expertise and competency of the staff by conducting various quality and well organized human resource development programmes based on good ethical and moral values.
d. To perform the research and development activities based on industrial problems in the process to develop post-graduate programmes and to produce prototypes that could be patented and commercialized.
e. To conduct teaching and learning based on writing and publication activities as well as research and consultancy activities.
f. To promote smart partnership between university and industry at faculty level.
g. To offer services in consultancy and life-long learning with practical and application oriented in the field of mechanical engineering and in other strategic field or specialization to meet the requirement of domestic and global market.

2.3 Organisational Structure

The faculty administration is headed by a Dean and assisted by three Deputy Deans who are responsible in academic, research & post graduate studies and student development. Each of undergraduate programmes is managed by respective Head of Department. Currently FKM has three departments, namely Department of Mechanical Engineering, Department of Automotive Engineering and Department of Diploma Studies. Each Head of Department is entrusted and is responsible for the academic activities and physical development of the infrastructure and facilities. The research activities are coordinated with the Manager of the Centre of Excellence (CoE). The CoE for FKM is known as the Centre for Advanced Research on Energy (CARe).

Figure 2.1 shows the current FKM management. The Administrative Office of FKM is located at Level 3 FKM Building, Technology Campus, where the office of Dean, Deputy Deans, Head of Departments, Chief Assistant Registrar, Assistant Registrar and administrative support staffs are located. The routine operation and management of laboratories at FKM is handled by Heads of Laboratory and Assistant Engineer. The complete FKM organization structure is shown in Figure 2.2.

DR. RUZTAMREEN BIN JENAL

DEAN

DR. SUHAIMI BIN MISHA

DEPUTY DEAN
(ACADEMIC)

ASSOC. PROF. DR. MOHD FADZLI BIN ABDOLLAH

DEPUTY DEAN
(RESEARCH & POSTGRADUATE STUDIES)

DR. SHAFIZAL BIN MAT

DEPUTY DEAN
(STUDENT DEVELOPMENT)

DR. REDUAN BIN MAT DAN

HEAD OF DEPARTMENT
(MECHANICAL ENGINEERING)

DR. NADLENE BINTI RAZALI

HEAD OF DEPARTMENT
(DIPLOMA STUDIES)

DR. FAIZ REDZA BIN RAMLI

PROGRAMME COORDINATOR
(MECHANICAL ENGINEERING)

DR. MOHD AFZANIZAM BIN MOHD ROSLI

PROGRAMME COORDINATOR
(POSTGRADUATE STUDIES)

DR. NOR AZMMI BIN MASRIPAN

LAB COORDINATOR

ASSOC. PROF. DR. TEE BOON TUAN

CoE MANAGER

TS. DR. MOHD AZLI BIN SALIM

CoE COORDINATOR

MRS. NORMA HAYATI BINTI HASHIM

SENIOR ASSISTANT REGISTRAR

MRS. ZAIHASRAH BINTI ALIAS

ASSISTANT REGISTRAR

Figure 2.1 FKM Management

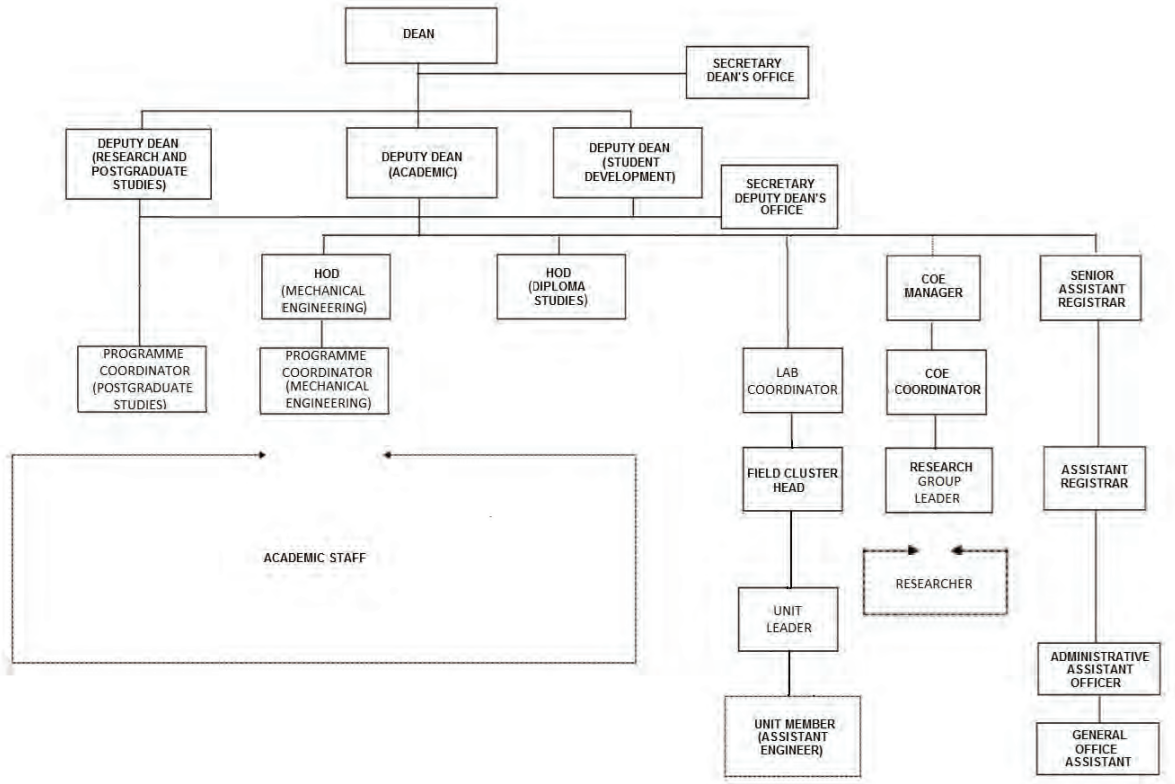


Figure 2.2 Organizational Structure of FKM

3 ACADEMIC PROGRAMMES

3.1 Introduction

The Faculty of Mechanical Engineering offers academic programmes at both undergraduate and postgraduate levels. This handbook focuses on information pertaining to the undergraduate programmes. The programmes offered at undergraduate level are the Bachelor of Mechanical Engineering (BMCG), the Bachelor of Automotive Engineering (BMCK), and the Diploma in Mechanical Engineering (DMC). The normal study periods for BMCG, BMCK and DMC programmes are four (for bachelor) and two and a half years (for diploma), respectively. The curriculum structures of BMCG, BMCK and DMC programmes are explained in Sections 3.6, 3.8, and 3.10, respectively.

Starting from Semester 1 Session 2014/2015, the faculty offers only one bachelor degree programme (BMCG). The purpose of offering a single programme is to produce graduates with broad engineering skills and therefore, highly adaptable to the job market. The specialization of students into various mechanical engineering fields will be accomplished through the offering of elective courses in Year 4.

The faculty's commitment in providing quality education programme continues by adhering to the guidelines set by the Engineering Accreditation Council of Malaysia (EAC). In addition, the faculty also continues the implementation of Outcome-Based Education (OBE) which has also been used by a large number of leading universities around the world. Using OBE system, the teaching and learning process is tailored to develop balanced graduates based on the objectives set in Programme Educational Objectives (PEO). Every taught course carries a set of learning outcomes (LOs), which students need to achieve upon completion of the course. These LOs are mapped to Programme Outcomes (POs) for assessment purposes.

3.2 Programme Educational Objectives (PEO)

PEOs are specific goals consistent with the mission and vision of the University, that are responsive to the expressed interest of programme stakeholders, describing the expected achievements of graduates in their career and professional life, few years after graduation.

3.2.1 PEO for BMCG and DMC Programme

The graduates from this programme are expected to become:

PEO1 Graduates who are competent and adaptable in multi industries by practicing the knowledge in mechanical engineering that is relevant to professional engineering practice. **(Competency)**

PEO2 Graduates who will pursue study in graduate works and others professional courses. **(Lifelong Learning)**

PEO3 Graduates who will be leader at note-worthy level and provide solutions that benefited the respective organization, society and nation. **(Leadership)**

3.2.2 PEO for BMCK Programme

The Faculty Program Objectives are to produce:

PEO1 Graduates who are competent and adaptable in multi industries by practicing the knowledge in mechanical-automotive engineering that is in accordance to the professional engineering practice. **(Competency)**

PEO2 Graduates who will further study at postgraduate level or other professional courses. **(Lifelong Learning)**

PEO3 Graduates who will be leader at note-worthy level and provide solutions that benefited the respective organization, society and nation. **(Leadership)**

3.3 Programme Outcomes (PO)

POs are statements that describe what students are expected to know and able to perform or attain by the time of graduation. These relate to the skills, knowledge, and behaviour that students acquire through the programme.

3.3.1 PO for BMCG Programme

The graduate from this programme is expected to be able to:

PO1 Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex mechanical engineering problems. **(Engineering Knowledge)**

PO2 Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principle of mathematics, natural sciences and engineering sciences. **(Problem Analysis)**

PO3 Utilize a systematic approach to design solution for complex engineering problem that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental consideration. **(Design/Development of Solutions)**

PO4 Conduct investigations of complex problem using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. **(Investigation)**

PO5 Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. **(Modern Tool Usage)**

PO6 Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and consequent responsibilities relevant to professional engineering practice. **(The Engineer and Society)**

PO7 Understand and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental context. **(Environment and Sustainability)**

PO8 Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. **(Ethics)**

PO9 Communicate effectively on complex engineering activities with engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions. **(Communication)**

PO10 Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings. **(Individual and Team Work)**

PO11 Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. **(Life Long Learning)**

PO12 Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply them effectively as a member and leader in a team to manage projects and in multidisciplinary environments. **(Project Management and** Finance)

3.3.2 PO for BMCK Programme

The POs are to to produce graduates who should be able to:

PO1 Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex mechanical-automotive engineering problems. **(Engineering Knowledge)**

PO2 Identify, formulate, research literature and analyze complex automotive engineering problems reaching substantiated conclusions using first principle of mathematics, natural sciences and engineering sciences. **(Problem Analysis)**

PO3 Utilize a systematic approach to design solution for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental consideration. **(Design/Development of Solution)**

PO4 Conduct investigations of complex problem using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. **(Investigation)**

PO5 Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. **(Modern Tool Usage)**

PO6 Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and consequent responsibilities relevant to professional engineering practice. **(The Engineer and Society)**

PO7 Understand and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental contexts. **(Environment and Sustainability)**

PO8 Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. **(Ethics)**

PO9 Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings. **(Individual and Team Work)**

PO10 Communicate effectively on complex engineering activities with engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions. **(Communication)**

PO11 Demonstrate knowledge and understanding the principles of engineering management, entrepreneurship and economic decision-making and apply these principles effectively as a member and leader in a team to manage projects and in multidisciplinary environments. **(Project Management and Finance)**

PO12 Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. **(Lifelong Learning)**

3.3.3 PO for DMC Programme

The graduate from this programme is expected to be able to:

PO1 Apply knowledge of applied mathematics, applied science, engineering fundamentals and an engineering specialization to wide practical procedures and practices. **(Engineering Knowledge)**

PO2 Identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity. **(Problem Analysis)**

PO3 Design solutions for well-defined technical problems and assist with the design of systems, components or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. **(Design/Development of Solution)**

PO4 Conduct investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements. **(Investigation)**

PO5 Apply appropriate techniques, resources, and modern engineering and IT tools to well-defined engineering problems, with an awareness of the limitations. **(Modern Tool Usage)**

PO6 Demonstrate knowledge of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering technician practice and solutions to well-defined engineering problems. **(The Engineer and Society)**

PO7 Understand and evaluate the sustainability and impact of engineering technician work in the solution of well-defined engineering problems in societal and environmental contexts. **(Environment and Sustainability)**

PO8 Understand and commit to professional ethics and responsibilities and norms of technician practice. **(Ethics)**

PO9 Communicate effectively on well-defined engineering activities with the engineering community and with society at large, by being able to comprehend the work of others, document their own work, and give and receive clear instructions. **(Communication)**

PO10 Function effectively as an individual, and as a member in diverse technical teams. **(Individual and Team Work)**

PO11 Recognise the need for, and have the ability to engage in independent updating in the context of specialised technical knowledge. **(Lifelong Learning)**

PO12 Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member or leader in a technical team and to manage projects in multidisciplinary environments. **(Project Management and Finance)**

3.4 Career in Mechanical Engineering

Career as a mechanical engineer or assistant mechanical engineer (technical assistant) is highly remunerated, however it demands great responsibilities. Engineers and assistant engineers are problem solvers who provide solutions to any engineering problem that arises. In other words, they are knowledgeable people with the ability to solve problems. Hence, mechanical engineer must be of very skilled person and comfortable with his or her knowledge in mechanical engineering.

Mechanical engineering typically exists together with electrical and civil engineering in terms of its historical development. Due to highly ethical and challenging nature of the engineers and assistant engineers' job scope, it gained a professional and semi professional recognition. Therefore, it is the aim of every mechanical engineer to be recognised professionally in terms of their ability and competency. There are avenues where mechanical engineer can be registered as a Professional Engineer.

Engineers or assistant engineers must possess good ethical values. Virtues are universal, irrespective of his or her position, place of work or race. Engineer and assistant engineer must heed those virtues which include sincerity, transparency and consistency. Other qualities needed by engineers are computer-literate, good in interpersonal skills, creative and critical thinking skills.

Upon the completion of mechanical engineering programmes at Bachelor' Degree or Diploma level, graduates have vast career opportunities. Mechanical Engineer and Assistant Mechanical Engineer are mostly employed in the manufacturing, automotive, marine, aerospace, oil & gas, robotic, mining and food and beverage (F&B) industries.

The job scope of a Mechanical Engineer and an Assistant Mechanical Engineer among others are design, material selections and analysis of manufactured products. Some examples of the product include home appliances, health care and sport equipment, instrumentation and crafts. Other fields of work include integration of mechanical, electronic engineering and computer control in the field of mechatronics.

Mechanical engineering graduates are employed in many industrial sectors which encompass the following work environments:-

a. Design and manufacturing of automotive components and engine
b. Defence industries, power generation and environmental protection
c. Marine industries and sea transport
d. Automation, control and robotic industries
e. Heavy machinery industries that use hydraulic and pneumatic system, electronic and digital driven machines
f. Agricultural and food production industries
g. Petrochemical, gas and mineral industries
h. Biotechnology and biomedical industries
i. Research and development, engineering management and service industries
j. Construction of building mechanical system

Graduates from the Bachelor of Automotive Engineering programme are expected to have a strong automotive engineering background and the required skills. They would usually work or build their career as an engineer in the field of:

a. Research & Development Engineer, Design Engineers, Production Engineers, Manufacturing Engineers, Quality Control/Quality Assurance Engineers, Sales Engineers, Consultants
b. Research and Development in automotive manufacturing
c. Design and innovation of vehicle components such as engine, chassis, vehicle interior, electrical, suspension, braking and structure analysis as well as other vehicle subsystems
d. Industrial equipment layout and workflow in automotive industry
e. Consultant for automotive components in terms of its validation, design reliability and quality
f. Maintenance management and vehicle recondition
g. Design and improvement of vehicle ride & handling as well as power train system

Autonomous vehicles are expected to be available in the near future. In order to equip the students with the technologies related to autonomous vehicles, courses such as Vehicle

Control System and Vehicle Autonomous System are included in the curriculum of the BMCK programme. These courses will cover the control system technologies, trajectory planning and tracking, and collision avoidance which are important topics for autonomous vehicles.

In the industry, graduates of mechanical engineering are highly marketable and hold a wide range of positions either in public agencies or private companies which include:

a. Mechanical Engineer
b. Sale & Service Engineer
c. Project Engineer
d. Technical Engineer
e. Production Engineer
f. Industrial Engineer
g. Plant Engineer
h. Design Engineer
i. Maintenance Engineer
j. Assistant Lecturer
k. Research Officer
l. Technical Officer

On the other hand, mechanical engineering diploma holders are highly sought after and often hired to hold positions such as:

a. Assistant Mechanical Engineer
b. Assistant Service Engineer
c. Assistant Project Engineer
d. Assistant Technical Engineer
e. Assistant Product Engineer
f. Assistant Industrial Engineer
g. Assistant Plant Engineer
h. Assistant Design Engineer
i. Assistant Maintenance Engineer
j. Assistant Research Officer
k. Assistant Technical Officer

3.5 Bachelor of Mechanical Engineering (BMCG)

The curriculum structure for the first two years of Bachelor of Mechanical Engineering (BMCG) is to enhance the students' basic Mechanical Engineering knowledge before engaging in more advance programme courses. These courses include Engineering Mathematics, Engineering Materials, Engineering Graphics and CAD, Statics, Differential Equation, Computer Aided Design and Manufacturing, Electrical Systems, Principle of Measurements and Instrumentation, Microprocessor Technology, and Statistics. The practical work and workshops are designed to enhance students' knowledge and skills. In addition, students will also study courses such as Language Elective, Ethnic Relation, English for Academic Purposes, Islamic and Asian Civilizations (TITAS) and Co-Curriculums.

In Year 3, students will undergo core curriculum programmes which cover advanced courses as well as compulsory university courses. Students are then required to undergo industrial training for at least 10 weeks, during the short semester (after semester 6) in selected industries. The objectives are to strengthen the engineering knowledge and theory as well as their hands-on skills. It is expected that this training will provide our graduates with enough technical knowledge before advancing into a real career in industry.

Fourth year students (final year), who are in their 7th and 8th semester, shall carry out Final Year Project (FYP), programme core and elective courses which are focused on advanced knowledge of Mechanical Engineering. In addition, students will also sit a number of important courses such as Sustainability and Environment, Engineer & Society, Sustainability & Environment, Engineering Seminar and Entrepreneurship Technology. The courses are designed to provide students with soft skills such as engineering management, entrepreneurship, and moral development programme. The intended outcome is to produce mechanical engineering graduates with knowledge in their specialised field, as well as in non-technical fields.

The minimum number of credits required for an award of Bachelor of Mechanical Engineering is **135**. The breakdown of course categories and credits required are as follows: engineering courses – 104 credits, non-engineering courses – 31 credits.

3.6 Curriculum Structure for BMCG Programme

YEAR 1 (SEMESTER I)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BLHW 1442	ENGLISH FOR ACADEMIC PURPOSES	W	2	-
BLHW 1702/ BLHW1742	ISLAMIC AND ASIAN CIVILIZATIONS*/ MALAYSIAN STUDIES**	W	2	-
BMFG 1313	ENGINEERING MATHEMATICS I	M	3	-
BMCG 1523	ENGINEERING GRAPHICS AND CAD	P	3	-
BMFG 1213	ENGINEERING MATERIALS	P	3	-
BMCG 1113	STATICS	P	3	-
TOTAL			16	

* For Malaysian students only
** For international students only

YEAR 1 (SEMESTER 2)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BKKX XXX1	CO-CURRICULUM I*	W	1	-
BMCG 1013	DIFFERENTIAL EQUATION	M	3	-
BEKG 1233	PRINCIPLES OF MEASUREMENT AND INSTRUMENTATION	P	3	-
BMCG 2713	THERMODYNAMICS I	P	3	-
BMCG 1213	DYNAMICS	P	3	-
BMCG 2021	MECHANICAL ENGINEERING WORKSHOP	P	1	-
BMCG 2312	MANUFACTURING PROCESS	P	2	-
TOTAL			16	

*Refer to Co-Curriculum Courses offered by Centre for Languages and Human Development.

YEAR 2 (SEMESTER 3)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BLHW 2712/ BLHW2752	ETHNIC RELATION*/ MALAYSIAN CULTURE**	W	2	-
BEKG 2443	ENGINEERING MATHEMATICS II	M	3	-
BEKG 1123	PRINCIPLES OF ELECTRIC AND ELECTRONICS	P	3	-
BMCG 1011	MECHANICAL ENGINEERING LABORATORY I	P	1	-
BMCG 2113	SOLID MECHANICS I	P	3	-
BMCG 2613	FLUID MECHANICS I	P	3	-
BLHL 1XX2	LANGUAGE ELECTIVE***	E	2	-
TOTAL			17	

* For Malaysian students only
** For international students only
***Refer to Language Courses offered by Centre for Languages and Human Development. International students whose native language is not Malay are required to take BLHL1012 Bahasa Melayu Komunikasi 1.

YEAR 2 (SEMESTER 4)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BLHW 2452	ACADEMIC WRITING	W	2	BLHW 1442
BKXX XXX1	CO-CURRICULUM II*	W	1	-
BENG 2143	ENGINEERING STATISTICS	M	3	
BEKG 2433	ELECTRICAL SYSTEMS	P	3	-
BMCG 2011	MECHANICAL ENGINEERING LABORATORY II	P	1	-
BMCG 3113	SOLID MECHANICS II	P	3	BMCG 2113
BMCG 2513	COMPUTER AIDED DESIGN AND MANUFACTURING	P	3	-
TOTAL			16	

*Refer to Co-Curriculum Courses offered by Centre for Languages and Human Development.

YEAR 3 (SEMESTER 5)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BITG 1233	COMPUTER PROGRAMMING	M	3	-
BMCG 2212	MICROPROCESSOR TECHNOLOGY	P	2	-
BMCG 3313	ENGINEERING DESIGN	P	3	-
BMCG 3713	THERMODYNAMICS II	P	3	BMCG 2713
BMCG 3613	FLUID MECHANICS II	P	3	BMCG 2613
BMCG 4113	FINITE ELEMENT ANALYSIS	P	3	-
TOTAL			17	

YEAR 3 (SEMESTER 6)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BLHW 3462	ENGLISH FOR PROFESSIONAL INTERACTION	W	2	BLHW 2452
BMCU 3013	INTEGRATED DESIGN PROJECT	P	3	-
BMFG 4623	ENGINEERING MANAGEMENT AND ECONOMY	P	3	-
BMCG 3223	CONTROL ENGINEERING	P	3	-
BMCG 3333	MECHANICAL DESIGN	P	3	-
BMCG 3011	MECHANICAL ENGINEERING LABORATORY III	P	1	-
BXXX XXX2	GENERAL ELECTIVE*	E	2	-
TOTAL			17	

* Refer to General and Open Elective table

YEAR 3 (SHORT SEMESTER)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BMCU 3935	INDUSTRIAL TRAINING	P	5	-
TOTAL			5	

YEAR 4 (SEMESTER 7)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BMCU 4972	FINAL YEAR PROJECT I	P	2	-
BMCG 4812	SUSTAINABILITY AND ENVIRONMENT	P	2	-
BMCG 4743	HEAT TRANSFER	P	3	-
BMCG 3233	MECHANICAL VIBRATION	P	3	-
BMCG 4XX3	ELECTIVE I	E	3	-
BMCG 4XX3	ELECTIVE II	E	3	-
TOTAL			16	

YEAR 4 (SEMESTER 8)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BTMW 4012	ENTREPRENEURSHIP TECHNOLOGY	W	2	-
BMCU 4984	FINAL YEAR PROJECT II	P	4	BMCU 4972
BMCU 4022	ENGINEER AND SOCIETY	P	2	-
BMCU 4011	ENGINEERING SEMINAR	P	1	-
BMCG 4XX3	ELECTIVE III	E	3	-
BMCG 4XX3	ELECTIVE IV	E	3	-
TOTAL			15	
TOTAL OVERALL CREDIT			135	

NOTE:

CATEGORY	DESCRIPTION
W	UNIVERSITY COMPULSORY COURSE
M	MATHEMATICS, STATISTICS AND COMPUTING
P	PROGRAMME CORE COURSE
E	ELECTIVE COURSE

PROGRAMME ELECTIVE COURSES

FIELD	CODE	COURSE	CREDIT
THERMAL-FLUID	BMCG 4713	RENEWABLE ENERGY SYSTEM	3
	BMCG 4723	REFRIGERATION AND AIR CONDITIONING SYSTEM	3
	BMCG 4733	POWERPLANT SYSTEM	3
	BMCG 4613	COMPUTATIONAL FLUID DYNAMICS	3
	BMCG 4623	FLUID POWER AND TURBOMACHINERY	3
STRUCTURE AND MATERIALS	BMCG 4123	ADVANCED SOLID MECHANICS	3
	BMCG 4133	FRACTURE MECHANICS	3
	BMCG 4413	NON DESTRUCTIVE TESTING	3
	BMCG 4423	COMPOSITES AND ADVANCED MATERIALS	3
	BMCG 4433	METALLURGY	3
DESIGN AND INNOVATION	BMCG 4313	MECHANISM DESIGN	3
	BMCG 4323	PROTOTYPE DEVELOPMENT TECHNOLOGY	3
	BMCG 4333	DESIGN QUALITY AND RELIABILITY	3

	BMCG 4343	DESIGN OPTIMIZATION	3
	BMCG 4513	ADVANCED COMPUTER AIDED DESIGN	3
AUTOMOTIVE	BMCG 4913	VEHICLE DYNAMICS	3
	BMCG 4923	AUTOMOTIVE TECHNOLOGY	3
	BMCG 4933	VEHICLE POWERTRAIN SYSTEMS	3
	BMCG 4943	INTERNAL COMBUSTION ENGINE	3
	BMCG 4953	VEHICLE SYSTEM MODELLING AND SIMULATION	3
MAINTENANCE	BMCG 4213	VIBRATION MONITORING OF ROTATING MACHINERY	3
	BMCG 4813	CONDITION BASED MAINTENANCE	3
	BMCG 4823	RELIABILITY, MAINTAINABILITY AND RISKS	3
	BMCG 4833	WEAR DEBRIS AND OIL ANALYSIS	3
	BMCG 4843	STRUCTURAL HEALTH MONITORING	3

*Students are required to complete four (4) courses (total of 12 credits) with at least three (3) of the courses must be from the same field.

OTHER ELECTIVE COURSES

NUMBER	CODE	COURSE
LANGUAGE ELECTIVE		
1	BLHL 1212	BAHASA MANDARIN 1
2	BLHL 1612	BAHASA KOREA 1
3	BLHL 1112	BAHASA ARAB 1
4	BLHL 1412	BAHASA JERMAN 1

5	BLHL 1312	BAHASA JEPUN 1
6	BLHL 1012	BAHASA MELAYU KOMUNIKASI 1*
GENERAL ELECTIVE		
1	BLHC 4032	CRITICAL AND CREATIVE THINKING
2	BLHC 4022	NEGOTIATION SKILLS
3	BLHH 1032	INDUSTRIAL AND ORGANIZATIONAL PSYCHOLOGY
4	BLHC 4012	ORGANIZATION COMMUNICATION
5	BLHW 1722	PHILOSOPHY OF SCIENCE AND TECHNOLOGY
6	TBA**	INDUSTRIAL SOCIOLOGY
OPEN ELECTIVE		
1	BMCK 42X3	VEHICLE AUTONOMOUS SYSTEM

* For international students whose native language is not Malay.
** To be announced

3.7 Bachelor of Automotive Engineering (BMCK)

The curriculum structure for the first year of Bachelor of Automotive Engineering (BMCK) is to enhance the students' basic engineering and mathematics knowledge before engaging in more specialized courses in mechanical and automotive engineering. These courses include Engineering Mathematics I, Engineering Graphics and CAD, Engineering Materials, Engineering Mechanics, Differential Equation, Computer Programming, Principles of Electric and Electronics, Principles of Measurements and Instrumentation, and Manufacturing Process. The practical work is designed to enhance students' knowledge and skills. In addition, students will also study courses such as Third Language, Islamic and Asian Civilizations, and Co-Curriculum I.

Year 2 students will be taking courses in mechanical and automotive engineering. These courses include Fluid Mechanics, Thermodynamics, Computer Aided Design and Manufacturing, Automotive Technology, Mechanical Design, Microprocessor Technology, Solid Mechanics, and Vehicle Electrical & Electronics. In addition, the students will study Engineering Mathematics II. Students will also take the university compulsory courses including Ethnic Relations, Co-Curriculum II, and Technical English.

In Year 3, students will study Control Engineering, Heat Transfer, Vehicle Dynamics, Mechanical Vibration, Vehicle System Modeling & Simulation, Internal Combustion Engine, and Engineering Statistics. In addition, students are required to conduct projects in Integrated Design Project I and Integrated Design Project II. Besides that, the students will undertake English for Professional Communication. Students are then required to undergo industrial training for at least 10 weeks, during the short semester (after semester 6) in selected industries. The objectives are to strengthen the engineering knowledge and theory as well as their hands-on skills. It is expected that this training will provide our graduates with enough technical knowledge before advancing into a real career in industry.

Fourth year students (final year), who are in their 7th and 8th semester, shall carry out Final Year Project (FYP), programme core and elective courses which are focused on advanced knowledge of Automotive Engineering. The programme core courses include Vehicle Aerodynamics, Vehicle Control System, and Vehicle Autonomous System. The elective courses include Noise, Vibration & Harshness, Vehicle Powertrain Systems, Vehicle Structure Analysis, Vehicle Ergonomics, Electric Propulsion System, and Automotive Manufacturing Systems. In addition, students will also undertake a number of important courses such as Engineering Seminar, Engineer & Society, Entrepreneurship Technology, Critical and Creative Thinking, and Engineering Management & Economy. These courses are designed to provide students with soft skills such as engineering management, entrepreneurship, and moral development programme. The intended outcome is to produce automotive engineering graduates with knowledge in their specialised field, as well as in non-technical fields.

The minimum number of credits required for an award of Bachelor of Automotive Engineering is **135**. The breakdown of course categories and credits required are as follows: engineering courses – 102 credits, non-engineering courses – 33 credits.

3.8 Curriculum Structure for BMCK Programme

YEAR 1 (SEMESTER I)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BLHL 1XX2	LANGUAGE ELECTIVE*	E	2	-
BLHW 1702/ BLHW 1742	ISLAMIC AND ASIAN CIVILIZATIONS**/ MALAYSIA STUDIES***	W	2	-
BMFG 1313	ENGINEERING MATHEMATICS I	M	3	-
BMCG 1523	ENGINEERING GRAPHICS AND CAD	P	3	-
BMFG 1213	ENGINEERING MATERIALS	P	3	-
BMCK 1113	ENGINEERING MECHANICS	K	3	-
BMCG 1011	MECHANICAL ENGINEERING LABORATORY I	K	1	-
TOTAL			17	

*Refer to Language Courses offered by Centre for Languages and Human Development. International students whose native language is not Malay are required to take BLHL1012 Bahasa Melayu Komunikasi 1. Also refer Language Elective in Section 3.6 and Other Elective Courses in Section 4.1.
** For Malaysian students only
*** For international students only

YEAR 1 (SEMESTER 2)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BKKX XXX1	CO-CURRICULUM I*	W	1	-
BMCG 1013	DIFFERENTIAL EQUATION	M	3	-
BITG 1233	COMPUTER PROGRAMMING	M	3	-
BEKG 1123	PRINCIPLES OF ELECTRIC AND ELECTRONICS	P	3	-
BEKG 1233	PRINCIPLES OF MEASUREMENTS AND INSTRUMENTATION	P	3	-
BMCG 2312	MANUFACTURING PROCESS	K	2	-
BMCG 2011	MECHANICAL ENGINEERING LABORATORY II	K	1	-
TOTAL			16	

*Refer to Co-Curriculum Courses offered by Centre for Languages and Human Development.

YEAR 2 (SEMESTER 3)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BLHW 2712/ BLHW2752	ETHNIC RELATION*/ MALAYSIAN CULTURE**	W	2	-
BKKX XXX1	CO-CURRICULUM II***	W	1	-
BMCG 21X3	FLUID MECHANICS	K	3	-
BMCG 31X1	MECHANICAL ENGINEERING LABORATORY III	K	1	-
BMCG 2X13	THERMODYNAMICS	K	3	-
BMCG 2513	COMPUTER AIDED DESIGN AND MANUFACTURING	K	3	-
BMCG 4923	AUTOMOTIVE TECHNOLOGY	K	3	-
TOTAL			16	

* For Malaysian students only
** For international students only
*** Refer to Co-Curriculum Courses offered by Centre for Languages and Human Development.

YEAR 2 (SEMESTER 4)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BLHW 2403	TECHNICAL ENGLISH	W	3	-
BMFG 22X3	ENGINEERING MATHEMATICS II	M	3	-
BMCG 3333	MECHANICAL DESIGN	K	3	-
BMCG 2212	MICROPROCESSOR TECHNOLOGY	K	2	-
BMCG 2XX3	SOLID MECHANICS	K	3	-
BMCK 2XX3	VEHICLE ELECTRICAL & ELECTRONICS	K	3	-
TOTAL			17	

YEAR 3 (SEMESTER 5)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BENG 2143	ENGINEERING STATISTICS	M	3	-
BMCU 3013	INTEGRATED DESIGN PROJECT I	P	3	-
BMCG 3223	CONTROL ENGINEERING	K	3	-
BMCG 3713	HEAT TRANSFER	K	3	-
BMCK 41X3	VEHICLE DYNAMICS	K	3	-
BMCK 31X1	AUTOMOTIVE LABORATORY I	K	1	-
TOTAL			16	

YEAR 3 (SEMESTER 6)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BLHW 3403	ENGLISH FOR PROFESSIONAL COMMUNICATION	W	3	-
BMCU 3023	INTEGRATED DESIGN PROJECT II	P	3	-
BMCG 3233	MECHANICAL VIBRATION	K	3	-
BMCK 32X3	VEHICLE SYSTEM MODELING & SIMULATION	K	3	-
BMCK 33X3	INTERNAL COMBUSTION ENGINE	K	3	-
BMCK 42X1	AUTOMOTIVE LABORATORY II	K	1	-
TOTAL			16	

YEAR 3 (SHORT SEMESTER)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BMCU 3935	INDUSTRIAL TRAINING	P	5	-
TOTAL			5	

YEAR 4 (SEMESTER 7)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BMCU 4972	FINAL YEAR PROJECT I	P	2	-
BMCU 4011	ENGINEERING SEMINAR	P	1	-
BENG 4322	ENGINEER & SOCIETY	P	2	-
BMCK 4XX3	VEHICLE AERODYNAMICS	K	3	-
BMCK 43X3	VEHICLE CONTROL SYSTEM	K	3	-
BMCK 42X1	AUTOMOTIVE LABORATORY III	K	1	-
BMCK 41X3	ELECTIVE I	E	3	-
TOTAL			15	

YEAR 4 (SEMESTER 8)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
BTMW 4012	ENTREPRENEURSHIP TECHNOLOGY	W	2	-
BLHC 4032	CRITICAL AND CREATIVE THINKING	W	2	-
BMCU 4984	FINAL YEAR PROJECT II	P	4	BMCU 4972
BMFG 4623	ENGINEERING MANAGEMENT & ECONOMY	P	3	-
BMCK 42X3	VEHICLE AUTONOMOUS SYSTEM	K	3	-
BMCK 42X3	ELECTIVE II	E	3	-
TOTAL			17	
TOTAL OVERALL CREDIT			135	

NOTE:

CATEGORY	DESCRIPTION
W	UNIVERSITY COMPULSORY COURSE
M	MATHEMATICS, STATISTICS AND COMPUTING
P	PROGRAMME CORE COURSE
K	COURSE CORE COURSE
E	ELECTIVE COURSE

ELECTIVE COURSES

CODE	COURSE	CREDIT
BMCK 4X13	NOISE, VIBRATION & HARSHNESS	3
BMCK 4X23	VEHICLE POWERTRAIN SYSTEMS	3
BMCK 4X33	VEHICLE STRUCTURE ANALYSIS	3
BMCK 4XX3	VEHICLE ERGONOMICS	3
BMCK 4X53	ELECTRIC PROPULSION SYSTEM	3
BMCK 4X63	AUTOMOTIVE MANUFACTURING SYSTEMS	3

3.9 Diploma in Mechanical Engineering (DMC)

The curriculum structure for Year 1 is the strengthening of the knowledge for SPM school leavers from technical, vocational, and government aided schools. Courses offered by the Faculty are Fundamental Mathematics, Experimental Method, Chemistry, Fundamental Physics, Electrical & Electronic Principles, Technology and Engineering Workshop Practice I,

Calculus, Computer Programming, Manufacturing Process, Engineering Graphics, Technology and Engineering Workshop Practice II, Statics, Engineering Mathematics, and Materials Science that provide students with opportunities to improve their knowledge and skills in mechanical field. Apart from the engineering courses, students are also offered Foundation English, Leadership, Asas Pembudayaan Keusahawanan, Malaysian Studies, Co-Curriculum I, Co-Curriculum II, and English for Effective Communication.

In Year 2, students will undertake the programme courses including Differential Equations, Engineering Design, Hydraulic and Pneumatics, Solid Mechanics, Dynamics, Thermodynamics, Statistics, Fluid Mechanics, Mechanics of Machines, Fundamental Electric and Microprocessor, and Occupational Safety and Health. Apart from the engineering courses, students are also offered English for Marketability. Year 2 students must also conduct project in the Diploma Project I and Diploma Project II.

In Year 3, students are required to undergo industrial training for a minimum of 16 weeks in various related industries. The students will be exposed to the real industrial working environment during this industrial training.

With this curriculum, the diploma engineering graduates are expected to acquire high technical knowledge and skills as well as good attitude in-line with *Malaysia Education Blueprint 2015-2025 (Higher Education)*. It aims to equip future graduates with technical knowledge/skills and preparation through the actual working environment in the industrial sector. The minimum credit hours required for the award of Diploma in Mechanical Engineering is **91 credits**. The breakdown of course categories and credits required are as follows: engineering courses – 64 credits, non-engineering courses – 27 credits.

3.10 Curriculum Structure for DMC Programme

PRELIMINARY SPECIAL SEMESTER

CODE	COURSE	CATEGORY	CREDIT	PRE–REQUISITE
DLHW 1012	FOUNDATION ENGLISH	W	2	-
DLHW 1742	LEADERSHIP	W	2	-
DLHW 1032	MALAYSIAN STUDIES	W	2	-
TOTAL			6	

YEAR 1 (SEMESTER I)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
DKTW 1012	ASAS PEMBUDAYAAN KEUSAHAWANAN	W	2	-
DXXX XXX1	CO-CURRICULUM I*	W	1	-
DMCU 1032	FUNDAMENTAL MATHEMATICS	M	2	-
DMCU 1012	EXPERIMENTAL METHOD	P	2	-
DMCU 1233	CHEMISTRY	P	3	-
DACS 1263	FUNDAMENTAL PHYSICS	P	3	-
DEKG 2113	ELECTRICAL & ELECTRONIC PRINCIPLES	P	3	-
DMCU 1912	TECHNOLOGY AND ENGINEERING WORKSHOP PRACTICE I	P	2	-
TOTAL			18	

*Refer to Co-Curriculum courses offered by Centre for Language and Human Development (PBPI).

YEAR 1 (SEMESTER 2)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
DXXX XXX1	CO-CURRICULUM II*	W	1	-
DMCU 1042	CALCULUS	M	2	-
DITG 1113	COMPUTER PROGRAMMING	M	3	-
DMCU 1323	MANUFACTURING PROCESS	P	3	-
DMCD 1543	ENGINEERING GRAPHICS	P	3	-
DMCU 2922	TECHNOLOGY AND ENGINEERING WORKSHOP PRACTICE II	P	2	-
DMCS 1313	STATICS	P	3	-
TOTAL			17	

*Refer to Co-Curriculum courses offered by Centre for Language and Human Development (PBPI).

YEAR 1 (SHORT SEMESTER)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
DLHW 2422	ENGLISH FOR EFFECTIVE COMMUNICATION	W	2	-
DMCU 2052	ENGINEERING MATHEMATICS	M	2	-
DMCU 2423	MATERIALS SCIENCE	P	3	-
TOTAL			7	

YEAR 2 (SEMESTER 3)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
DMCU 2062	DIFFERENTIAL EQUATIONS	M	2	-
DMCD 3523	ENGINEERING DESIGN	P	3	-
DMCF 2233	HYDRAULIC AND PNEUMATICS	P	2	-
DMCS 2333	SOLID MECHANICS	P	3	-
DMCM 2713	DYNAMICS	P	3	-
DMCT 2133	THERMODYNAMICS	P	3	-
DMCU 2982	DIPLOMA PROJECT I	P	2	-
TOTAL			18	

YEAR 2 (SEMESTER 4)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
DLHW 3432	ENGLISH FOR MARKETABILITY	W	2	-
DMCU 3082	STATISTICS	M	2	-
DMCF 2223	FLUID MECHANICS	P	3	-
DMCM 3723	MECHANICS OF MACHINES	P	3	-
DENG 2223	FUNDAMENTAL ELECTRIC AND MICROPROCESSOR	P	3	-
DMCD 2512	OCCUPATIONAL SAFETY AND HEALTH	P	2	-
DMCU 2992	DIPLOMA PROJECT II	P	2	DMCU 2982
TOTAL			17	

YEAR 3 (SEMESTER 5)

CODE	COURSE	CATEGORY	CREDIT	PRE-REQUISITE
DMCU 2968	INDUSTRIAL TRAINING	P	8	-
TOTAL			8	
OVERALL TOTAL CREDIT			91	

NOTE:

CATEGORY	DESCRIPTION
W	UNIVERSITY COMPULSORY COURSE
M	MATHEMATICS, STATISTICS AND COMPUTING
P	PROGRAMME CORE COURSE

4 SYLLABUS SYNOPSIS

4.1 Bachelor of Mechanical Engineering Programme (BMCG)

YEAR 1 COURSES - UNIVERSITY COMPULSORY

BLHW 1442 ENGLISH FOR ACADEMIC PURPOSES

LEARNING OUTCOMES

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

LO1 Apply correct grammar rules according to context.

LO2 Demonstrate knowledge of various reading skills in the reading tasks given.

SYNOPSIS

This course aims to develop students' reading skills and grammar. A variety of academic reading texts and reading skills are explored to facilitate students' comprehension of the texts. These reading skills are also necessary in assisting students to master study skills. Grammar elements are taught in context to develop students' accuracy in the use of the language. This course also includes elements of blended learning.

REFERENCES

a. De Chazal, E., & Rogers, L. (2013). *Oxford EAP: A course in English for Academic Purposes*. Oxford: Oxford University Press.

b. McDonald, A. & Hancock, M. (2010). *English result*. Oxford: Oxford University Press.

c. Paterson, K. & Wedge, R. (2013). *Oxford grammar for EAP*. Oxford: Oxford University Press.

BLHW 1702 ISLAMIC AND ASIAN CIVILIZATION (TITAS)*

* For Malaysian students only

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Menjelaskan konsep asas ketamadunan melalui perbincangan kumpulan.

LO2 Menghubungkait sejarah dengan kemajuan tamadun bangsa di dunia melalui tugasan berkumpulan.

LO3 Merumus isu dan cabaran peradaban dunia melalui pembentangan kumpulan.

SYNOPSIS

Mata pelajaran ini menjelaskan tentang ilmu ketamadunan yang mencakupi definisi, pandangan semesta dan sumber ketamadunan. Mata pelajaran ini turut membincangkan persamaan dan perbezaan tamadun-tamadun dunia dengan mencari titik pertemuan melalui dialog peradaban. Selain itu, mata pelajaran ini juga turut mengupas isu dan cabaran semasa serta kesannya dalam perkembangan peradaban masa kini.

REFERENCES

a. Bakar, O., 2009, *Modul Pengajian Tamadun Islam dan Tamadun Asia*, Penerbit Universiti Malaya, Kuala Lumpur.

b. Arif, S., Noor, A. R. M., Hassan, M. A., Sulaiman, N. & Rawi, A. H. M., 2007, *Tamadun Islam dan Tamadun Asia*, Mc Graw-Hill (Malaysia) Sdn.

Bhd., Kuala Lumpur.
c. Musa, H., 2005, Pemerkasaan Tamadun Melayu Malaysia Menghadapi Globalisasi Barat, Penerbit Universiti Malaya, Kuala Lumpur.

BLHW 1742 MALAYSIAN STUDIES*

* For international students only

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the political and economic structure of Malaysia.

LO2 Respond to the uniqueness of the Malaysian's historical and cultural heritage.

LO3 Compare the Malaysian experience and achievement with their home countries in various aspects.

SYNOPSIS

By going through this course, students will be exposed to a wealth of information on Malaysia. They will gain information on Malaysian's historical background, political system and socio-economic structure. Additionally, this course highlights the Malaysian government's development plans and major policies in economic, industrial and socio-cultural aspects. It also gives emphasis on the attitude and commitment of the Malaysian government towards the regional and international issues as reflected in its foreign policy.

REFERENCES

a. Abdul Rahman Embong (2010). *Malaysian Studies: Looking Back Moving Forward: Selected Speeches, Public Statements and Other Writings*. Kuala Lumpur: Persatuan Sains Sosial Malaysia.

b. Abdul Razak Baginda (2009). *Malaysia at 50 and Beyond*. Kuala Lumpur: Malaysian Strategic Research Centre.

c. Ambri Buang (2009). Dasar-Dasar Utama Kerajaan Malaysia. Kuala Lumpur: Institusi Tadbiran Awam Malaysia.

BKKX XXX1 CO-CURRICULUM I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Recognise a balanced and comprehensive education

LO2 Develop leadership aspects stressing on disciplines and cooperation within a group or organisaton.

LO3 Build personality and character guided by rules of conduct.

LO4 Foster cooperation and unity in multi-racial society.

SYNOPSIS

a. Cultural
Choir, *Gamelan, Cak Lempung, Nasyid, Seni Khat*, Seni Lakon, Art, English Elocution, Bahasa Melayu Elocution, and Kompang.

b. Entrepreneurship
Video, Film and Photography, Publishing & Journalism, Computer and Technopreneurship.

c. Society
Fiqh Muamalat, Fiqh Amali, Tahsin Al-Quran & *Yaasin* and Peer Program.

d. Recreation
Go-Kart, Adventure and Cycling.

e. Sports
Swimming, Volley Ball, Golf, *Takraw*, Aerobic, Badminton, Football and Net ball.

f. Martial Arts
Silat Gayong, Karate-Do and Taekwando.

YEAR 1 COURSES - PROGRAMME CORE

BMCG 1523 ENGINEERING GRAPHICS AND CAD

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the engineering graphics fundamentals.

LO2 Construct technical drawing using manual sketching and computer aided design.

LO3 Communicate by using engineering drawings.

SYNOPSIS

The course will provide students with an understanding of the importance of engineering graphics as a communication tool among engineers. Student will be exposed to the engineering graphics fundamentals of manual sketching, geometric dimensioning and tolerancing, graphic projections, sectioning and engineering drawings. Students will develop visualization skills by constructing technical drawings using manual sketches and computer aided design (CAD) software. The course consists of both lecture and practical session where students will be guided in presenting and interpreting engineering drawings correctly.

REFERENCES

a. Rizal, M. A. et al., 2009, *Modul Lukisan Berbantu Komputer*, Penerbit Universiti Teknikal Malaysia Melaka, Melaka.

b. Dix, M. & Riley, P., 2014, *Discovering AutoCAD 2014*, Prentice Hall, New York.

c. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Dygdon, J. T. and Novak, J. E., 2011, *Technical Drawing*, 14th Ed., Prentice Hall, New York.

d. Jensen, C., & Jay D. H., 2007, *Engineering Drawing and Design*, 7th Ed., Glencoe and McGraw Hill, New York.

e. Frederick, E. G. & Mitchell, A., 2008, *Technical Drawing and Engineering Drawing*, 14th Ed., Prentice Hall.

BMFG 1213 ENGINEERING MATERIALS

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

LO1 Explain the basic concepts of engineering materials in terms of interatomic bonding and crystal structure.

LO2 Analyze the properties of engineering materials based on its structure.

LO3 Apply the basic understanding of engineering materials properties to determine their processing method.

SYNOPSIS

This course introduces basic concepts of engineering materials that covers introduction to engineering materials, interatomic bonding, crystalline structure and imperfections and diffusion in solid. Explanation on different types of engineering material (i.e. metal, ceramic, polymer and composites), its mechanical properties, basic applications and processing are also included. Introduction to the binary phase diagrams (composition and microstructure correlation) is also given.

REFERENCES

a. Callister, W.D. Jr., 2010, *Materials Science and Engineering - An Introduction*, 8th Edition. John Wiley & Sons Inc.

b. Smith, W.F., 1998, *Principle of Materials Science & Engineering*, 4th Edition, Mc. Graw Hill.
c. Shackelford, J.F., 2000, *Materials Science and Engineering - An Introduction*, 5th Edition, Prentice Hall.
d. Bolton, W., 2001, *Engineering Materials Technology,* 3rd Edition, BH Publisher.
e. Vernon, J. (2001) *Introduction to Engineering Materials*, 4th Edition, Palgrave MacMilan.

BMCG 1113 STATICS

LEARNING OUTCOMES

On successful completion of this course, student should be able to:

LO1 Describe and apply the basic concepts and fundamental principles of engineering mechanics (statics).
LO2 Analyze and solve equilibrium problems of particle and rigid body.
LO3 Work as an effective member of a team to solve engineering mechanics (statics) problems.

SYNOPSIS

The engineering mechanics of statics provides an introduction and the basic concept of statics as physical sciences, system of units, scalars and vectors, Free Body Diagram, forces system, force system resultants and moment, equilibrium of a particle, equilibrium of a rigid body, structural analysis (trusses analysis and simple frames and machines), friction and center of gravity and centroid.

REFERENCES

a. Hibbeler, R.C., 2013, *Engineering Mechanics – Statics*, 13th Ed., Prentice Hall.
b. Beer, F.P., and Johnston, E.R., 2011, *Statics and mechanics of materials*, McGraw-Hill.
c. Morrow, H.W., 2011, *Statics and Strength of Materials*, Prentice Hall.
d. Mott, R.L., 2010, *Statics and strength of materials*, Prentice Hall.

BEKG 1233 PRINCIPLES OF MEASUREMENT AND INSTRUMENTATION

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

LO1 Describe the principle, various terms and standards in measurement.
LO2 Explain the principles of measurement devices.
LO3 Apply the suitable bridge techniques to measure component values such as resistance, inductance and capacitance.
LO4 Explain the operation, function and applications of transducers/sensors.

SYNOPSIS

This course discusses about units and dimensions, standards, errors, static characteristic, noise and calibration in measurement devices such as galvanometers, ammeters, voltmeters, wattmeter, temperature, force and torque and pressure measurement as well as accelerometer. It also introduces oscilloscope and sensors for instrumentation application.

REFERENCES

a. Kalsi, H.S., 2010, *Electronic Instrumentation*, 3rd Ed., Tata McGraw Hill.
b. Bakshi, U.A., Bakshi, A.V., and Bakshi, K.A., 2009, *Electronic Measurements and Instrumentation*,

Technical Publications Pune.
c. Wolf. S., Smith, R.F.M., 2004, *Reference Manual for Electronic Instrumentation Laboratories*, 2nd Ed., Prentice-Hall.
d. Vaisala, V.O., 2006, *Calibration Book*.

BMCG 2713 THERMODYNAMICS I

LEARNING OUTCOMES

At the end of this course, student should be able to:

LO1 Define the First and Second Law of Thermodynamics.
LO2 Apply the thermodynamic principles using property tables.
LO3 Solve the thermodynamics processes relating to ideal gas and pure substances.

SYNOPSIS

The aim of this course is to provide students a basic understanding of the thermodynamics fundamental laws and the ability to implement them in solving a range of simple engineering problems. The course covers the following topics:

- Introduction to thermodynamics: relevance in the context of energy and the environment.
- Basic concepts: microscopic and macroscopic points of view, system and control volume approaches, properties, state, equilibrium, processes and cycles.
- Energy, heat, work and the First Law: kinetic, potential and internal energy; heat transfer; displacement work and shaft work; the first law of thermodynamics for a system.
- Properties of substances: pure substances; the two-property rule, state diagrams; intensive and extensive properties; internal energy, enthalpy and specific heats; ideal and perfect gases; phase change, vapour and liquid properties, steam and water.
- The First Law for flow processes: the steady-flow energy equation and application to e.g. throttling processes, nozzles, turbines, pumps, compressors.
- Consequences of the Second law: Clausius inequality, definition of entropy, state diagrams using entropy; T dS relationships; isentropic processes for perfect gases; isentropic efficiency; simple ideas of work potential in the presence of the environment.

REFERENCES

a. Cengel, Y.A., & Boles, M.A., 2014, *Thermodynamics: An Engineering Approach,* 8th Edition, McGraw-Hill, Singapore.
b. Moran, M.J., Shapiro, H.N., Boettner, D.D. & Bailey, M.B., 2014, *Fundamental of Engineering Thermodynamics*, 8th Edition, John Wiley & Sons, Inc.
c. Borgnakke, C. & Sonntag, R. E., 2012, *Fundamentals of Thermodynamics*, 8th Edition, John Wiley & Sons, Inc.

BMCG 1213 DYNAMICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Describe the fundamentals of dynamics.
LO2 Apply the dynamics of particles and rigid bodies using principle of force and acceleration, work and energy, and impulse and momentum.
LO3 Apply the laws of dynamics to analyze and interpret the dynamics of particles and rigid bodies.

SYNOPSIS

This course introduces the principle of kinematics and kinetics of particles and rigid bodies. The lessons cover the concept of position, velocity and acceleration of particles; and application of Newton's second law, Principle of Work and Energy, Principle of Impulse and Momentum for both particles and rigid bodies.

REFERENCES

a. Hibbeler, R. C., 2012, *Engineering Mechanics, Dynamics*, 13th Edition, Prentice Hall.
b. Beer, F. P., Johnston, E. R. and Flori, R., 2008, *Mechanics for Engineers, Dynamics*, 5th Edition, McGraw-Hill.
c. Beer, F. P., Johnston, E. R., Clausen, W. E., Eisenberg, E. R. and Cornwell, P. J., , 2010, *Vector Mechanics for Engineers: Dynamics*, 9th Edition, McGraw Hill.

BMCG 2021 MECHANICAL ENGINEERING WORKSHOP

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Identify common shop hazards and use common shop safety equipments.
LO2 Use various kinds of hand tools, measuring tools and equipments for workshop practice.
LO3 Work as an effective member of a team to produce engineering products.

SYNOPSIS

This course covers the fundamentals of cutting, forming, joining and machining processes. The processes include sheet metal forming, welding, conventional milling and CNC Lathe. Other aspects such as handling, safety regulations, and main functions of the machining are introduced. The students will be exposed with practical use of the machine.

REFERENCES

a. Kalpakjian, S. & Schmid, S.R., 2013, *Manufacturing Engineering and Technology*, 7th Ed., Pearson.
b. Groover, M.P., 2007, *Fundamentals of Modern Manufacturing*, 5th Ed., John Wiley & Son Inc.
c. Mike, T., 2000, *Basic Manufacturing*, Butterworth-Heinemann.

BMCG 2312 MANUFACTURING PROCESS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the result of manufacturing processes by applying knowledge of material science and engineering fundamentals.
LO2 Analyse the issues and aspects of manufacturing in order to select the most suitable manufacturing processes for a particular component.
LO3 Demonstrate knowledge of understanding on the impact of manufacturing solutions to societal and environmental contexts.

SYNOPSIS

This course covers theoretical issues of manufacturing and the quality aspects of manufacturing such as quality assurance and tolerance. The type and fundamental principle of joining processes, metal casting processes, forming processes, shaping processes, material removal processes, modern machining processes and their equipments are

also covered. The quantitative problem analysis of certain manufacturing processes is included as well. Societal and environment issue in manufacturing processes are also included. Finally the need to engage in life-long learning processes is emphasised as to ensure students alert on the manufacturing technological changes.

REFERENCES

a. Groover, M.P., 2007, *Fundamentals of Modern Manufacturing*, 3rd Edition, John Wiley & Sons Inc.
b. Kalpakjian, S., and Schmid, S. R., 2001, *Manufacturing Engineering and Technology*, 5th Edition,Prentice Hall International.
c. Schey, J.A., 1999, *Introduction to Manufacturing Processes*, McGraw Hill.

YEAR 1 COURSES – MATHEMATICS, STATISTICS AND COMPUTING

BMFG 1313 ENGINEERING MATHEMATICS 1

LEARNING OUTCOMES

Upon completion of this subject, students should be able to:

LO1 Describe the fundamental concepts of matrices, eigenvalues and eigen vector, complex numbers, interpolation, differentiation, integration and vector-valued functions.

LO2 Solve the mathematical problems that involve matrices, eigenvalues and eigenvector, complex numbers, interpolation, differentiation, integration and vector-valued functions by using an appropriate technique.

LO3 Apply the knowledge of engineering mathematics to deal with the engineering problems.

SYNOPSIS

This course is a blend of analytical and numerical approaches that mainly focusing on the matrices, nonlinear equations, eigenvalues and eigen vectors, complex numbers, interpolation, differentiation, integration and vector valued functions.

REFERENCES

a. James, G., *Modern Engineering Mathematics*, 5th edition, Pearson, 2015.
b. Khoo, C.F., Sharifah Sakinah, S. A., Zuraini, O.and Lok, Y.Y., *Numerical Methods,* 3rd Edition, Pearson Prentice Hall, 2009.
c. Muzalna M.J, Irma Wani J., Rahifa R. and Norazlina A.R., *Engineering Mathematics*, 2nd Edition, Prentice Hall, 2009.
d. Kreysziq E. (2009). *Advanced Engineering Mathematics*, 9th edition, John Wiley.
e. Guo W., *Advanced Mathematics for Engineering and Applied Sciences*, Pearson, 2015.

BMCG 1013 DIFFERENTIAL EQUATIONS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe the basic concept and solution of second order differential equations, Laplace transform and Fourier series.

LO2 Select an appropriate technique to solve problems involving differential equations.

LO3 Apply the concept of differential equations in solving engineering problems.

SYNOPSIS

This course is intended to introduce the concept and theories of differential equations. Second order linear differential equations with constant coefficients will be solved by using the methods of undetermined coefficient, variation of parameters and Laplace transform. Fourier series in relation to periodic functions will be discussed. An introduction to the solution and application of partial differential equations with boundary value problems using the method of separation of variables and Fourier series will also be discussed.

REFERENCES

a. Muzalna, M. J., Irmawani, J., Rahifa, R., Nurilyana, A. A., 2010, *Module 2: Differential Equations*, Penerbit UTeM.
b. Cengel, Y. A., & Palm, W. J., 2013, *Differential Equations for Engineers and Scientists*, 1st Ed. McGraw-Hill., U.S.A.
c. Nagle, R. K., Saff, E. B., & Snider, A. D., 2011, *Fundamentals of Differential Equations and Boundary Value Problems*, 6th Ed. Pearson Education Inc., U.S.A.
d. Kohler, W., & Johnson, L., 2011. *Elementary Differential Equations with Boundary Value Problems*. Pearson Education Inc., U.S.A.
e. Edwards, C. H., & Penny, D. E., 2008. *Differential Equations and Boundary Value Problems*, 4th Ed. Pearson Education Inc., New Jersey, U.S.A.

YEAR 2 COURSES - UNIVERSITY COMPULSORY

BLHW 2712 ETHNIC RELATIONS*

* For Malaysian students only

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Menganalisis peranan hubungan etnik dan kepentingannya dalam proses pembangunan Malaysia melalui perbincangan kumpulan.
LO2 Memberi respons tentang isu dan cabaran etnik budaya di Malaysia melalui pembentangan kumpulan.
LO3 Merumus isu-isu perpaduan dan cadangan untuk memperkasakannya di Malaysia melalui penulisan artikel.

SYNOPSIS

Mata pelajaran ini membincangkan konsep-konsep asas budaya, peranan etnik dan pengaruhnya terhadap sosiopolitik dan sosioekonomi negara khususnya dalam merealisasikan agenda perpaduan. Mata pelajaran ini juga memberi pendedahan tentang isu-isu dan cabaran dalam konteks perpaduan di Malaysia. Selain itu, mata pelajaran ini turut mengupas perkembangan globalisasi dan kesannya ke atas jati diri dan proses pembangunan di peringkat Malaysia. Selain itu mata pelajaran ini akan merumuskan isu-isu perpaduan dan cadangan penambahbaikannya di Malaysia.

REFERENCES

a. Baharuddin, S.A., 2012, *Modul Hubungan Etnik Edisi Kedua.Bangi: Institut Kajian Etnik*, Universiti Kebangsaan Malaysia.

BLHW 2752 MALAYSIAN CULTURE*

* For international students only

LEARNING OUTCOMES

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

LO1 Discuss issues related to Malaysian culture.
LO2 Present issues related to Malaysian culture.
LO3 Reflect the scenario of cultural diversity in Malaysia.
LO4 Describe an element in Malaysian culture.

SYNOPSIS

This course exposes international students to the socio-cultural background of Malaysia which includes ethnic composition, religions, traditions and values. Other elements like music, arts, cuisine, costume, ethnic games, celebrations and national festivals are also highlighted. Student Centered Learning (SCL) methods such as group discussion and presentation will be used in order to assist international students in developing their understanding and appreciation of Malaysian culture.

REFERENCES

a. Heidi Munan (2010). *Cultural Shock. A Guide to Customs and Etiquette*. Kuala Lumpur: The New Straits Times Press.
b. Heidi Munan (2010). *Malaysian Culture Group*. Kuala Lumpur: Book Group.
c. Guan Yeoh Seng (2011). *Media, Culture and Society in Malaysia*. Kuala Lumpur: Routledge.

BLHW 2452 ACADEMIC WRITING

LEARNING OUTCOMES

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

LO1 Prepare clear and detailed descriptions of a product related to fields of interest.
LO2 Express arguments systematically in a composition.
LO3 Prepare short reviews of technical materials.

SYNOPSIS

This course aims to equip the students with the skills to communicate clear and detailed viewpoints in writing. The students are expected to have a stand on topics of their fields by providing advantages and disadvantages to support their arguments. From time to time, consultations with the students will be conducted throughout the completion of their assignments. This serves as the formative evaluation in the course. Grammar components are embedded in the course to support the required writing skills. Blended learning is incorporated in this course.

REFERENCES

a. De Chazal, E., & Rogers, L. (2012). Oxford EAP: *A Course In English For Academic Purposes*. Oxford: Oxford University Press.
b. Hancock, M. & McDonald, A. (2010). *English Result Upper-Intermediate*. New York: Oxford University Press.
c. Paterson, K. & Wedge, R. (2013). *Oxford Grammar for EAP*. UK: Oxford University Press.

BKKX XXXX CO-CURRICULUM II

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Recognise a balanced and comprehensive education
LO2 Develop leadership aspects stressing on disciplines and cooperation within a group or organisaton.

LO3 Build personality and character guided by rules of conduct.
LO4 Foster cooperation and unity in multi-racial society.

SYNOPSIS
a. Cultural
Choir, Gamelan, Cak Lempung, Nasyid, Seni Khat, Seni Lakon, Art, English Elocution, Bahasa Melayu Elocution, and Kompang.
b. Entrepreneurship
Video, Film and Photography, Publishing & Journalism, Computer and Technopreneurship.
c. Society
Fiqh Muamalat, Fiqh Amali, Tahsin Al-Quran & Yaasin and Peer Program.
d. Recreation
Go-Kart, Adventure and Cycling.
e. Sports
Swimming, Volley Ball, Golf, Takraw, Aerobic, Badminton, Football and Net ball.
f. Martial Arts Silat Gayong, Karate-Do and Taekwando.

YEAR 2 COURSES - PROGRAMME CORE

BEKG 1123 PRINCIPLES OF ELECTRIC AND ELECTRONICS

LEARNING OUTCOMES
Upon completion of this course, students should be able to:
LO1 Explain the basic electrical and electronics principles, circuit schematics and components.
LO2 Demonstrate the electrical and electronic knowledge to solve the series and parallel circuits in DC and phasor approach for AC circuit.
LO3 Explain the principle knowledge of semiconductor devices for Diode, BJT and Op Amp.
LO4 Apply the electronic knowledge to solve the Diode, BJT and Op Amp circuits.

SYNOPSIS
This course will discuss about the basic principles of electrical and electronics; Introduction to electric element, symbol and components. KCL, KVL, Node and Mesh in solving DC series and parallel circuit. Introduction in magnetism, electromagnetism and AC characteristic. Introduction to semiconductors, atomic structures, energy band, P-type and N-type. Study on structure, principle and application of diode, BJT and Op-Amp circuits.

REFERENCES
a. Floyd, T.L., 2010, *Principles of Electric Circuits*, Pearson, 9th Ed.
b. Floyd, T.L., and Buchala, D.M., 2010, *Electric Circuits Fundamentals*, Pearson, 8th Ed.
c. Boylestad, R.L., Nasheslsky, L., 2010, *Electronic Devices and Circuit Theory*, Pearson Prentice Hall.

BMCG 1011 MECHANICAL ENGINEERING LABORATORY I

LEARNING OUTCOMES

At the end of the session, students should be able to:

LO1 Observe discipline in attending laboratory sessions, applied safety precautions before, during and after conducting experiments in terms of experimental procedures and aware of the general experimental ethics.

LO2 Use basic mechanical engineering instruments to measure engineering variables pertinent to the conducted experiments

LO3 Write a well organised, sensible and readable technical reports which describe the experiment in a standard writing format

SYNOPSIS

Introduction to Science, Engineering and Technology. Introduction to safety. Ethics in laboratory. Use of scientific method. Mechanical measurement concept. Introduction to measuring devices. Basic engineering instruments. Use of instrument to measure engineering variables. Experimental report writing.

The experiments will be conducted in mechanical engineering laboratories that study fundamental engineering concepts in statics, dynamics, material sciences, measurements and instrumentation as well as engineering drawing.

REFERENCES

a. Wheeler, A.J. and Ganji, A.R., 2010. Introduction to Engineering Experimentation, 3rd Edition, International Edition, Pearson.

b. Alan, S.M., 2001. Measurement and Instrumentation Principles, 1st Edition, Butterworth-Heinemann

c. Holman, J.P. 2001. Experimental Methods for Engineers. 7th Ed., McGraw Hill.

BMCG 2113 SOLID MECHANICS I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Describe and apply the basic concepts and fundamental principles of solid mechanics.

LO2 Analyse and solve the state of stress and strain in elastic structural members under various loading conditions.

LO3 Analyze and determine the principle stresses for plane stress problem due to combine loading.

SYNOPSIS

Introduction to various types of structures and type of supports. Concepts of stress, strain, shear force and bending moment. Theory on torsion. Pure bending on a structure. Combination of loads. Transformation of stress.

REFERENCES

a. Beer, F.P., Johnston E.R., Jr, John, T., Dewolf, Kazurek, D. F., 2012, *Mechanics of Materials*, 6th Edition (Global Edition) , McGraw-Hill.

b. Hibbeler, R.C., 2011, *Mechanics of Materials*, 8th Edition in SI Unit, Prentice Hall.

c. Gere, J.M., 2004, Mechanics of Materials, Thomson.

d. Vable, M., 2002, *Mechanics of Materials*, Oxford University Press.

e. Shames, I.H., 2000, *Introduction to Solid Mechanics*, Prentice Hall.

BMCG 2613 FLUID MECHANICS I

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Define and describe the basic concepts and fundamental principles of fluid mechanics

LO2 Apply fluid mechanics equations in solving fluid mechanics problem.

LO3 Analyse the fluid mechanics concepts in solving fluid mechanics problem

SYNOPSIS

The introduction to the basic physical properties of fluids. Definition of pressure and head. Derivation of hydrostatic equation and its application in pressure measurement, static forces analysis on immersed surface and buoyancy analysis. The introduction to fluid dynamics and fluid flow analysis. Derivation of flow equations. The application of energy equation and Bernoulli equation in the calculation of flow velocity, discharge, and head lost in piping systems. Dimensional analysis and its application.

REFERENCES

a. Cengel, Y. A. and Cimbala, J. M., 2009, *Fluid Mechanics: Fundamentals and Applications*, 2nd International Ed., McGraw-Hill, Singapore.

b. Munson, B.R., Young D.F. and Okiishi, T.H., 2009, *Fundamentals of Fluid Mechanics*, 6th Ed., John Wiley & Sons, Inc, Asia.

c. Douglas, J. F., Gasiorek J. M. and Swaffield, J. A., 2006, *Fluid Mechanics*, 5th Ed., Prentice Hall, Spain.

BEKG 2433 ELECTRICAL SYSTEM

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Explain the basic principle of electromagnetism, power concepts & equations, power factor corrections (single and three-phase system) and per-unit calculation.

LO2 Analyze the characteristics for static and rotation electric machine principles, including AC, DC, Synchronous and induction motor and transformer.

LO3 Apply the concepts of the electric power system network (generation, transmission and distribution) and various power generation system and energy sources.

LO4 Apply the characteristics and performance of electrical transmission line and distribution system.

SYNOPSIS

This is an introductory course for students on the fundamental knowledge of electrical power system. The students will be taught on the physics of electrical power system, which includes the theory and analysis of electromagnetism, followed bypower concepts & equations (single and three phase), power factor & power factor corrections, single and three-phase system and per-unit calculation. There will also topics on characteristics for static and rotating electric machine principles, including AC, DC, synchronous, induction motor and transformer. Furthermore, students will be introduced to the concepts on the electric power system network (generation, transmission and distribution) and various power generation system and energy sources. The students will also learn on basic characteristics and performance of electrical transmission line and distribution system.

REFERENCES
a. Glover, S. & Overbye, 2012, *Power System Analysis and Design*, 5th ed., Cengage Learning.
b. Saadat, H., 2004, *Power System Analysis*, 2nd ed., Mc-Graw Hill.
c. Hughes, *Electrical and Electronic Technology*, 10th ed., UK: Pearson Edu. Ltd.

BMCG 2011 MECHANICAL ENGINEERING LABORATORY II

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Observe discipline in attending laboratory sessions, applied safety precautions before, during and after conducting experiments in terms of experimental procedures and aware of the general experimental ethics.

LO2 Plan, design and conduct experiments to prove a proposed hypothesis out of a given real and practical engineering problem.

LO3 Analyse experimental results that include graphical data presentation and error analysis.

LO4 Write a well organised, sensible and readable technical reports which describe the experiment in a standard writing format.

SYNOPSIS

Introduction to safety procedures in a laboratory. Hypothesis formulation. Design of experiments. Data Analysis. Use of graphical presentation techniques for experimental data. Error and uncertainty. Measurement Accuracy and Precision. Statistical analysis. Good laboratory report writing.

The experiments will be conducted in mechanical engineering laboratories that study fundamental engineering concepts in thermodynamics, fluid mechanics, solid mechanics and mechanical design.

REFERENCES
a. Wheeler, A.J. and Ganji, A.R., 2010. *Introduction to Engineering Experimentation*, 3rd Ed., International Edition, Pearson.
b. Alan, S.M., 2001. *Measurement and Instrumentation Principles*, 1st Ed., Butterworth-Heinemann
c. Holman, J.P. 2001. *Experimental Methods for Engineers*. 7th Ed., McGraw Hill.

BMCG 3113 SOLID MECHANICS II

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Analyse plane-strain problems, strain measurements, stress-strain for pressure vessels and finally apply yield criteria to avoid elastic failure or yielding.

LO2 Analyse and solve the deformation of structural members based on double integration and energy methods.

LO3 Evaluate and solve buckling problem of structural members under compressive axial load and plastic collapse of mechanical members due to various loading conditions.

SYNOPSIS

Transformation of plane-strain and measurements of strain. Pressure vessels: thin, thick and compound cylinders. Yield criteria for ductile and brittle materials. Deflection of beams. Strain energy: Energy concept and Castigliano's theorem. Column: Euler's buckling stress and Secant Formula. Plastic

deformation due to axial, bending and torsional loadings and residual stresses.

REFERENCES

a. Beer, F.P, Johnston, E.R., Dewolf, J.T., and Mazurek, D.F., 2012, *Mechanics of Materials*, 6th edition. McGraw-Hill.
b. Hibbeler, R.C., 2011, *Mechanics of Materials*, SI Ed., Prentice Hall.
c. Gere, J.M., 2012, *Mechanics of Materials*, CL Engineering.

BMCG 2513 COMPUTER AIDED DESIGN AND MANUFACTURING

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Acquire and apply fundamental sketching and feature modeling, build feature based models of parts and assemblies for easy editing.

LO2 Produce document design intent of parts and assemblies in manufacturing drawings.

LO3 Design and develop products effectively through the applications of engineering design methodology.

SYNOPSIS

This course will empower the students with fundamental knowledge and technical skills of 3D solid modeling skills using industry-proven 3D mechanical CAD/CAM software. The students will learn about theory of CAD/CAM systems, the different techniques for creating sketches, solid models, assemblies and CAM operations with emphasis on design intent. The course includes hands-on exercises and best practice methods for students to interpret common error messages during part, assembly, drafting stages and machining stages.

REFERENCES

a. Dassault Systeme, 2012, *Solidworks 2012 Essential Part Assembly and Drawing*, France.
b. Dassault Systeme, 2006, *CATIA R16: Part Design Fundamental* and CATIA machining, France.
c. Rao, P.N., 2004, *CAD/CAM Principles and Applications*, 2nd Edition, McGraw Hill

YEAR 2 COURSES – MATHEMATICS, STATISTICS AND COMPUTING

BENG 2143 ENGINEERING STATISTICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1. Apply the concepts of data description, normal and sampling distributions, estimation and hypothesis testing, ANOVA, regression and non-parametric tests to solve mathematical problems

LO2. Analyze engineering data using descriptive statistics

LO3. Deduce statistical inference for engineering problems by using the techniques of estimation, hypothesis testing and regressio

SYNOPSIS

The outcome of this course is to deliver statistical techniques and tools for data analysis. The course begins with data description. Then, students will be exposed to normal and sampling distributions, estimation and hypothesis testing for one and two populations. In addition, ANOVA, simple linear regression, multiple linear regression and polynomial regression will be taught in this course. Apart from that, students will learn non-parametric statistics. Finally, students will apply their knowledge in statistical software application which are widely used in the industry.

REFERENCES

a. Farah Shahnaz Feroz, Nortazi Sanusi, Hanissah Mohamad, A Student's Guide to Engineering Statistics, Peneribit UTeM, 2019.
b. Prem S. Mann, Introductory Statistics, 9th Edition, John Wiley & Sons, 2016.
c. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, 6th Edition, John Wiley, 2013.
d. Richard Johnson, John Freund, Irwin Miller, Miller and Freund's Probability and Statistics for Engineers, 9th Edition, Pearson-Prentice Hall, 2017.
e. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 9th Edition, Brooks Cole, 2015.
f. Sharifah Sara, Hanissah, Fauziah, Nortazi, Farah Shahnaz, Introduction To Statistics & Probability A Study Guide, Pearson-Prentice Hall, 2008.

BEKG 2443 ENGINEERING MATHEMATICS II

LEARNING OUTCOMES

Upon completion of this subject, students should be able to:

LO1 Describe the fundamental concepts of multivariable functions, multiple integrals and vector calculus.

LO2 Solve the mathematical problems that involve function of several variable, multiple integrals and vector calculus.

LO3 Apply the knowledge of advanced engineering mathematics to deal with the engineering problems.

SYNOPSIS

This course consists of three chapters: Function of Several Variables: Functions of Two or More Variables, Limit and Continuity, Partial Derivatives, Total Differential, Chain Rule, Implicit Differentiation and Local Extrema.

Multiple Integrals: Double Integral, Double Integral Over Non-rectangular Regions, Double Integral in Polar Coordinates, Triple Integral, Triple Integral in Cylindrical and Spherical Coordinates and Moment and Centre of Gravity.
Vector Calculus: Vector fields, Line integral, Green's theorem, Curl and Divergence, Parametric surfaces and their Areas, Surface integrals, Stoke's theorem and Divergence theorem.

REFERENCES

a. Yusof, Y. M., Baharun, S. And Rahman, R. A., 2013. Multivariable calculus for Independent learners. Pearson, Malaysia.
b. Croft, A., Davison, R., Hargreaves, M. and Flint, J., 2012. Engineering Mathematics. Pearson Higher Ed, USA.
c. Anton, H., Bivens, I., and Davis, S., 2010. Calculus Multivariable, 8th edition. John Wiley & Sons, USA.
d. Stewart, J., 2015. Calculus. Cengage Learning, USA.
e. Colley S. J., 2012. Vector Calculus 4th Edition. Pearson, Boston.

YEAR 3 COURSES UNIVERSITY COMPULSORY

BLHW 3462 ENGLISH FOR PROFESSIONAL INTERACTION

LEARNING OUTCOMES

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

LO1 Listen and infer based on situations in context.
LO2 Respond to standard spoken language using communication strategies
LO3 Display detailed descriptions by expanding and supporting points of view using relevant examples.

SYNOPSIS

This course which is designed based on a blended and student-centred learning approach aims to develop students' listening skills as well as communication skills and strategies. Among the elements covered are professional interactions that include group discussion and public speaking. Students are also required to express ideas with relevant examples in public speaking and online assessments. They are also exposed to the rudiments of grammar implicitly via the communicative activities.

REFERENCES

a. Fry, R. (2016). *101 Smart Questions To Ask On Your Interview*. U.K.: New Page Books.
b. Cooper, S. (2016). *100 Tricks To Appear Smart In Meetings: How To Get By Without Even Trying*. Andrews McMeel Publishing.
c. Hood, J.H. (2013). *How To Book Of Meetings: A Complete Guide For Every Business*. South Australia: Magill.
d. Carmine,G. (2014). *Talk like TED: The 9 Public-Speaking Secret Of The World's Top Minds*. New York: St Martins Press.
e. Jason, S.W. (2013). *Workplace Communication For The 21st Century: Tools And Strategies That Impact The Bottom Line*. California: Praeger.

YEAR 3 COURSES - PROGRAMME CORE

BMCG 2212 MICROPROCESSOR TECHNOLOGY

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Explain the architectures of microprocessor technology and its components.

LO2 Characterize functions of microprocessor and the peripheral devices.

LO3 Design applications for the simple problems in the field of control of processes and machines using microprocessor technology.

SYNOPSIS

Introduction and examples of practical utilizations in the field of control systems, data acquisition and communication using microprocessor technology. Explanation of basic terms (memory, bit, byte, word, address, bus, microprocessor, microcomputer, register, instruction, instruction set, program, stack, arithmetical/logical unit) and basic principles of the program execution (interrupt and timer/counter). Combinational and sequential logic gate. Computer number system. Principles of the function and utilization of the input/output ports as general digital inputs and output for switches, sensors, LED indicators, alphanumeric LCD, DC and stepper motors. Utilization of A/D converter and serial communication interface for real application.

REFERENCES

a. Godse, A.P. and Godse, D.A., A Comprehensive Aproach To Microcontrollers, Technical Publications, 2012.
b. Godse, A.P. and Godse, D.A., Microcontroller, Technical Publications, 2013.
c. Mazidi, M.A., PIC Microcontroller and Embedded Systems using assembly and C for PIC18, 2nd Edition, Pearson (Prentice Hall), 2016.
d. Martin, P.B., PIC Microcontrollers, 3rd Edition, Newnes, 2013.
e. Martin, P.B., Interfacing Pic Microcontrollers, 2nd Edition, Newnes, 2013.

BMCG 3313 ENGINEERING DESIGN

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain and apply an appropriate design method at the particular design phase in the course of developing a practical solution of an engineering design problem.

LO2 Develop a practical design solution through a systematic investigation of the engineering design problem.

LO3 Communicate effectively in written, oral and visual means in a technical setting.

SYNOPSIS

This course covers Engineering Design process started from problems analysis, Formulating Design problems, Concept Design, Configuration Design, Parametric Design, Detail Design and Prototypes Development. Suitable methods such as QFD, Weighted Objective Method will be used at the particular design stage. Engineering Economics aspect of product, human factor, ethic and safety in design is included. Design for Manufacture and Assembly (DFMA) is a part of this course. In addition students are required to carry out teamwork project and communicate effectively in written and oral in the technical setting.

REFERENCES
a. Dieter, G.E., Schmidt, L.C, 2009, *Engineering Design*, 4th Edition, McGraw- Hill/Higher Education, Singapore.
b. Ulrich, K.T. and Eppinger, S.D., 2009, *Product Design and Development*, McGraw-Hill
c. Ullman, D.G., 2004, *The Mechanical Design Process*, McGraw-Hill Education (Asia), Singapore.

BMCG 3713 THERMODYNAMICS II

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Apply the principles of thermodynamics (the first and the second laws of thermodynamics) to the optimal design of the basic energy conversion systems: power generation, refrigeration and air-condition.

LO2 Analyze energy conversion systems in the course of their operation, engineering design quantities and their effects on the basic performance characteristics.

LO3 Design the basic energy conversion systems, select working fluids and estimate the system efficiency.

SYNOPSIS

Thermodynamics II is a continuation of Thermodynamics I (BMCG 2713). Thermodynamics principles are applied to the analysis of power generation, refrigeration and air-conditioning systems. Energy and availability analysis (exergy), moist air properties and psychrometric chart and analysis are discussed in this course.

REFERENCES
a. Cengel, Y.A., & Boles, M.A., 2014, *Thermodynamics: An Engineering Approach*, 8th Edition, McGraw-Hill, Singapore.
b. Moran, M.J., Shapiro, H.N., Boettner, D.D. & Bailey, M.B., 2014, *Fundamental of Engineering Thermodynamics*, 8th Edition, John Wiley & Sons, Inc.
c. Borgnakke, C., & Sonntag, R.E., 2012, *Fundamentals of Thermodynamics*, 8th Edition, John Wiley & Sons, Inc.

BMCG 3613 FLUID MECHANICS II

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Understand and apply the principles of fluid mechanics (Fluid kinematics and fluid dynamics, boundary layer theory, turbomachinery and similitude) to engineering problems

LO2 Analyze and evaluate the flow system (wall bounded, internal and external flow and turbomachinery) for discerning its characteristic and/or performance

LO3 Evaluate the flow system (wall bounded, internal and external flow and turbomachinery) for engineering application

SYNOPSIS

Introduction to the concept of fluid flow. Two dimensional ideal fluid flows. Viscous flow field and differential analysis of fluid motion. Vortex and Drag. Boundary layer theory, Von Karman Equation, Prandtl-Blasius solution. Dimensional Analysis and similarity. Working concepts and performance prediction of some fluid machineries such as pumps and turbines. Fundamental introduction of Computational Fluid Dynamics (CFD).

REFERENCES

a. Cengel, Y.A. & Cimbala, J.M., 2009, *Fluid Mechanics: Fundamentals and Applications*, 2nd Ed., McGraw-Hill, Singapore.
b. Munson, B.R., Young, D.F., & Okiishi, T.H., 2009, *Fundamentals of Fluid Mechanics*, 6th Ed., Wiley,
c. Crowe, C.T., Elger, D.F., Roberson, J.A. & Williams, B.C., 2008, *Engineering Fluid Mechanics*, 9th Ed, Wiley.

BMCG XXX3 FINITE ELEMENT METHOD

LEARNING OUTCOMES

At the end of this course, the student should be able to:

a. Describe appropriately the concept of finite elements method.
b. Develop finite elements model related to engineering problem analysis and solve it using finite elements modeler and analysis ANSYS software.
c. Analyse successfully complex problem to illustrate application of the method and write a report based on analysis of the result obtained.

SYNOPSIS

The purpose of this course is to expose the practice of structural analysis in engineering using finite elements. Introduction to finite elements method and understanding of direct method for 1-D elements including bar and beam elements. Understanding of formulation/variational methods including Potential Energy and Galerkin methods. Hands-on ANSYS software in order to build finite element model to solve the problems of linear statics analysis.

REFERENCES

a. Moaveni Saeed, 2008, Finite Element analysis: Theory and Application with ANSYS, 3rd Edition, Pearson, New Jersey.
b. Chandrupatla, T. R. and Belegundu, A. D., 2012, *Introduction to Finite Elements in Engineering*, 4th Edition, Prentice Hall, New Jersey.
c. Logan, D. L., 2012, *A First Course in the Finite Element Method*, 5th Edition, PWS Publishing Company, Boston.
d. Huebner, K. H., Dewhirst, D. L., Smith, D. E. and Byron, T. G., 2001, *The Finite Element Method For Engineers*, 4th Edition, John Wiley & Son Inc., New York.
e. Reddy, J. N., 2005, *An Introduction to Finite Element Method*, 3rd Edition, McGraw-Hill, Inc., New York.

BMCU 3013 INTEGRATED DESIGN PROJECT

LEARNING OUTCOMES

At the end of this course, the student should be able to:

LO1 Design solution by synthesizing mechanical engineering knowledge that will solve complex mechanical engineering problem in accordance withrelevant standards.
LO2 Utilize modern engineering and IT tools in facilitatingsolutions to complex mechanical engineering problems with an understanding of the limitations.
LO3 Evaluate the impact of the design product, component or processes in term of safety, environmental and sustainability factors.
LO4 Demonstrate effectively teamwork skill in completing the IDP.

LO5 Apply project management and financial knowledge effectively in completing the IDP.

SYNOPSIS

Integrated Design Project is a course where students have to design a mechanical engineering project, including project management, project planning, project feasibility study, design selection, design costing and sizing, analysis and evaluation. The course focuses on the implementation and integration of product/conceptual design development to produce a comprehensive final technical report, including engineering proposals and drawings, specifications and bills of quantities, cost estimates of development projects given to students, working in groups. Apart from basic mechanical design, students are also required to integrate their knowledge of other engineering disciplines such as (but not limited to) structural analysis and design, including material selections, project scheduling techniques and sustainable development considerations into their overall project work. At the end of this course, the students will be able to comprehend the needs and requirements for product design procedures and are able to appreciate the importance of integration and synthesis of various disciplines of mechanical engineering knowledge.

REFERENCES

a. International Engineering Alliance, Graduates attributes and professional competencies, version 3, June 2013.
b. Richard G. Budynas and J. Keith Nisbett, Shigley's Mechanical Engineering Design (McGraw-Hill Series in Mechanical Engineering) 10th Edition, January 27, 2014
c. Peter R. N. Childs BSc. and D.Phil , 2013, Mechanical Design Engineering Handbook Butterworth-Heinemann; 1st edition (November 18, 2013).
d. Michael F. Ashby., 2010, Materials Selection in Mechanical Design, 4th Edition, Butterworth-Heinemann; (October 5, 2010).

BMFG 4623 ENGINEERING MANAGEMENT AND ECONOMY

LEARNING OUTCOMES

At the end of this course, student should be able to:

LO1 Explain the core concepts and principles in project management and engineering economics.
LO2 Construct critical decision-making tools in an engineering project by analysing project management and financial elements.
LO3 Generate a comprehensive & viable Project Proposal and justify by a presentation in group discussion session.

SYNOPSIS

This course covers engineering economics and managing risk in an organization. Engineering economics discusses about the time value of money and interest relationships, which are useful to define certain project criteria that are utilised by engineers and project managers to select the best economic choice among several alternatives. Projects examined will include both product and service-producing investments. The effects of escalation, inflation, and taxes on the economic analysis of alternatives are also discussed. Management of

risk incorporates the concepts of probability and statistics in the evaluation of alternatives. This allows management to determine the probability of success or failure of the project.

REFERENCES

a. Blank, L., and Tarquin, A., 2012, *Engineering Economy*, 7th Edition, McGraw Hill.
b. Sullivan, W.G., Wicks, E.M., and Koelling, C.P., 2012, *Engineering Economy*, 15th Edition, Pearson.
c. Park C.S., 2011, *Contemporary Engineering Economics*, 5th Edition, Pearson.
d. Whitman, D., and Terry, R., 2012, *Fundamentals of Engineering Economics and Decision Analysis*, Morgan & Claypool Publishers.

BMCG 3223 CONTROL ENGINEERING

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Derive mathematical model and obtain transfer function of dynamic systems.
LO2 Explain stability of control system using standard techniques in times domain and analyze the time response of the system.
LO3 Utilize frequency response techniques and its relative stability to control the dynamic systems.

SYNOPSIS

Introduction to open loop and closed-loop control systems. Modeling of real system using differential equations to obtain the transfer function of dynamic systems and utilization of block diagrams for the closed-loop control system. Analysis of system for stability in time and frequency domains, final value, steady-state error, overshoot and settling time. Application of controller such as, P, PI and PID algorithms to achieve the desired system response.

REFERENCES

a. Mohd Khairi Mohamed Nor, Mohd Azli Salim, Md Fahmi Abd Samad @ Mahmood, Zairulazha Zainal, Nor Salim Muhammad, 2017, Control Engineering, Penerbit UTeM. (main text)
b. Andrea-Novel, B. and Lara, M., 2013, Control Theory for Engineers: A Primer, Springer-Verlag Berlin Heidelberg.
c. Dorf, R.C. and Bishop, R.H., 2011, Modern Control Systems, 12th Edition, Pearson Education Inc.
d. Jamaluddin, H., Yaacob, M.S. and Ahmad R., 2011, Introduction to Control Engineering, Johor Bahru, Johor: Penerbit UTM Press.
e. Nise, S.N. 2015, Control Systems Engineering, 7th Edition, Wiley.

BMCG 3333 MECHANICAL DESIGN

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Apply the formulation for optimized and safe design based on engineering standard.
LO2 Analyze the statics and dynamics of mechanical systems design
LO3 Evaluate mechanical design system in solving complex engineering problem.

SYNOPSIS

This course covers a brief review of the Engineering Design Process, Design for Static Strength, Design for Fatigue Strength, Linkage Mechanisms and the Applications of Springs and Brakes, Design of Threaded and Welded Joints, Bearings and Shafts

Design and Balancing, the Basics of Gyroscopes, Gear Strength for Power Transmission,as well as the Belt and Chain for Flexible Power Transmission.

REFERENCES

a. J. K. Nisbett & R. G. Budinas, 2014 Shigley's Mechanical Engineering Design, 9th Edition in SI Units, McGraw-Hill Companies, Inc., New York.
b. Peter R. N. Childs BSc. and D.Phil, 2013, Mechanical Design Engineering Handbook Butterworth-Heinemann; 1st edition (November 18, 2013).
c. Michael F. Ashby., 2010, Materials Selection in Mechanical Design, Fourth Edition 4th Edition, Butterworth-Heinemann; (October 5, 2010).

BMCG 3011 MECHANICAL ENGINEERING LABORATORY III

LEARNING OUTCOME

At the end of this course, students should be able to:

LO1 Observe discipline in attending laboratory sessions, applied safety precautions before, during and after conducting experiments in terms of experimental procedures and aware of the general experimental ethics.

LO2 Plan, design and conduct experiments to prove a proposed hypothesis out of a given real and practical engineering problem.

LO3 Write a well organised, sensible and readable technical reports.

SYNOPSIS

Introduction to safety procedures in a laboratory. Hypothesis formulation. Design of experiments. Data analysis. Use of graphical presentation techniques for experimental data. Error and uncertainty. Measurement accuracy and precision. Statistical analysis. Good laboratory report writing. The experiments will be conducted in mechanical engineering laboratories that study fundamental engineering concepts in:-

A) THERMODYNAMICS
   i) Air-conditioning
   ii) Cooling Tower
B) FLUID MECHANICS
   i) Aerodynamic of common geometry
   ii) Drag Measurement
   iii) Pump Performance Test
C) SOLID MECHANICS
   i) Thin & Thick Cylinder
   ii) Curve & Davit Test

REFERENCES

a. Wheeler, A.J. and Ganji, A.R., 2010. *Introduction to Engineering Experimentation*, 3rd Ed., International Edition Pearson.
b. Cengel, Y. A. and Boles, M. A., 2007. *Thermodynamics: An Engineering Approach*, 6th Ed., McGraw Hill.Singapore
c. Yuan, C.S., 2006, *Fluid Mechanics II*, Pearson Prentice Hall, Malaysia.
d. Hibbeler, R. C., 2007, *Solid Mechanics*, 7th Ed., Prentice Hall.

BMCU 3935 INDUSTRIAL TRAINING

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Acquire on-job training or in-plant training in a working environment relevant to the field of mechanical engineering.

LO2 Develop appropriate soft skills and

professional engineering environment exposure throughout the duration of industrial training.

LO3 Apply all knowledge in order to solve common industrial problems as an individual and as a leader in a group or a member of a team.

LO4 Practice the ethics of social, environmental and cultural responsibilities appropriately during industrial training.

SYNOPSIS

Students in third year are required to undergo industrial training for a minimum of 10 weeks at the designated organisation. During the industrial training, students are given continuous supervision by an industrial supervisor as well as supervisor appointed by the faculty. Daily activities throughout the industrial training must be recorded in a log book provided by the faculty, which will be evaluated by the supervisors. Five credit-hours are given for this industrial training. Students must show satisfactory attendance and discipline in order to pass this course. The faculty' supervisor may visit the students during the training period.

YEAR 3 COURSES – MATHEMATICS, STATISTICS AND COMPUTING

BITG 1233 COMPUTER PROGRAMMING

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

LO1 Describe the fundamental principles of problem solving, programming techniques and structures in program development.

LO2 Explain problems and their solutions based on the principles of problem solving and programming techniques.

LO3 Trace and debug in troubleshooting program applications.

LO4 Construct computer program codes by applying suitable programming structures and techniques.

SYNOPSIS

This course covers the introductory topics in programming using C++ language. It includes the introduction to computers and programming, the fundamentals of programming, problem solving and software development. Data types and operators, selection, repetition, function, array, file, structured data and pointer are among the topics covered in the course.

REFERENCES

a. Gaddis, T., 2011, *Starting Out with C++ Brief Version: From Control Structures Through Objects, 7th*. Edition, Pearson Education.

b. Abdullah, N. et. al, 2006, *Lab Module Computer Programming BITG 1113*, FTMK, UTeM.

c. Friedman, Koffman, 2010, *Problem Solving, Abstraction and Design using* C++, Pearson Education.

d. Etter, D.M., Ingber, J.A., 2008, *Engineering Problem Solving with* C++, 2nd Edition, Pearson Education.

e. Hanly, J.R, 2002, *Essential* C++ *for Engineers and Scientists*, Addison Wesley.

YEAR 4 COURSES - UNIVERSITY COMPULSORY

BTMW 4012 ENTREPRENEURSHIP TECHNOLOGY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Recognize the importance of entrepreneurship, the role of entrepreneurship in today's society, and the technical knowledge of the entrepreneurial process.

LO2 Explain the basic concepts of interdisciplinary competences in management, and create technology-based businesses.

LO3 Present a business plan project and develop an entrepreneurial profile.

SYNOPSIS

The course provides students with technological knowledge about entrepreneurship as well as the skills to turn such knowledge into practice. The teaching and learning (T&L) activities include case study and field work with the aim to inculcate entrepreneurship values and entrepreneurship acculturation with a view to successfully launch and subsequently manage their enterprises. Students will be exposed with the support systems available or government agencies in starting new ventures, including the tactics commonly employed by entrepreneurs starting a business. The course allows students to critically evaluate business in terms of technical feasibility, investment potential, and risks.

REFERENCES

a. Barringer, B.R., and Ireland, R.D., 2012, *Entrepreneurship*, 4th Edition, Pearson.

b. Scarborough, N.M., 2011, *Essentials of Entrepreneurship and Small Business Management*, 6th. Edition, Pearson.

c. UiTM Entrepreneurship Study, 2010, *Fundamentals of Entrepreneurship*, Pearson.

YEAR 4 COURSES - PROGRAMME CORE

BMCU 4972 FINAL YEAR PROJECT I

LEARNING OUTCOMES

After completing the course, students should be able to:

LO1 Formulate a problem statement and design a project methodology to fulfill objecives of the project.

LO2 Conduct initial measurements and/or predictive studies to meet objectives of the project.

LO3 Present a project report in written and oral forms.

SYNOPSIS

The student needs to plan and implement the project individually that related to the mechanical engineering field. It covers problem statement, literature review, methodology to overcome the problem. The student needs to achieve the objective of the project and presented it in the report.

BMCU 4984 FINAL YEAR PROJECT II

LEARNING OUTCOMES

At the end of this course, students will be able to:

LO1 Carry out project management based on the principle of engineering.

LO2 Conduct initial measurements and/or predictive studies to meet objectives of the project.

LO3 Analyze data and interpret results.

LO4 Present a full project report in written and oral forms.

SYNOPSIS

The student needs to plan and implement the project individually that related to the mechanical engineering field. It covers problem statement, literature review, methodology to overcome the problem. The student needs to achieve the objective of the project and presented it in the report.

BMCG 4812 SUSTAINABILITY AND ENVIRONMENT

LEARNING OUTCOMES:

At the end of the course, students should be able to:

LO1 Explain the impact of pollution and climate changes towards the environment.

LO2 Apply the concept of sustainable development in engineering design, manufacturing and technologies abide with the current national laws, regulations and policies.

LO3 Analyse using sustainability assessment tools in engineering design, manufacturing and technologies.

SYPNOPSIS:

This course is an introductory course on sustainability and environment. It focuses on five main elements for sustainability; Water, Energy, Health, Agriculture and Biodiversity. Sustainable development and its application in Malaysia in relation to the National Environmental Policy and Green Technology Policy are highlighted. Assessment tools such as Life Cycle Assessment, Carbon Footprint and Cleaner Production abide with the latest guideline, policies, laws and regulation. The application of engineering design, manufacturing and technologies towards sustainability and environment will be discussed.

REFERENCES

a. Robertson, M., 2014, *Sustainability Principles and Practice*, Routledge.

b. De Vries, B.J.M., 2012, *Sustainability Science*. Cambridge University Press.

c. Davis, M.L., and Masten, S.J., 2014, *Principle of Environmental Engineering and Science*. New York: McGraw-Hill.

d. Snedden, R., 2014, *Environmental Engineering and the Science of Sustainability*. New York: Crabtree Publishing.

BMCG 4743 HEAT TRANSFER

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Solve problems on steady state and unsteady state on one dimension and multiple dimension heat transfer.

LO2 Determine the heat transfer coefficient for natural or forced convection in dimensionless parameter in thermal system.

LO3 Determine of energy exchanges between black and grey surfaces at different temperatures.

SYNOPSIS

Introduction to heat transfer, steady state conduction-one dimension and multiple dimensions, unsteady state conduction. Numerical analysis for solving heat transfer problems, forced convection in laminar and turbulent flow on plate and pipe, natural convection, phase changes of heat transfer, thermal radiation on black body and surface, and boiling and condensation

REFERENCES

a. Chengel, Y.A., & Ghajar, A., 2014, *Heat and Mass Transfer: Fundamentals & Applications*, 5th Ed., McGraw-Hill.
b. Incropera, F.P. & Dewit, D.P., 2011, *Fundamentals of Heat and Mass Transfer*, 7th Ed., John Wiley & Sons.
c. Holman, J., 2009, *Heat Transfer*, 10th Ed., McGraw-Hill.

BMCG 3233 MECHANICAL VIBRATION

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Apply the fundamental principles of vibration of one-and two-degree-of-freedom systems in engineering practice.
LO2 Identify the vibration characteristics of a vibrating system
LO3 Design basic techniques of vibration control.

SYNOPSIS

Fundamental of vibration. One-degree-of-freedom system: free vibration of an undamped and damped systems. Harmonically excited vibration: forced undamped and damped systems; unbalance rotating mass; base excitation. Two-degree-of-freedom system: natural frequencies and mode shapes. Continuous structures: beam, string and plates. Design of vibration suppression: vibration isolation and vibration absorber.

REFERENCES

a. Rao, S.S., 2011, *Mechanical Vibrations*, 5th edition: Prentice Hall.
b. Kelly, S.G., 2011, *Mechanical Vibrations: Theory and Applications*, Cengage Learning.
c. Meirovitch, L., 2010, *Fundamental of Vibration*, McGraw-Hill.
d. Inman, D.J., 2008, *Engineering Vibrations*, 3rd edition, Pearson Education Inc.
e. Kelly, S.G., 2006, *Schaum's Mechanical Vibrations*, McGraw-Hill.
f. Putra, A., Ramlan, R., and Ismail, A.Y., 2014, *Mechanical Vibrations*: Teaching Modul and Learning Series, UTeM.

BMCU 4022 ENGINEER AND SOCIETY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Relate the effect and impact of technology on society, culture and environment.
LO2 Demonstrate as a responsible professional, abiding to the code of professional ethics.
LO3 Demonstrate effectively the assignment given in a group or individual.
LO4 Response critically and handle social, cultural and global issues as well as environment, occupational health & safety issues.

SYNOPSIS

Role of engineer in Nation Building, evaluation of engineering, National development Role of engineers in society, laws related to public safety, health & welfare, future engineers, professionalism

and codes of ethics, definition of professionalism, understanding engineering as a profession, ethical theories, IEM and BEM code of ethics. Ethical problem solving techniques analysis of issues in ethical problems, line drawing, flow charting, learn to handle conflicting problems, application in bribery and accepting gifts situation. Ethics practice in Occupational Safety and Health at work. Rights and responsibilities of engineers. Quality from engineering perspective. Carrier guidance and project management.

REFERENCES

a. The Institution Of Engineer, Engineering Professionalism and Ethics, 4th Ed, 1995.
b. Fleddermann, C.B., 2008, *Engineering Ethics*, 3rd Ed, Prentice Hall.
c. Martin, M.W., & Schinzinger, R., 2005, *Ethics in Engineering*, 4th Ed, McGraw-Hill.
d. Harris JR, C.E., Pritchard, M.S., Rabin, M.J., 2003, *Engineering Ethics*, 2nd Ed, Thomson and Wadsworth.
e. Canning, J., 2007, Workplace Safety for Occupational Health and Safety (Safety at Work Series V4).
f. Safe Work in 21st Centuries (Educational and Training for the Next Decade Occupational Health and Safety Personnel) National Academy Press, 2006
g. Idrus, A., Sulaiman, S.A., Khamidi, M.F., 2010, *Engineers in Society*, Mc Graw Hill Education.

BMCU 4011 ENGINEERING SEMINAR

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Identify the professional engineering knowledge, practices and responsibilities.
LO2 Gather and sort relevant information with regard to the given technical talk.
LO3 Discuss current engineering issues and practices in small group and present the reflection in a forum or short report.

SYNOPSIS

A series of technical talks will be organised and the attendance is compulsory. The technical talks will dwell on engineering profession that relates to the technology advancement, economy issues, technopreneurship, environment, sustainability and safety aspects. Reflection of the seminar will be discussed in a forum and short report will be produced by the students.

YEAR 4 COURSES - ELECTIVE

BMCG 4713 RENEWABLE ENERGY SYSTEM

LEARNING OUTCOMES

At the end of this course the students should be able to:

LO1 Calculate the potential output for the renewable energy applications.

LO2 Design the technoeconomics of stand-alone renewable energy system based on consumption data, local weather and current technology.

LO3 Evaluate the scenario of renewable energy application and energy policy in Malaysia.

SYNOPSIS

Introduction to renewable energy. Solar photovoltaics, solar thermal systems, wind power, wave and tidal power, hydroelectric, biofuels, biomass, geothermal and ground-source heat pump, hydrogen and fuel cells.

REFERENCES

a. Boyle, G., 2012, *Renewable Energy: Power for a Sustainable Future*, 3rd Edition Oxford, University Press.

b. Kaltschmitt, M., Streicher, W., Wiese, A., 2010, *Renewable Energy: Technology, Economics and Environment*, 1st Edition, Springer.

c. Da Rosa, A.V., 2012, *Fundamentals of Renewable Energy Processes*, 3rd Edition, Academic Press.

BMCG 4723 REFIRGERATION AND AIR CONDITIONING SYSTEM

LEARNING OUTCOMES

At the end of this course, the students should be able to:

LO1 Design the vapour compression and vapour absorption refrigeration systems by estimating the corresponding system performance.

LO2 List and discuss the relevancy of the working fluids such as steam and refrigerants (natural or otherwise) that are available and applicable to the industries especially in terms of the global warming, carbon emission and environmental sustainability.

LO3 Formulate and discuss the basic psychrometric theory and use the theory to design thermal systems related to the air conditioning processes.

LO4 Design an air conditioning system that meet the heat gain load and thermal comfort requirements by establishing the building cooling load and designing of ducting system.

SYNOPSIS

Introduction to the underlying thermodynamics principles, refrigeration system and air conditioning system. Carnot cycle and thermodynamics properties phase diagrams such as p-h, T-s and p-v. Vapour compression and absorption refrigeration systems. Types and use of refrigerants in the heating, ventilating and air conditioning (HVAC) system. Effect of green-house gases to the environmental sustainability. Psychrometric principles and thermal processes related to the HVAC. Interior design and thermal comfort configuration for domestic and industrial buildings. Cooling load estimation and ducting design for ventilation.

REFERENCES
a. McQuiston, F.C., 2011, *Heating, Ventilating and Air Conditioning Analysis and Design*, Wiley.
b. Arora, C.P., 2009, *Refirgeration and Air Conditioning*, 3rd Edition, Tata-McGrawHill, New Delhi.
c. Jones, W.P., 2001, *Air Conditioning*, 5th Edition, Butterwort Heinemann, Oxford.
d. Wang, S.K., 2009, *Handbook of Air Conditioning and Refrigeration*, 2nd Edition, MCGraw-Hill, New York.

BMCG 4733 POWERPLANT SYSTEM

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Determine the performance of different cycles and component for power generation plant.
LO2 Calculate the performance of different combustion system using different fuel source.
LO3 Analyze the cooling tower performance.
LO4 Appraise the performance of Nuclear energy power generation system.

SYNOPSIS

The course will involve the studies on the Thermodynamics review, Rankine Cycles, Fossil-Fuel Steam Generator, Fuels and Combustion, Turbines, Condensate Feedwater System, Circulating Water System, Gas Turbines, Nuclear Energy, Reactors, Powerplant and Power Generation Influence on the Environment.

REFERENCES
a. Kiameh, P., 2011, Power Plant Equipment Operation and Maintenance Guide, McGraw Hill.
b. Woodruff, E., Lammers, H., and Lammers, T., 2011, *Steam Plant Operation*, 9th Ed., McGraw-Hill.
c. El-Wakil, M.M., 2002, *Powerplant Technology*, McGraw Hill.

BMCG 4613 COMPUTATIONAL FLUID DYNAMICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 To explain the concept of major theories, approaches and methodologies used in CFD.
LO2 To conduct the actual implementation of CFD methods in using commercial CFD codes.
LO3 To be able to interpret and present the results in an appropriate professional context.

SYNOPSIS

The fundamental principles of fluid mechanics are conservation of mass, momentum and energy. Engineering students must understand and be able to apply these basic principles before designing fluids engineering systems. Hence, this course is designed for undergraduate students tend to pursue industrial employment after graduation. The course is focused on two areas: the fundamental of the method and the correct way of conducting the analysis using readily available software, i.e. ANSYS Version 14.

REFERENCES
a. Anderson, J.D., 2006, Computational Fluid Dynamics The Basic with Application, McGraw-Hill: Singapore.
b. Chung, T.J., 2010, Computational Fluid Dynamics, Second Edition, Cambridge University Press: United States of America.

c. Tannehill, J.C., Anderson, D.A., and Pletcher, R.H., 1997, Computational Fluid Mechanics and Heat Transfer, Second Edition, Taylor and Francis: USA.

BMCG 4623 FLUID POWER AND TURBOMACHINERY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Apply turbomachine theory in the design process of these devices.

LO2 Predict the performance characteristics of turbomachine devices.

LO3 Explain the common hydraulic and pneumatic components, their use, symbols and their application in the industry.

LO4 Design and evaluate hydraulic and pneumatic system manually and using related computer software

SYNOPSIS

The turbomachinery section covers classification of different types of turbomachines, basic relations of velocity diagrams, mass flow rates, energy and momentum equations for axial flow gas turbines and compressors. However, the Fluid Power section covers the introduction of the hydraulic and pneumatic systems, components and their working principles and performance. Furthermore, the level of understanding is enhanced to the system ancillaries, sensors, fluid power circuit design, and analysis and control. The computer software is used to design and simulate the fluid power application.

REFERENCES

a. Dixon, S. L., 2005, *Fluid Mechanics and Thermodynamics of Turbomachinery*, Elsevier Butterworth-Heinemann, USA.

b. Peng, W.W., 2008, *Fundamental of Turbomachinery*, John Wiley & Son, USA.

c. Boyce, M.P., 2006, *Gas Turbine Engineering Handbook*, 3rd Edition, Gulf Proffesional Publishing, USA.

d. Ilango S. 2007. *Introduction to Hydraulics and Pneumatics*. Prentice Hall-India. New Delhi.

e. Esposito A. 2013. *Fluid Power with Applications*. 7th Ed. Pearson Education Limited. UK.

f. Johnson, J.L. 2002. *Introduction to Fluid Power*. Delmar. New York.

BMCG 4123 ADVANCED SOLID MECHANICS

LEARNING OUTCOMES

At the end of this course the student should be able to:

LO1 Analyse and determine shear centre and stresses of structures due to unsymmetrical bending and torsional load.

LO2 Analyse and determine principal stresses by using imaging technique.

LO3 Analyse and evaluate the contact stresses due to contact between curved surfaces.

SYNOPSIS

Unsymmetrical bending theory, stresses in curved beams, shear centre and stress, torsion for open and closed cells thin-walled, photoelasticity, stresses in circular and square plate, and contact stresses.

REFERENCES

a. Beer, F.P., and Johnston, E.R, 2013, *Mechanics of Materials*, 4th Ed., McGraw-Hill.

b. Budynas, R.G., 1999, *Advanced Strength and Applied Stress Analysis*, McGraw-hill.

c. Hearn, E. J., 1997, *Mechanics of Materials Vol. I & II.*, Butterworth-Heinemann.

d. Benham, P.P., Crawford, R.J., and Armstrong, C.G, 1996, *Mechanics of Engineering Materials,* Longman Group, Ltd., UK.
e. Vable, M., 2004, *Mechanics of Materials*. Oxford University Press.
f. Solecki, R., and Conant, R.J., 2003, *Advanced Mechanics of Materials*. Oxford University Press.

BMCG 4133 FRACTURE MECHANICS

LEARNING OUTCOMES

LO1 Define the fracture mechanics and describe fracture mechanisms of materials and explain why structures fail by giving examples of structural failures occurred for the last few decades and recent years.

LO2 Define and differentiate the differences between stress concentration factor (SCF) and stress intensity factor (SIF) and explain how these parameters may be determined by using various methods and its relation with the KIC of the material.

LO3 Determine, analyze and validate (or verify) data of fracture toughness of materials by using LEFM (Linear Elastic Fracture Mechanics) and EPFM (Elastic Plastic Fracture Mechanics) concepts.

LO4 Apply fracture criteria into structural design and determine fatigue life of engineering structures or components by using fracture mechanics approaches (either based on LEFM or EPFM concepts)

LO5 Examine and evaluate the fatigue phenomena of metallic materials and carry-out failure analysis (life prediction) by using stress-based and strain-based approaches

SYNOPSIS

Introduction to the subject of fracture mechanics and provides history and overview, Fundamental concepts of linear elastics and elastic-plastic fracture mechanics (LEFM and EPFM), Fracture toughness testing, Fatigue crack threshold and propagation equations, and Fatigue behaviour and failure analysis of metallic materials based on Stress-based and Strain-based approaches.

REFERENCES

a. *Fundamentals and application of Fracture Mechanics* by T.L Anderson
b. *Mechanical Behaviour of Materials* by Norman E. Dowling
c. *Elementary Engineering Fracture Mechanics* by D. Broek.
d. *Fracture and Fatigue Control in Structure* by J.M. Barson and S.T. Rolfe.
e. *Principle of Fracture Mechanics* by R.J. Sanford.
f. *Fracture of Engineering Brittle Materials* by A.S. Jayatilaka.
g. *Annual Book of ASTM Standards and Handbooks of Peterson's Stress Concentration Factors* (By W.D Pilkey & D.F Pilkey) and SIFs Handbook by Tada, H., Paris, P.C., & Irwin, G.R

BMCG 4413 NON DESTRUCTIVE TESTING

LEARNING OUTCOMES

At the end of the course, the student should be able to:

LO1 Describe fundamental principles of current state of SHM process and technology.

LO2 Assess structural integrity loss of mechanical structure.

LO3 Suggest the best SHM strategy to sustain mechanical structures

SYNOPSIS

This course is intended to introduce the Structural Health Monitoring (SHM) Systems and Technologies. It covers the system methodology that includes system components, data acquisition; the sensory technology; the SHM testing categories such as static field test, dynamic field test and etc; the SHM system design; vibration-based techniques for SHM; and case studies.

REFERENCES

a. Stepinski, T., Uhl, T., Staszewski, W., 2013, Advanced Structural Damage Detection: From Theory to Engineering Applications, John Wiley & Sons.
b. Mix, P.E., 2005, Introduction to Nondestructive Testing, 2th Editions, John Wiley & Sons.
c. Sansalone, M.J., Streett, W.B., 1997, Impact-Echo: Nondestructive Evaluation of Concrete and Masonry, Bullbrier Press

BMCG 4423 COMPOSITES AND ADVANCED MATERIALS

LEARNING OUTCOMES

At the end of the course, the student should be able to:

LO1 Explain the characteristics of materials that determine their properties.
LO2 Identify various classes of composites and advanced materials and their processing, properties and applications.
LO3 Apply the information provided in the course to properly identify, characterize, and select materials that satisfy a set of requirements.

SYNOPSIS

This course introduces students to composites and advanced materials in general, with the focus on their classifications, basic constituents, processing and applications. In addition, knowledge on the mechanical testing of fibre-reinforced composites is included. This course also emphasis on specific advanced materials including nanomaterials, natural fibre-reinforced plastic and powder metallurgy. The course also introduces some of the fundamental concepts in selecting and designing with composites and advanced materials in various engineering applications.

REFERENCES

a. Chawla, K.K., 2012, *Composite materials: Science and Engineering*, Springer.
b. Budinski, K.G., and Budinski, M.K., 2010, *Engineering Materials*, Ninth Edition, Pearson Prentince Hall.
c. Matthew, F.L., and Rawling, R.D., 2003, *Composite Materials: Engineering and Science*, Woodhead Publishing Limited.
d. Hodgkinson, John, 2000, *Mechanical testing of advanced fibre composites*, Woodhead Publishing.
e. Edelstein, Alan, S., and Cammaratra, R.C., 1998, *Nanomaterials: synthesis, properties and applications*. CRC Press.

BMCG 4433 METALLURGY

LEARNING OUTCOMES

At the end of the course, the student should be able to:

LO1 Explain clearly the structure, physical and mechanical behaviour of the metallic materials.

LO2 Describe properly the solidifications process, plastic deformation, strengthening mechanism, principle of recovery, recrystallization and grain growth.

LO3 Correlate the composition, microstructure and heat treatment processes by interpretation of Ferum-Carbide phase diagrams and transformation diagrams system appropriately and corrosion and prevention of metallic materials.

LO4 Develop the ability to communicate effectively using available resources to disseminate knowledge of metallurhy various enginnering application.

SYNOPSIS

Physical metallurgy: crystal structure and properties of pure metals, solidification; strengthening mechanisms; recovery, recrystallization and grain growth; ferum-carbide phase diagram; TTT diagrams; heat treatment of steel; non-ferrous metals and its alloy; heat treatment of non-ferrous metals; properties of metallic materials and its alloy, corrosion and prevention of metallic materials .

Mechanical metallurgy: stress and strain; elastic behavior; theory of elasticity; true stress and true strain; effect of heat/temperature on strain rate and stress flow; metallurgy structure; mechanic testing for metallic materials for stress, hardness, impact and creep; fundamental of mechanical working for metallic materials.

REFERENCES

a. George, E.D., 2013, *Mechanical Metallurgys*, 3rd Ed. in SI Units, Tata McGraw-Hill.
b. V. Raghavan, 2006, *Physical Metallurgy Principles And Practice* 2nd Ed.. Prentice Hall.
c. Smith, W.F., 2010, *Principles of Materials Science and Engineerings*, 5th Ed., McGraw Hill.
d. Hertzberg, R.W., 1996, *Deformation and Fraxture Mechanics of Engineering Materials*, 4th Ed., Willey.

BMCG 4313 MECHANISM DESIGN

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe the concept and the process of designing a mechanism system.

LO2 Analyze the motion characteristics of the machine analytically, graphically or computationally.

LO3 Synthesize mechanisms according to motion requirement.

SYNOPSIS

This course is to introduce the principles of designing mechanisms, aided by the use of computer applications. Students will investigate the kinematics and dynamics of machineries. Topics include cam and cam follower design, gear kinematic analysis, and linkage synthesis.

REFERENCES

a. Myszka, Dave, 2012, *Machines & Mechanisms: Applied Kinematic Analysis*, 4th ed., Prentice Hall, Upper Saddle River, New Jersey.
b. Norton, Robert, 2012, *Design of Machinery*, 5th ed., McGraw-Hill, New York.
c. Uicker Jr., J.J., Pennock, G.R., and Shigley, J.E., 2003, *Theory of Machines and Mechanisms*, 3rd ed., Oxford University Press, New York.

BMCG 4323 PROTOTYPE DEVELOPMENT TECHNOLOGY

LEARNING OUTCOMES

At the end of this course, the students should be able to:

LO1 Explain the fundamental issues in concurrent product and process development in terms of concurrent engineering tools and technologies such as rapid prototyping, reverse engineering, computer aided design, and high speed machining.

LO2 Discuss the main design issues issues with relation to rapid prototyping, reverse engineering and high speed machining.

LO3 Analyze and recognize the appropriate time compression technologies based on its application, engineering requirements and lead-time.

SYNOPSIS

This course introduces essential tools and techniques in concurrent product and process development. It explains and discusses the functions and roles of time compression technologies such as rapid prototyping, CAD, and reverse engineering within product development. Comparison between additive and subtractive layer manufacturing is included. An overview of several RP, RE, and CAD systems current application and future trends are also discussed. The application of solid modeling and surface modeling, together with STL file generation in component design is analyzed. Reverse engineering systems, rapid tooling and rapid manufacturing techniques are compared and discussed.

REFERENCES

a. Thompson, R., 2011, *Prototyping and Low-Volume Production: The Manufacturing Guides*, Thames and Hudson.

b. Bartolo, P.J., 2011, *Stereolithography: Material, Processes and Applications*, Springer.

c. Gibson, I., Rosen, D.W., & Stucker B., 2009, *Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing*, Springer.

BMCG 4333 DESIGN QUALITY AND RELIABILITY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Apply technique of benchmarking, quality function deployment and design of experiment to improve product quality for customer's satisfaction.

LO2 Develops mathematical models useful in analyzing components and system reliability as well as develop the common failure laws based upon its distributions to predict reliability.

LO3 Demonstrate the ability of quality and reliability methodology in developing products in a technical setting.

SYNOPSIS

This course introduces essential techniques in quality and reliability issues in design. The students will be exposed to the Total Quality Management concept, application of quality function deployment, design of experiment (Taguchi method) for product and process design. It also covers topics such as product reliability, application of fault tree analysis, failure distribution method and reliability prediction analysis.

REFERENCES

a. Krajewski, L.J., Ritzman, L.P., & Malhotra, M.K., 2007, *Opeartion Management: Process and Value Chains*, Prentice Hall.
b. Smith, D.J., 2011, *Reliability, Maintainability and Risk*, Elsevier Ltd.
c. Ebeling, C.E., 2010, *An Introduction to Reliability and Maintainability Engineering*, The McGraw-Hill Companies, INC.

BMCG 4343 DESIGN OPTIMIZATION

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Understand and formulate of optimization problems in engineering design.
LO2 Analyze design constraint and variables to solve optimization problem.
LO3 Apply an engineering package to optimize the design. Modern Tool Usage.
LO4 Explore optimization cases in industry.

SYNOPSIS

This course covers Mathematical modeling of engineering design problems for optimization. Boundedness and monotonicity analysis of models. Differential optimization theory for unconstrained and constrained problems, and selected numerical algorithms for continuous nonlinear models. Emphasis on the interaction between proper modeling and computation. Students propose design term projects from various disciplines and apply course methodology to optimize designs.

REFERENCES

a. Papalambros, P.Y., and Wilde, D.J., 2000, *Principles of Optimal Design: Modelling and Computation*, Cambridge University Press.
b. Arora, J., 2011, *Introduction to Optimum Design* (Third Edition), Academic Press.
c. Venkataraman, P., 2009, *Applied Optimization with MATLAB Programming* (2nd Edition), Wiley.
d. Rao, S.S., 2009, Engineering Optimization: Theory and Practice, Wiley.

BMCG 4513 ADVANCED COMPUTER AIDED DESIGN

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Understand and apply the fundamentals of surface modeling in CAD using the tools and workbenches studied in the class in relation to the design and automotive industries.
LO2 Develop 3D surface models in the process of concept design generation and also for the engineering design detail data development.
LO3 Analyze the surface modeling data using the surface analysis tools for further engineering design and development process.

SYNOPSIS

This course will empower the students with fundamental knowledge and technical skills of 3D surface modeling skills using industry-proven 3D mechanical CAD software. The students will learn about the different techniques for creating surface models with emphasis on design intent. Other topics include surface analysis, A-class surface, generation of complex shape, surface requirement in mechanical applications.

REFERENCES

a. Dassault Systeme, 2006, *CATIA: Generative Shape Design Fundamentals*; Lecture
b. Guide CATIA V5R16, France.
c. Dassault Systeme, 2006, *CATIA: FreeStyle Fundamentals; Lecture Guide CATIA V5R16*, France.
d. Dassault Systeme, 2006, *CATIA: FreeStyle Sketch Tracer; Lecture Guide CATIA V5R16*, France.
e. Dassault Systeme, 2006, *CATIA: Digital Shape Editor; Lecture Guide CATIA V5R16*, France.

BMCG 4913 VEHICLE DYNAMICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain some basic vehicle dynamics requirements.
LO2 Explain the basics of vehicle handling/ride and primary factors that affect it.
LO3 Develop physical and mathematical model to predict the dynamic response of a vehicle.

SYNOPSIS

This course is intended to discuss an introduction and the basic concept of vehicle dynamics, fundamental approach towards vehicle dynamics modeling, vehicle response to various driver and ambient inputs, road loads, mechanics of tyre, relation between ride and handling, steering and suspension system.

REFERENCES

a. Dukkipati, R.V., Pang, J., Qatu, M.S., Sheng, G., & Shuguang, Z., 2008, *Road Vehicle Dynamics*, 1st Ed., SAE International, Warrendale, PA, USA.
b. Wong, J.Y., 2008, *Theory of Ground Vehicles*, 4th Ed., John Wiley & Sons.
c. Rajamani, R., 2012, *Vehicle Dynamics and Control*, 2nd Ed., Springer, New York, USA.

BMCG 4923 AUTOMOTIVE TECHNOLOGY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe the classifications and fundamental concept of automotive system.
LO2 Analysis the assembly and disassembly process of automotive system or components.
LO3 Review the technological advances in any automotive system in modern vehicle supporting Energy Efficient Vehicle (EEV).

SYNOPSIS

This course covers automotive configurations, basic operation of automotive system and components such as engine and power train system, electric and electronic system, suspension, brake, steering, fuel and lubricants.

REFERENCES

a. Halderman, J.D., 2009, *Automotive Technology: Principles, Diagnosis and Services*, 3rd Edition, Prentice Hall.
b. Erjavec, J., 2010, *Automotive Technology 5e: A Systems Approach*, 5th Edition, Thomson Delmar Learning, New York.
c. Duffy, J.E., 2009, *Modern Automotive Technology*, 7th Edition, Goodheart-Willcox Publisher.

BMCG 4933 VEHICLE POWERTRAIN SYSTEMS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the principles behind the design of vehicle powertrain components and systems.

LO2 Use mathematical programming for examination of performance and energy usage.

LO3 Solve the design challenge that involves a compromise between vehicle performance and energy usage.

LO4 Analyse on the overall vehicle performance using a system approach that focuses on the integration and interaction of all powertrain components.

SYNOPSIS

Transmission design engineering has been enriched by numerous variants such as automatic transmission, continuous variable transmission, torque converter, clutch transmission and transmission for all-wheel drive. The purpose of this course is to describe the development of motor vehicle transmission as an ongoing part of the vehicle development system. The contents including discussing and introducing the basic concept of automotive power train, fundamental approach towards automotive engine performance, power conversion, engine and transmission matching, principle design of transmission system, vehicle response to various engine and transmission configurations, automatic and manual transmission, brakes and wheel, and power train technology. New era of power train technology will also be analyzed.

REFERENCES

a. Mashadi, B., and Crolla, D., 2012, *AutomotiveVehicle Powertrain Systems*, John Wiley & Sons Ltd.

b. Naunheimer, H., Bertsche, B., Ryborz, J., and Novak, W., 2011, *Automotive of Vehicle Dynamics*, Society of Automotive Engineers: USA.

c. Nam, K.H., 2010, *AC Motor Control and Electric Vehicle Applications*, CRC Press.

BMCG 4943 INTERNAL COMBUSTION ENGINE

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the fundamental concepts of the internal combustion engine.

LO2 Explain the combustion process, engine cycles, operating parameters and emissions produced by internal combustion engine.

LO3 Use analytical and computational approaches for analyzing internal combustion engine.

SYNOPSIS

The course introduces students to the fundamentals of internal combustion engines (ICEs). Thermodynamic operating principles are used to solve problems on spark ignition and compression ignition engines that operate on four-stroke or two-stroke cycles. The scope of the course includes all ICEs with an emphasis on reciprocating engines used in automobiles and similar applications. Topics include operating characteristics, engine cycles, thermochemistry and fuels, air and fuel induction, fluid motion within combustion chamber, combustion, exhaust flow, emissions and air pollution, heat transfer in engines, and friction and lubrication. The latest automotive

technologies are also discussed in relevant topics such as hybrid vehicles, higher voltage electrical systems, and electronic valve actuation.

REFERENCES

a. Ganesan, V., 2010, *Internal Combustion Engines*, 3rd Edition, Tata-McGraw Hill, New Delhi.
b. Bosch, R., 2006, *Gasoline-Engine Management: Systems and Components*, 3rd Ed., Professional Engineering publishing.
c. Pulkrabek, W.W., 2004, *Engineering Fundamental of the Internal Combustion Engine*, 2nd Ed., Prentice Hall, New Jersey.

BMCG 4953 VEHICLE SYSTEM MODELING AND SIMULATION

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Develop mathematical models for a given vehicle application or analysis.
LO2 Verify the models using vehicle dynamics simulation software.
LO3 Simulate and evaluate the performance of vehicle system.

SYNOPSIS

This course is intended to introduce vehicle dynamics modeling and simulation. Mathematical models will be developed in order to predict the vehicle behaviour in longitudinal, lateral and vertical directions. Tire modeling will cover both linear and non-linear tire models. Validation and limitations of vehicle models will be discussed. These models will be used to evaluate the performance of tire, ride and handling. For vehicle handling assessment, steady-state and transient tests will be described. Modeling and simulation of vehicle systems in MATLAB/SIMULINK environment will be used extensively in class notes and assignments.

REFERENCES

a. Wong, J.Y., 2008, *Theory of Ground Vehicles*, 4th Ed., John Wiley and Sons Inc, USA.
b. Rajamani, R., 2012, *Vehicle Dynamics and Control*, 2nd Ed., Springer, New York, USA.
c. Dukkipati, R.V., Pang, J., Qatu, M.S., Sheng, G., & Shuguang, Z., 2008, *Road Vehicle Dynamics*, 1st Ed., SAE International, Warrendale, PA, USA.

BMCG 4213 VIBRATION MONITORING OF ROTATING MACHINERY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe the principle of vibration measurement, signal processing and the standards used in rotating machineries fault diagnosis.
LO2 Classify the fault criteria in rotating machineries.
LO3 Diagnose and justify the type of faults.

SYNOPSIS

The course emphasizes on the basic vibration measurement involving rotating machineries. It covers the basic signal processing especially relating to the time domain and frequency domain analyses. Several fault diagnosis involving unbalance, alignment, looseness, rolling element bearing analysis, gearbox analysis, pumps, fans and compressors are covered in the course. The course also highlights the right way to the vibration analysis process and the setting of alarm limits.

Several related ISO standards are also briefly introduced.

REFERENCES

a. Vance, J., Zeidan, F., & Murphy, B., 2010, *Machinery Vibration and Rotordynamics*, 1st Ed., John Wiley & Sons, USA.
b. Adams, M.L., 2009, *Rotating Machinery Vibration: From Analysis to Troubleshooting*, 2nd Ed., CRC Press, USA.
c. Muszynska, A., 2005, *Rotordynamics (MECHANICAL ENGINEERING)*, CRC Press, USA.
d. Bently, D.E. & Hatch, C.T., 2003, *Fundamentals of Rotating Machinery Diagnostics (Design and Manufacturing)*, 1st Ed., American Society of Mechanical Engineers, USA.
e. Randall, R.B., 2011, *Vibration-based Condition Monitoring: Industrial, Aerospace and Automotive Applications*, 1st Ed., John Wiley & Sons, USA.

BMCG 4813 CONDITION BASED MAINTENANCE

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Differentiate different maintenance strategies.
LO2 Debate suitable diagnostic methods for a given condition of the machine/structure.
LO3 Apply the common techniques to monitor the condition of a machine/structure.

SYNOPSIS

This course introduces the maintenance philosophy in general and focuses more on the philosophy of the condition based maintenance. It also covers the basic techniques used in condition monitoring such as vibration analysis, oil and wear debris analysis, thermography and ultrasonic techniques. By introducing these common techniques, students are exposed on how to decide the best diagnosis method to determine the faults. Sometime, one technique may not be able to determine the faults and requires integrated condition monitoring which involves various techniques.

REFERENCES

a. Williams, J.H., Davies, A., & Drake, P.R., 1994, *Condition-based Maintenance and Machine Diagnostics*, 1st Ed., Chapman and Hall, USA.
b. Chang, F.K., 2011, *Structural Health Monitoring 2011: Condition Based Maintenance and Intelligent Structures*, 1st Ed., Destech Pubns Inc, USA.
c. Rao, B.K.N., 1996, *Handbook of Condition Monitoring*, 1st Ed., Elsevier Advanced Technology, UK.
d. Davies, A., 1998, *Handbook of Condition Monitoring: Techniques and Methodology*, Chapman & Hall, UK.
e. Yardley, E.D., 2002, *Condition Monitoring: Engineering the Practice*, John Wiley & Sons, USA

BMCG 4823 RELIABILITY, MAINTAINABILITY AND RISKS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Apply the analysis of failure and reliabilty of equipment or component by using statistical method.
LO2 Conduct the maintainability analysis of machine or component.

LO3 Predict the failure risk and safety of the machine or component.

SYNOPSIS

The course provides knowledges in analyzing the reliability of machine and component. Generate failure statistic of machine or components. . Decision making analysis (Pareto and trend analysis). Analysis and assessment of component reliability (Weibull distribution and graphic analysis). Maintainability analysis and Fault tree analysis, for safety risk assessment which include: (a) symbols and construction, (b) minimum cut sets, (c) top event quantification, (d) importance measures. The Reliability Block Diagram (RDB): representation and assessment of the reliability of simple configurations. Maintainability analysis. Estimating system repair times.

REFERENCES

a. Smith, D.J., 2011, *Reliability, Maintainability and Risk: Practical Methods for Engineers Including Reliability Centred Maintenance and Safety-Related Systems*, 8th Ed., Butterworth-Heinemann.
b. Stapelberg, R.F., 2009, *Handbook of Reliability, Availability, Maintainability and Safety in Engineering Design*, 1st Ed., Springer.
c. Plucknette, D., 2009, *Reliability Centered Maintenance using RCM Blitz*, Reliabilityweb.com.
d. Dhillon, B.S., 2006, *Maintainability, Maintenance, and Reliability for Engineers*, CRC Press.

BMCG 4833 WEAR DEBRIS AND OIL ANALYSIS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Apply the wear debris and oil analysis on machine lubricated component.

LO2 Predict onset of failures using wear debris and oil analysis for further maintenance action.

LO3 Decide on maintenance action of the analyzed machine and component.

SYNOPSIS

The course provides knowledge in lubrication fundamentals, lubricant additive properties, lubricant perfomance properties, and deteriotation condition due to the process. It focuses on condition monitoring techniques using wear debris and oil analysis. The technique enables the prediction of machine deterioration through wear particle counts, particle shape analysis, quantity analysis and surface condition of particles. In addition, oil analysis is capable of giving the condition of lubricants being used in the machine and components such as gearboxes and bearing. The status of the additives of the lubricants can also be determined in order to know the deterioration performance of the lubricants. Through contamination analysis, the source of the contaminants can be detected in order to ensure the rate of contamination can be controlled and eliminated. Through the combined analysis, decision can be made on the next course of actions to be taken on the analyzed machine component. This course will extend to cover the best practice technique of lubricant management.

REFERENCES

a. Hunt, T. M., 1992, *Handbook of wear debris analysis and particle detection in liquids*, Elsevier Science Publisher.
b. Hunt, T. M., 2004, *Oil Analysis*, Coxmoor Publishing Company's.
c. Yardley, E. D., 2002, *Condition monitoring: Engineering the practice*,Wiley.

d. M.J.Neale (2001), "Lubrication and reliability handbook", Butterworth-Heneimman.
e. Davies, A., 1996, *Handbook of condition monitoring*, Thomson science.

BMCG 4843 STRUCTURAL HEALTH MONITORING

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe fundamental principles of current state of SHM process and technology.
LO2 Assess structural integrity loss of mechanical structure.
LO3 Suggest the best SHM strategy to sustain mechanical structures.

SYNOPSIS

This course is intended to introduce the Structural Health Monitoring (SHM) Systems and Technologies. It covers the system methodology that includes system components, data acquisition; the sensory technology; the SHM testing categories such as static field test, dynamic field test and etc; the SHM system design; vibration-based techniques for SHM; and case studies.

REFERENCES

a. Stepinski, T., Uhl, T., Staszewski, W., 2013, *Advanced Structural Damage Detection: From Theory to Engineering Applications*, John Wiley & Sons.
b. Mix, P.E., 2005, *Introduction to Nondestructive Testing*, 2nd Editions, John Wiley & Sons.
c. Sansalone, M.J., Streett, W.B., 1997, *Impact-Echo: Nondestructive Evaluation of Concrete and Masonry*, Bullbrier Press.

OTHER ELECTIVE COURSES

BLHL 1212 BAHASA MANDARIN I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Demonstrate the ability to converse in Mandarin with correct and accurate pronunciation and respond to it accordingly.
LO2 Construct sentences with correct grammar and demonstrate writing skills.
LO3 Interpret the information in the simple text.

SYNOPSIS

This subject is designed for students who do not have prior knowledge in Mandarin. It provides students with the foundation of knowledge to enable them to understand and respond in the oral and written forms. This subject encompasses the listening, speaking, reading and writing components. This subject aims to help students to obtain enough exposure of the Mandarin phonetics (Han Yu Pin Yin). The basic grammar introduced is related to the language used daily by the Chinese. Particular care is also taken to ensure the development of verbal communication and written skills in Mandarin.

REFERENCES

a. Cheong, K. M. (2015). *Mari belajar Mandarin*. Penerbit: Universiti Teknikal Malaysia Melaka.
b. Ang, L.H. & Ooi, B.L. (2012). *Basic Chinese for everyone*. Selangor: Pelanduk Publications.

c. Wu, J. & Bai, L. (2011). *Chinese grammar step by step*. Singapore: Cengage Learning Asia Pte Ltd.
d. Soh W. N., Chia T.H., San, L. & Mok, S. S. (2009). *Conversational Mandarin Chinese for non-native speakers*. Selangor: Xueer publisher.
e. Alison, L.M. (2006). *The first 100 Chinese characters*. Hong Kong: Tuttle Publishing.

BLHL 1612 BAHASA KOREA I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Demonstrate the ability to converse in Korean with correct and accurate pronunciation and respond to it accordingly.
LO2 Identify basic vocabulary and demonstrate writing skills.
LO3 Interpret the information in the simple text and construct sentences with correct grammar.

SYNOPSIS

This subject is designed for students who do not have prior knowledge in Korean. It provides students with the foundation of knowledge to enable them to understand and respond in the oral and written forms. This subject encompasses the listening, speaking, reading and writing components. This subject aims to help students to obtain basic knowledge about Korean language. The basic grammar introduced is related to the language used daily by the Korean. Particular care is also taken to ensure the development of verbal communication and written skills in Korean.

REFERENCES

a. K. Park (2015). *Essential Korean Vocabulary*. Tuttle Publishing.
b. P. Jun Seok & S. Chaemin. 2015. *Korean: Language 1 for Beginners*. Institut Terjemahan & Buku Malaysia.
c. J. Hong & W. Lee. 2008. *Korean for Dummies*. Wiley Publishing Inc.

BLHL 1112 BAHASA ARAB I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Demonstrate the ability to converse in Arabic with correct and accurate pronunciation and respond to it accordingly.
LO2 Identify basic vocabulary and demonstrate writing skills.
LO3 Interpret the information in the simple text and construct sentences with correct grammar.

SYNOPSIS

This subject is designed for students who do not have prior knowledge in Arabic. It provides students with the foundation of knowledge to enable them to understand and respond in the oral and written forms. This subject encompasses the listening, speaking, reading and writing components. This subject aims to help students to obtain enough exposure of the Arabic language skills. The basic grammar introduced is related to the language used daily in conversation. Particular care is also taken to ensure the development of verbal communication and written skills in Arabic.

REFERENCES

a. M. Helmi Omar & Ab Rahim Ibrahim (2016). *Mari Belajar Bahasa Arab*. Melaka, Universiti Teknikal Malaysia Melaka.
b. Che, R. M. & Norhayuza, M. (2011). *Kosa kata*

Arab: Teori dan aplikasi. Serdang, Selangor: Penerbit Universiti Putra Malaysia.

c. Mohd, A. G. (2010). *Kamus mini: Asas perbualan dan perkataan*. Kajang, Selangor: Awfal Enterprise.

d. Noorli, M. N. (2012). *Bahasa Arab mudah*. Kota Bharu, Kelantan: AE Books Enterprise.

e. Othman, A. (2009). *Cara mudah belajar bahasa Arab (Buku 3)*. Kuala Lumpur: Al-Hidayah Publication.

f. Ragy, I. (2009). *Learn Arabic the fast and fun way*. New York: Barron's Educational Series.

BLHL 1412 BAHASA JERMAN I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Demonstrate the ability to converse in German with correct and accurate pronunciation and respond to it accordingly.

LO2 Identify basic vocabulary and demonstrate writing skills.

LO3 Interpret the information in the simple text and construct sentences with correct grammar.

SYNOPSIS

This subject is designed for students who do not have prior knowledge in German. It provides students with the foundation of knowledge to enable them to understand and respond in the oral and written forms. This subject encompasses the listening, speaking, reading and writing components. This subject aims to help students to obtain basic exposure of the German phonetics. The basic grammar introduced is related to the language used daily by the German. Particular care is also taken to ensure the development of verbal communication and written skills in German.

REFERENCES

a. H. Aufderstrasse, H. Bock, M. Gerdes, M. Gerdes, J. Mueller, H. Mueller (2003). *Themen 1 aktuel*, Hueber Publishing.

b. Funk, H. Etl. (2002), *Geni@l Deutsch als Fremdsprache fuer Jugendliche*. Berlin, Germany Langenscheidt

BLHL 1412 BAHASA JEPUN I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Demonstrate the ability to converse in German with correct and accurate pronunciation and respond to it accordingly.

LO2 Identify basic vocabulary and demonstrate writing skills.

LO3 Interpret the information in the simple text and construct sentences with correct grammar.

SYNOPSIS

This subject is designed for students who do not have any background in Japanese. It provides students with the knowledge to enable them to understand and communicate in the oral and written forms. This subject encompasses the listening, speaking, reading and writing components. The grammar introduced is related to the language used daily by the Japanese. In addition, two types of Japanese language writing systems; Hiragana and Katakana are also introduced. Students are also exposed to elementary reading materials.

REFERENCES
a. *Minna no Nihongo shokyu 1 (2012). (Beginners 1) Sentence* Pattern Workbook. 3A Network
b. *Minna no Nihongo shokyu 1 (2012). (Beginners 1)* Translation & Grammatical Notes. 3A Network.
c. *The Association For Overseas Technical Scholarship (AOTS)* (2009). Shin Nihongo No Kiso 1-English Translation. Asian Edition.
d. *The Association for Japanese-Language Teaching* (2009). Shin Nihongo No Kiso 1-English Translation. Asian Edition.

BLHL 1012 BAHASA MELAYU KOMUNIKASI

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Respond to information from oral texts and face-to-face interactional activities (HPP5).

LO2 Relate the basic sounds of Bahasa Melayu in terms of grammar, phonology and oral communication skills related to oneself, family, university and daily activities.

LO3 Construct sentences and communicate well in Bahasa Melayu.

SYNOPSIS

This subject introduces the grammar of the language. Students will be exposed to the aspects of grammar, clause, terminology, sentence construction, collective nouns and literature. It is hoped that students will be able to use correct Malay grammar.

REFERENCES
a. Zarina Othman, Roosfa Hashim & Rusdi Abdullah. (2012). Modul Komunikasi Bahasa Melayu Antarabangsa. Bangi, Selangor: Penerbit Universiti Kebangsaan Malaysia.
b. *Daftar Ejaan Rumi Bahasa Malaysia*. (2006). Kuala Lumpur: Dewan Bahasa dan Pustaka.
c. *Daftar Istilah Majlis Bahasa Indonesia-Malaysia*. (2005). Kuala Lumpur: Dewan Bahasa dan Pustaka.
d. Yong Chyn Chye, Rohaidah Mashudi dan Maarof Abd Rahman. (2012). *Bahasa Kebangsaan untuk pelajar luar negara (Malay Language for International Students)*. Kuala Lumpur: Pearson Malaysia Sdn. Bhd.

BLHC 4032 CRITICAL AND CREATIVE THINKING

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Mengenalpasti prinsip asas kemahiran pemikiran kritis dan kreatif dalam menyelesaikan masalah harian.

LO2 Memberi maklum balas terhadap isu berkaitan perkembangan kemahiran pemikiran kritis dan kreatif.

LO3 Menyelesaikan masalah kajian kes terhadap isu semasa yang berkaitan bidang pengajian mereka.

LO4 Menganalisis kehendak pasaran akan datang dan mencadangkan penyelesaian berasaskan produk.

SYNOPSIS

Mata pelajaran ini direka untuk memberi pendedahan kepada pelajar tentang prinsip-prinsip asas dalam pemikiran kritis dan kreatif. Pelajar akan mengaplikasikan kaedah pemikiran kritis dan kreatif dalam penyelesaian masalah melalui pendekatan pembelajaran berpusatkan pelajar termasuk pendekatan pembelajaran berasaskan permasalahan (PBL). Pelajar

akan dipandu di dalam projek akhir di mana penganalisaan kehendak pasaran akan datang akan dilaksanakan dan cadangan penyelesaian adalah berasaskan produk keperluan pasaran dari pelbagai perspektif dan pemikiran di luar kotak (out of the box).

REFERENCES

a. Aziz Yahya, Aida Nasirah Abdullah, Hazmilah Hasan, Raja Roslan Raja Abd Rahman., 2011, *Critical and Creative Thinking Module 2*. Melaka. Penerbit UTeM.
b. Buzan, T., 2009, *Mind maps for business: revolutionise your business thinking and practice*, New York: Pearson BBC Active.
c. Claxton, G., Lucas, B., 2007, *The Creative Thinking Plan*, London: BBC Books.
d. Fisher, A., 2011, *Critical Thinking: An Introduction*. London: Cambridge University Press.

BLHC 4022 NEGOTIATION SKILLS

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Mengenalpasti konsep-konsep asas dalam proses perundingan menggunakan amalan komunikasi berkesan.
LO2 Membuat kesimpulan terhadap teknik-teknik perundingan yang terbaik berdasarkan pendekatan teori yang pelbagai.
LO3 Menyelesaikan isu-isu perundingan berdasarkan teknik-teknik kemahiran perundingan yang berkesan berasaskan pelbagai situasi.

SYNOPSIS

Kursus ini akan membincangkan konsep asas perundingan, teknik berfikiran secara kritis dan kreatif, teknik komunikasi berkesan dan teknik mendengar dan menyoal secara berkesan. Pelajar turut didedahkan dengan pengetahuan dan kemahiran yang diperlukan untuk menjalankan dan meguruskan proses perundingan pelbagai secara berkesan. Selian itu, kemahiran berfikir secara kritis dan kreatif, serta kemahiran komunikasi berkesan yang diperlukan bagi menjalankan proses perundingan juga akan dibincangkan.

REFERENCES

a. Lemiwki, R., Barry, B. & Saunders, D. (2016). *Essentials of negotiation*. USA: McGraw Hill Education.
b. Fisher, R & Ury. (2011). *Getting to YES: Negotiating agreement without giving in*. Third Edition. Penguin Books.
c. Covey, S. (2013) *The 3rd Alternative: Solving Life's Most Difficult Problems*. New York: Free Press.

BLHH 1032 INDUSTRIAL AND ORGANIZATIONAL PSYCHOLOGY

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Menghubung kait proses persekitaran dan teori di tempat kerja dalam dunia organisasi dan perindustrian.
LO2 Mempamerkan ciri-ciri kepimpinan dalam aktiviti tugasan kumpulan.
LO3 Memberi tindak balas terhadap peranan dan tanggungjawab sebagai seorang bakal pekerja di dalam organisasi.

SYNOPSIS

Kursus ini memberi pendedahan kepada aspek psikologi dalam dunia pekerjaan dalam sektor industri serta permasalahan yang berhubung dengan tingkah laku dalam organisasi. Terdapat beberapa topik yang dibincangkan termasuk isu-isu semasa dalam psikologi di tempat kerja, perancangan personel, tekanan di tempat kerja dan psikologi kejuruteraan.

REFERENCES

a. Azlina Abu Bakar (2013). *Psikologi Industri dan Pengurusan Sumber Manusia*. Terengganu: Penerbit Universiti Malaysia Terengganu.
b. Schultz & Schultz, Duane (2010). *Psychology and Work Today*. New York: Prentice Hall.
c. Yukl, G. (2010). *Leadership in Organizations*.

BLHW 1722 PHILOSOPHY OF SCIENCE AND TECHNOLOGY

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Menghuraikan konsep ilmu, falsafah sains dan teknologi dalam perspektif Islam secara kritis dan kreatif.

LO2 Menunjukkan perkaitan antara konsep falsafah sains dan teknologi dari perspektif Islam dan barat.

LO3 Mengaplikasikan pemahaman tentang konsep ilmu falsafah sains dan teknologi dalam kehidupan masyarakat masa kini.

SYNOPSIS

Kursus ini membincangkan tentang konsep ilmu, konsep falsafah, sains dan teknologi yang berunsurkan kreativiti dan inovasi menurut sarjana Islam dan barat. Selain itu, kursus ini juga menekankan tentang metodologi dalam sains Islam, konsep dan pencapaian tamadun Islam dalam bidang matematik, astronomi, fizik, kimia, perubatan, konsep penciptaan alam dan kosmologi dalam Islam, pencapaian dalam bidang telekomunikasi terkini dan isu-isu sains semasa. Pendekatan sarjana Islam silam menjadi contoh kepada generasi masa kini menjadi manusia yang kreatif dan mempunyai pemikiran kritis dalam pelbagai bidang seperti penciptaan dan kejuruteraan.

REFERENCES

a. Abdul Rahman Abdullah (2010). Wacana Falsafah Sains Sejarah dan Pemikiran. Pulau Pinang: Pusat Kajian Pengurusan Pembangunan Islam Universiti Sains Malaysia.
b. Azizan Baharuddin & Maisarah Hasbullah (2010). Pendidikan Sejarah dan Falsafah Sains di Institusi Pengajian Tinggi Awam. Kuala Lumpur: Dewan Bahasa dan Pustaka.
c. Azizan Baharuddin (2009). Pemantapan PengajianSejarah, Falsafah dan Dasar Sains. Kuala Lumpur: Dewan Bahasa dan Pustaka.

BMCK 42X3 VEHICLE AUTONOMOUS SYSTEM

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Explain the fundamental concept and theory in autonomous vehicle as well as the features and function of sensors and actuators involved (PO12).

LO2 Create and evaluate control system for autonomous vehicle system (PO2).

LO3 Apply and analyze fundamental methods in autonomous vehicle, such as motion planning, obstacle avoidance, localization and mapping using simulation software. (PO5).

SYNOPSIS

This subject discusses the state of the art of autonomous systems, examines some promising autonomy technology that will be available in the near future, and identifies some shortfalls in autonomy capability that need to be alleviated. The subject goes on to explore the level of autonomy as a design choice and autonomy technologies.

REFERENCES

a. Fossen, Thor I., Pettersen, Kristin Y., Nijmeijer, Henk. (2017). Sensing and Control for Autonomous Vehicles. Sringer.
b. BMaurer, M., Gerdes, J.C., Lenz, B., Winner, H. (2016). Autonomous Driving. Springer.
c. Agus B. and Muljowidodo K.(2013). Autonomous Control Systems and Vehicles: Intelligent Unmanned Systems. Springer.
d. Rao V. Dukkipati, Jian Pang, Mohamad S. Qatu, Gang Sheng and Zuo Shuguang (2008) Road Vehicle Dynamics, Society of Automotive Engineers.

4.2 Bachelor of Automotive Engineering Programme (BMCK)

YEAR 1 COURSES - UNIVERSITY COMPULSORY

BLHW 1702 ISLAMIC AND ASIAN CIVILIZATION (TITAS)*

* For Malaysian students only

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Menjelaskan konsep asas ketamadunan melalui perbincangan kumpulan.
LO2 Menghubungkait sejarah dengan kemajuan tamadun bangsa di dunia melalui tugasan berkumpulan.
LO3 Merumus isu dan cabaran peradaban dunia melalui pembentangan kumpulan.

SYNOPSIS

Mata pelajaran ini menjelaskan tentang ilmu ketamadunan yang mencakupi definisi, pandangan semesta dan sumber ketamadunan. Mata pelajaran ini turut membincangkan persamaan dan perbezaan tamadun-tamadun dunia dengan mencari titik pertemuan melalui dialog peradaban. Selain itu, mata pelajaran ini juga turut mengupas isu dan cabaran semasa serta kesannya dalam perkembangan peradaban masa kini.

REFERENCES

a. Bakar, O., 2009, *Modul Pengajian Tamadun Islam dan Tamadun Asia*, Penerbit Universiti Malaya, Kuala Lumpur.
b. Arif, S., Noor, A. R. M., Hassan, M. A., Sulaiman, N. & Rawi, A. H. M., 2007, *Tamadun Islam dan Tamadun Asia*, Mc Graw-Hill (Malaysia) Sdn. Bhd., Kuala Lumpur.
c. Musa, H., 2005, *Pemerkasaan Tamadun Melayu Malaysia Menghadapi Globalisasi Barat*, Penerbit Universiti Malaya, Kuala Lumpur.

BLHW 1742 MALAYSIAN STUDIES*

* For international students only

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the political and economic structure of Malaysia.

LO2 Respond to the uniqueness of the Malaysian's historical and cultural heritage.

LO3 Compare the Malaysian experience and achievement with their home countries in various aspects.

SYNOPSIS

By going through this course, students will be exposed to a wealth of information on Malaysia. They will gain information on Malaysian's historical background, political system and socio-economic structure. Additionally, this course highlights the Malaysian government's development plans and major policies in economic, industrial and socio-cultural aspects. It also gives emphasis on the attitude and commitment of the Malaysian government towards the regional and international issues as reflected in its foreign policy.

REFERENCES

a. Abdul Rahman Embong (2010). *Malaysian Studies: Looking Back Moving Forward: Selected Speeches, Public Statements and Other Writings*. Kuala Lumpur: Persatuan Sains Sosial Malaysia.

b. Abdul Razak Baginda (2009). *Malaysia at 50 and Beyond*. Kuala Lumpur: Malaysian Strategic Research Centre.

c. Ambri Buang (2009). Dasar-Dasar Utama Kerajaan Malaysia. Kuala Lumpur: Institusi Tadbiran Awam Malaysia.

BKKX XXX1 CO-CURRICULUM I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Recognise a balanced and comprehensive education

LO2 Develop leadership aspects stressing on disciplines and cooperation within a group or organisaton.

LO3 Build personality and character guided by rules of conduct.

LO4 Foster cooperation and unity in multi-racial society.

SYNOPSIS

a. Cultural
Choir, *Gamelan, Cak Lempung, Nasyid, Seni Khat*, Seni Lakon, Art, English Elocution, Bahasa Melayu Elocution, and *Kompang*.

b. Entrepreneurship
Video, Film and Photography, Publishing & Journalism, Computer and Technopreneurship.

c. Society
Fiqh Muamalat, *Fiqh Amali*, *Tahsin Al-Quran & Yaasin* and Peer Program.

d. Recreation
Go-Kart, Adventure and Cycling.

e. Sports
Swimming, Volley Ball, Golf, *Takraw*, Aerobic, Badminton, Football and Net ball.

f. Martial Arts
Silat Gayong, Karate-Do and Taekwando.

YEAR 1 COURSES - PROGRAMME CORE

BMCG 1523 ENGINEERING GRAPHICS AND CAD

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the engineering graphics fundamentals.

LO2 Construct technical drawing using manual sketching and computer aided design.

LO3 Communicate by using engineering drawings.

SYNOPSIS

The course will provide students with an understanding of the importance of engineering graphics as a communication tool among engineers. Student will be exposed to the engineering graphics fundamentals of manual sketching, geometric dimensioning and tolerancing, graphic projections, sectioning and engineering drawings. Students will develop visualization skills by constructing technical drawings using manual sketches and computer aided design (CAD) software. The course consists of both lecture and practical session where students will be guided in presenting and interpreting engineering drawings correctly.

REFERENCES

a. Rizal, M. A. et al., 2009, *Modul Lukisan Berbantu Komputer*, Penerbit Universiti Teknikal Malaysia Melaka, Melaka.

b. Dix, M. & Riley, P., 2014, *Discovering AutoCAD 2014*, Prentice Hall, New York.

c. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Dygdon, J. T. and Novak, J. E., 2011, *Technical Drawing*, 14th Ed., Prentice Hall, New York.

d. Jensen, C., & Jay D. H., 2007, *Engineering Drawing and Design*, 7th Ed., Glencoe and McGraw Hill, New York.

e. Frederick, E. G. & Mitchell, A., 2008, *Technical Drawing and Engineering Drawing*, 14th Ed., Prentice Hall.

BEKG 1123 PRINCIPLES OF ELECTRIC AND ELECTRONICS

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

LO1 Explain the basic electrical and electronics principles, circuit schematics and components.

LO2 Demonstrate the electrical and electronic knowledge to solve the series and parallel circuits in DC and phasor approach for AC circuit.

LO3 Explain the principle knowledge of semiconductor devices for Diode, BJT and Op Amp.

LO4 Apply the electronic knowledge to solve the Diode, BJT and Op Amp circuits.

SYNOPSIS

This course will discuss about the basic principles of electrical and electronics; Introduction to electric element, symbol and components. KCL, KVL, Node and Mesh in solving DC series and parallel circuit. Introduction in magnetism, electromagnetism and AC characteristic. Introduction to semiconductors, atomic structures, energy band, P-type and N-type. Study on structure, principle and application of diode, BJT and Op-Amp circuits.

REFERENCES
a. Floyd, T.L., 2010, *Principles of Electric Circuits*, Pearson, 9th Ed.
b. Floyd, T.L., and Buchala, D.M., 2010, *Electric Circuits Fundamentals, Pearson*, 8th Ed.
c. Boylestad, R.L., Nasheslsky, L., 2010, *Electronic Devices and Circuit Theory*, Pearson Prentice Hall.

BMFG 1213 ENGINEERING MATERIALS

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

LO1 Explain the basic concepts of engineering materials in terms of interatomic bonding and crystal structure.

LO2 Analyze the properties of engineering materials based on its structure.

LO3 Apply the basic understanding of engineering materials properties to determine their processing method.

SYNOPSIS

This course introduces basic concepts of engineering materials that covers introduction to engineering materials, interatomic bonding, crystalline structure and imperfections and diffusion in solid. Explanation on different types of engineering material (i.e. metal, ceramic, polymer and composites), its mechanical properties, basic applications and processing are also included. Introduction to the binary phase diagrams (composition and microstructure correlation) is also given.

REFERENCES
a. Callister, W.D. Jr., 2010, *Materials Science and Engineering - An Introduction*, 8th Edition. John Wiley & Sons Inc.
b. Smith, W.F., 1998, *Principle of Materials Science & Engineering*, 4th Edition, Mc. Graw Hill.
c. Shackelford, J.F., 2000, *Materials Science and Engineering - An Introduction*, 5th Edition, Prentice Hall.
d. Bolton, W., 2001, *Engineering Materials Technology*, 3rd Edition, BH Publisher.
e. Vernon, J. (2001) *Introduction to Engineering Materials*, 4th Edition, Palgrave MacMilan.

BEKG 1233 PRINCIPLES OF MEASUREMENTS AND INSTRUMENTATION

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

LO5 Describe the principle, various terms and standards in measurement.

LO6 Explain the principles of measurement devices.

LO7 Apply the suitable bridge techniques to measure component values such as resistance, inductance and capacitance.

LO8 Explain the operation, function and applications of transducers/sensors.

SYNOPSIS

This course discusses about units and dimensions, standards, errors, static characteristic, noise and calibration in measurement devices such as galvanometers, ammeters, voltmeters, wattmeter, temperature, force and torque and pressure measurement as well as accelerometer. It also introduces oscilloscope and sensors for instrumentation application.

REFERENCES
a. Kalsi, H.S., 2010, *Electronic Instrumentation*, 3rd Ed., Tata McGraw Hill.
b. Bakshi, U.A., Bakshi, A.V., and Bakshi, K.A., 2009, *Electronic Measurements and Instrumentation*, Technical Publications Pune.
c. Wolf. S., Smith, R.F.M., 2004, *Reference Manual for Electronic Instrumentation Laboratories*, 2nd Ed., Prentice-Hall.
d. Vaisala, V.O., 2006, *Calibration Book*.

YEAR 1 COURSES - COURSE CORE

BMCK 1113 ENGINEERING MECHANICS

LEARNING OUTCOMES

On successful completion of this course, student should be able to:

LO1 Describe and apply the basic concepts and fundamental principles of engineering mechanics (statics).

LO2 Analyze and solve equilibrium problems of particle and rigid body both statics and dynamics.

LO3 Work as an effective member of a team to solve engineering mechanics problems.

SYNOPSIS

The engineering mechanics of statics and dynamics provides an introduction and the basic concept of statics as physicals sciences, system of units, scalars and vectors, free body diagram, forces and moment, particle and rigid body and structural analysis. In dynamics it provides the kinematics principle of particles and rigid bodies, concept of position, velocity and acceleration, application of Newton's second law, principle work and energy, also the impulse and momentum.

REFERENCES
a. Hibbeler R.C., 2015, Engineering Mechanics – Statics, 14th Ed., Prentice Hall.
b. Beer, F.P., and Johnston, E.R., 2011, *Statics and mechanics of materials*, McGraw-Hill.
c. Morrow, H.W., 2011, *Statics and Strength of Materials*, Prentice Hall.
d. Mott, R.L., 2010, *Statics and strength of materials*, Prentice Hall.

BMCG 2312 MANUFACTURING PROCESS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the result of manufacturing processes by applying knowledge of material science and engineering fundamentals.

LO2 Analyse the issues and aspects of manufacturing in order to select the most suitable manufacturing processes for a particular component.

LO3 Demonstrate knowledge of understanding on the impact of manufacturing solutions to societal and environmental contexts.

SYNOPSIS

This course covers theoretical issues of manufacturing and the quality aspects of manufacturing such as quality assurance and tolerance. The type and fundamental principle of joining processes, metal

casting processes, forming processes, shaping processes, material removal processes, modern machining processes and their equipments are also covered. The quantitative problem analysis of certain manufacturing processes is included as well. Societal and environment issue in manufacturing processes are also included. Finally the need to engage in life-long learning processes is emphasised as to ensure students alert on the manufacturing technological changes.

REFERENCES

a. Groover, M.P., 2007, *Fundamentals of Modern Manufacturing*, 3rd Edition, John Wiley & Sons Inc.
b. Kalpakjian, S., and Schmid, S. R., 2014, *Manufacturing Engineering and Technology*, 5th Edition,Prentice Hall International.
c. Schey, J.A., 1999, *Introduction to Manufacturing Processes*, McGraw Hill.

BMCG 1011 MECHANICAL ENGINEERING LABORATORY I

LEARNING OUTCOMES

At the end of the session, students should be able to:

LO1 Observe discipline in attending laboratory sessions, applied safety precautions before, during and after conducting experiments in terms of experimental procedures and aware of the general experimental ethics.

LO2 Use basic mechanical engineering instruments to measure engineering variables pertinent to the conducted experiments.

LO3 Write a well organised, sensible and readable technical reports which describe the experiment in a standard writing format.

SYNOPSIS

Introduction to Science, Engineering and Technology. Introduction to safety. Ethics in laboratory. Use of scientific method. Mechanical measurement concept. Introduction to measuring devices. Basic engineering instruments. Use of instrument to measure engineering variables. Experimental report writing.

The experiments will be conducted in mechanical engineering laboratories that study fundamental engineering concepts in statics, dynamics, material sciences, measurements and instrumentation as well as engineering drawing.

REFERENCES

a. Wheeler, A.J. and Ganji, A.R., 2010. Introduction to Engineering Experimentation, 3rd Edition, International Edition, Pearson.
b. Alan, S.M., 2001. Measurement and Instrumentation Principles, 1st Edition, Butterworth-Heinemann.
c. Holman, J.P. 2001. Experimental Methods for Engineers. 7th Ed., McGraw Hill.

BMCG 2011 MECHANICAL ENGINEERING LABORATORY II

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Observe discipline in attending laboratory sessions, applied safety precautions before, during and after conducting experiments in terms of experimental procedures and aware of the general experimental ethics.

LO2 Plan, design and conduct experiments to prove a proposed hypothesis out of a given real and practical engineering problem.

LO3 Analyse experimental results that include graphical data presentation and error analysis.

LO4 Write a well organised, sensible and readable technical reports which describe the experiment in a standard writing format.

SYNOPSIS

Introduction to safety procedures in a laboratory. Hypothesis formulation. Design of experiments. Data Analysis. Use of graphical presentation techniques for experimental data. Error and uncertainty. Measurement Accuracy and Precision. Statistical analysis. Good laboratory report writing.

The experiments will be conducted in mechanical engineering laboratories that study fundamental engineering concepts in thermodynamics, fluid mechanics, solid mechanics and mechanical design.

REFERENCES

a. Wheeler, A.J. and Ganji, A.R., 2010. *Introduction to Engineering Experimentation*, 3rd Ed., International Edition, Pearson.
b. Alan, S.M., 2001. *Measurement and Instrumentation Principles*, 1st Ed., Butterworth-Heinemann
c. Holman, J.P. 2001. *Experimental Methods for Engineers*. 7th Ed., McGraw Hill.

YEAR 1 COURSES – MATHEMATICS, STATISTICS AND COMPUTING

BMFG 1313 ENGINEERING MATHEMATICS 1

LEARNING OUTCOMES

Upon completion of this subject, students should be able to:

LO1 Describe the basic concept of partial derivatives, multiple integrals and vector-valued functions.

LO2 Select an appropriate technique to solve problems that involved partial derivatives, multiple integrals and vector-valued functions.

LO3 Apply the concept of partial derivatives, multiple integrals and vector-valued functions in solving engineering problems.

LO4 Perform the given tasks that pertain to the engineering problems by using the knowledge of engineering mathematics.

SYNOPSIS

This course consists of three chapters: Functions of Several Variables, Multiple Integrals and Vector-valued Functions. The syllabus is developed by introducing the concepts of the functions with severable variables, integration and also vector-valued function, followed by learning various techniques in solving the problems and its application in physical and engineering fields.

REFERENCES

a. Anton, H., & Bivens, I., Davis, S., 2010, Calculus Multivariable, 8th edition, John Wiley.
b. Kreysziq E. (2009). Advanced Engineering Mathematics, 9th edition, John Wiley.
c. Trim, D., 2008, Calculus for Engineers, 4th edition, Prentice Hall.
d. James, G., 2007, Modern Engineering Mathematics, 4th edition, Prentice Hall.

e. Stroud, K. A, 2007, Engineering Mathematics, 5th Edition, Palgrave Macmillan.

BMCG 1013 DIFFERENTIAL EQUATIONS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe the basic concept and solution of second order differential equations, Laplace transform and Fourier series.

LO2 Select an appropriate technique to solve problems involving differential equations.

LO3 Apply the concept of differential equations in solving engineering problems.

SYNOPSIS

This course is intended to introduce the concept and theories of differential equations. Second order linear differential equations with constant coefficients will be solved by using the methods of undetermined coefficient, variation of parameters and Laplace transform. Fourier series in relation to periodic functions will be discussed. An introduction to the solution and application of partial differential equations with boundary value problems using the method of separation of variables and Fourier series will also be discussed.

REFERENCES

a. Muzalna, M. J., Irmawani, J., Rahifa, R., Nurilyana, A. A., 2010, *Module 2: Differential Equations*, Penerbit UTeM.

b. Cengel, Y. A., & Palm, W. J., 2013, *Differential Equations for Engineers and Scientists*, 1st Ed. McGraw-Hill., U.S.A.

c. Nagle, R. K., Saff, E. B., & Snider, A. D., 2011, *Fundamentals of Differential Equations and*

d. *Boundary Value Problems*, 6th Ed. Pearson Education Inc., U.S.A.

e. Kohler, W., & Johnson, L., 2011. *Elementary Differential Equations with Boundary Value Problems*. Pearson Education Inc., U.S.A.

f. Edwards, C. H., & Penny, D. E., 2008. *Differential Equations and Boundary Value Problems*, 4th Ed. Pearson Education Inc., New Jersey, U.S.A.

BITG 1233 COMPUTER PROGRAMMING

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

LO1 Describe the fundamental principles of problem solving, programming techniques and structures in program development.

LO2 Explain problems and their solutions based on the principles of problem solving and programming techniques.

LO3 Trace and debug in troubleshooting program applications.

LO4 Construct computer program codes by applying suitable programming structures and techniques.

SYNOPSIS

This course covers the introductory topics in programming using C++ language. It includes the introduction to computers and programming, the fundamentals of programming, problem solving and software development. Data types and operators, selection, repetition, function, array, file, structured data and pointer are among the topics covered in the course.

REFERENCES

a. Gaddis, T., 2011, Starting Out with C++ Brief Version: From Control Structures Through

Objects, 7th. Edition, Pearson Education.
b. Abdullah, N. et. al, 2006, Lab Module Computer Programming BITG 1113, FTMK, UTeM
c. Friedman, Koffman, 2010, Problem Solving, Abstraction and Design using C++, Pearson Education.
d. Etter, D.M., Ingber, J.A., 2008, Engineering Problem Solving with C++, 2nd Edition, Pearson Education.
e. Hanly, J.R, 2002, Essential C++ for Engineers and Scientists, Addison Wesley.

YEAR 2 COURSES - UNIVERSITY COMPULSORY

BLHW 2712 ETHNIC RELATIONS*

* For Malaysian students only

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Menganalisis peranan hubungan etnik dan kepentingannya dalam proses pembangunan Malaysia melalui perbincangan kumpulan.

LO2 Memberi respons tentang isu dan cabaran etnik budaya di Malaysia melalui pembentangan kumpulan.

LO3 Merumus isu-isu perpaduan dan cadangan untuk memperkasakannya di Malaysia melalui penulisan artikel.

SYNOPSIS

Mata pelajaran ini membincangkan konsep-konsep asas budaya, peranan etnik dan pengaruhnya terhadap sosiopolitik dan sosioekonomi negara khususnya dalam merealisasikan agenda perpaduan. Mata pelajaran ini juga memberi pendedahan tentang isu-isu dan cabaran dalam konteks perpaduan di Malaysia. Selain itu, mata pelajaran ini turut mengupas perkembangan globalisasi dan kesannya ke atas jati diri dan proses pembangunan di peringkat Malaysia. Selain itu mata pelajaran ini akan merumuskan isu-isu perpaduan dan cadangan penambahbaikannya di Malaysia.

REFERENCES

a. Baharuddin, S.A., 2012, Modul Hubungan Etnik Edisi Kedua.Bangi: Institut Kajian Etnik, Universiti Kebangsaan Malaysia.

BLHW 2403 TECHNICAL ENGLISH

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Distinguish the use of tenses, run-ons, fragments, modifiers and parallelism.

LO2 Summarise and paraphrase main ideas.

LO3 Write a proposal as well as progress and project reports in a group.

LO4 Organise and present project report in groups.

SYNOPSIS

This course is content-based in nature and aims to equip students with the necessary language skills required to write various reports. As this course prepares students for the mechanics of the different genres of writing, the emphasis is on proposal, progress and project reports by employing Student-Centred Learning approach. It also introduces

students to the elements of presentation as well as provides them with the necessary grammar skills in writing.

REFERENCES

b. Devi, S. I., Khamis, N., Suradi, N., Zainal Abidin, N., Abdullah, F., Hamdzah, N. L. A., Ahmad Ahsan, N.I., Rajendraan, E.,& Teh Zanariah Mohd Raus, T.Z., 2008, *Technical English*. Melaka: Pusat Bahasa dan Pembangunan Insan, UTeM.
c. Anderson, P. V., 2007, *Technical communication: A reader-centred approach*, 6th ed, California: Wadsworth Publishing.
d. Finkelstein, L. J., 2007, *Pocket book of technical writing for engineers and scientists*, 3rd ed., New York: McGraw Hill.
e. Hart, H., 2008, *Introduction to engineering communication*, 2nd ed., London: Prentice Hall.

BKKX XXX1 CO-CURRICULUM II

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Recognise a balanced and comprehensive education.
LO2 Develop leadership aspects stressing on disciplines and cooperation within a group or organisaton.
LO3 Build personality and character guided by rules of conduct.
LO4 Foster cooperation and unity in multi-racial society.

SYNOPSIS

a. Cultural
Choir, Gamelan, Cak Lempung, Nasyid, Seni Khat, Seni Lakon, Art, English Elocution, Bahasa Melayu Elocution, and Kompang.
b. Entrepreneurship
Video, Film and Photography, Publishing & Journalism, Computer and Technopreneurship.
c. Society
Fiqh Muamalat, Fiqh Amali, Tahsin Al-Quran & Yaasin and Peer Program.
d. Recreation
Go-Kart, Adventure and Cycling.
e. Sports
Swimming, Volley Ball, Golf, Takraw, Aerobic, Badminton, Football and Net ball.
f. Martial Arts
Silat Gayong, Karate-Do and Taekwando.

YEAR 2 COURSES - COURSE CORE

BMCG 21X3 FLUID MECHANICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Define and describe the basic concepts and fundamental principles of fluid mechanics

LO2 Apply fluid mechanics equations in solving fluid mechanics problem.

LO3 Analyse the fluid mechanics concepts in solving fluid mechanics problem

SYNOPSIS

Introduction, Classification of fluids. Properties of fluids. Pressure and Head. Fluid Dynamics: Laws of kinematics of fluid flow. Continuity, momentum and energy equations. Bernoulli's equations and its applications. Flow measurements, pitot static tube, venturi meter, and orifice plate. Applications of momentum equations. Dimensional Analysis: Buckingham's theorem, Non-dimensional numbers, similarities of flow. Model studies. Two dimensional ideal fluid flows and viscous flow field. Differential analysis of fluid motion. Lagrangian and Eulerian method. Stream function and potential functions. Boundary layer theory, Karman integral equation, Prandtl-Blasius solution. External flows and the associated drag and lift forces. Working concepts and performance prediction of some fluid machineries such as centrifugal and axial pumps. Turbo blowers and turbines.

REFERENCES

a. Cengel, Y. A. and Cimbala, J. M., 2014, Fluid Mechanics: Fundamentals and Applications, 3rd International Ed., McGraw-Hill, Singapore.

b. Munson, B.R., Young D.F. and Okiishi, T.H., 2009, Fundamentals of Fluid Mechanics, 6th Ed., John Wiley & Sons, Inc, Asia.

c. Douglas, J. F., Gasiorek J. M. and Swaffield, J. A., 2006, Fluid Mechanics, 5th Ed., Prentice Hall, Spain.

BMCG 31X1 MECHANICAL ENGINEERING LABORATORY III

LEARNING OUTCOME

At the end of this course, students should be able to:

LO1 Observe discipline in attending laboratory sessions, applied safety precautions before, during and after conducting experiments in terms of experimental procedures and aware of the general experimental ethics.

LO2 Plan, design and conduct experiments to prove a proposed hypothesis out of a given real and practical engineering problem.

LO3 Write a well organised, sensible and readable technical reports.

SYNOPSIS

Introduction to safety procedures in a laboratory. Hypothesis formulation. Design of experiments. Data analysis. Use of graphical presentation techniques for experimental data. Error and uncertainty. Measurement accuracy and precision. Statistical analysis. Good laboratory report writing. The experiments will be conducted in mechanical engineering laboratories that study fundamental engineering concepts in:-

A) THERMODYNAMICS
   i) Air-conditioning
   ii) Cooling Tower

B) FLUID MECHANICS
   i) Aerodynamic of common geometry
   ii) Drag Measurement
   iii) Pump Performance Test
C) SOLID MECHANICS
   i) Thin & Thick Cylinder
   ii) Curve & Davit Test

REFERENCES

a. Wheeler, A.J. and Ganji, A.R., 2010. *Introduction to Engineering Experimentation*, 3rd Ed., International Edition Pearson.
b. Cengel, Y. A. and Boles, M. A..2007. *Thermodynamics: An Engineering Approach*, 6th Ed., McGraw Hill.Singapore.
c. Yuan, C.S., 2006, *Fluid Mechanics II*, Pearson Prentice Hall, Malaysia.
d. Hibbeler, R. C., 2007, *Solid Mechanics*, 7th Ed., Prentice Hall.

BMCG 3333 MECHANICAL DESIGN

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Apply the formulation for optimized and safe design based on engineering standard.
LO2 Analyze the statics and dynamics of mechanical systems design
LO3 Evaluate mechanical design system in solving complex engineering problem.

SYNOPSIS

This course covers a brief review of the Engineering Design Process, Design for Static Strength, Design for Fatigue Strength, Linkage Mechanisms and the Applications of Springs and Brakes, Design of Threaded and Welded Joints, Bearings and Shafts Design and Balancing, the Basics of Gyroscopes, Gear Strength for Power Transmission, as well as the Belt and Chain for Flexible Power Transmission.

REFERENCES

a. J. K. Nisbett & R. G. Budinas, 2014 Shigley's Mechanical Engineering Design, Ninth Edition in SI Units, McGraw-Hill Companies, Inc., New York.
b. Peter R. N. Childs BSc. Aand D.Phil, 2013, Mechanical Design Engineering Handbook Butterworth-Heinemann; 1 edition (November 18, 2013).
c. Michael F. Ashby., 2010, Materials Selection in Mechanical
d. Design, Fourth Edition 4th Edition, Butterworth-Heinemann; 4 edition (October 5, 2010).

BMCG 2X13 THERMODYNAMICS

LEARNING OUTCOMES

At the end of this course, student should be able to:

LO1 Define the First and Second Law of Thermodynamics.
LO2 Apply the thermodynamic principles using property tables.
LO3 Solve the thermodynamics processes relating to ideal gas and pure substances.

SYNOPSIS

Thermodynamics principles are applied to the analysis of power generation, refrigeration and air- conditioning systems. Energy and availability analysis (exergy), moist air properties and psychrometric systems and analysis are discussed in this subject.

REFERENCES
a. Cengel, Y.A., & Boles, M.A., 2014, *Thermodynamics: An Engineering Approach*, 8th Edition, McGraw-Hill, Singapore.
b. Moran, M.J., Shapiro, H.N., Boettner, D.D. & Bailey, M.B., 2014, *Fundamental of Engineering Thermodynamics*, 8th Edition, John Wiley & Sons, Inc.
c. Borgnakke, C. & Sonntag, R. E., 2012, *Fundamentals of Thermodynamics*, 8th Edition, John Wiley & Sons, Inc.

BMCG 2212 MICROPROCESSOR TECHNOLOGY

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Explain the architectures of microprocessor technology and its components.

LO2 Characterize functions of microprocessor and the peripheral devices.

LO3 Design applications for the simple problems in the field of control of processes and machines using microprocessor technology.

SYNOPSIS

Introduction and examples of practical utilizations in the field of control systems, data acquisition and communication using microprocessor technology. Explanation of basic terms (memory, bit, byte, word, address, bus, microprocessor, microcomputer, register, instruction, instruction set, program, stack, arithmetical/logical unit) and basic principles of the program execution (interrupt and timer/counter). Combinational and sequential logic gate. Computer number system. Principles of the function and utilization of the input/output ports as general digital inputs and output for switches, sensors, LED indicators, alphanumeric LCD, DC and stepper motors. Utilization of A/D converter and serial communication interface for real application.

REFERENCES
a. Godse, A.P. and Godse, D.A., A Comprehensive Aproach To Microcontrollers, Technical Publications, 2012.
b. Godse, A.P. and Godse, D.A., Microcontroller, Technical Publications, 2013.
c. Mazidi, M.A., PIC Microcontroller and Embedded Systems using assembly and C for PIC18, 2nd Edition, Pearson (Prentice Hall), 2016.
d. Martin, P.B., PIC Microcontrollers, 3rd Edition, Newnes, 2013.
e. Martin, P.B., Interfacing Pic Microcontrollers, 2nd Edition, Newnes, 2013.

BMCG 2513 COMPUTER AIDED DESIGN AND MANUFACTURING

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Acquire and apply fundamental sketching and feature modeling, build feature based models of parts and assemblies for easy editing.

LO2 Produce document design intent of parts and assemblies in manufacturing drawings.

LO3 Design and develop products effectively through the applications of engineering design methodology.

SYNOPSIS

This course will empower the students with fundamental knowledge and technical skills of 3D solid modeling skills using industry-proven 3D

mechanical CAD/CAM software. The students will learn about theory of CAD/CAM systems, the different techniques for creating sketches, solid models, assemblies and CAM operations with emphasis on design intent. The course includes hands-on exercises and best practice methods for students to interpret common error messages during part, assembly, drafting stages and machining stages.

REFERENCES

a. Dassault Systeme, 2012, *Solidworks 2012 Essential Part Assembly and Drawing*, France.
b. Dassault Systeme, 2006, *CATIA R16: Part Design Fundamental* and CATIA machining, France.
c. Rao, P.N., 2004, *CAD/CAM Principles and Applications*, 2nd Edition, McGraw Hill.

BMCG 3XX3 AUTOMOTIVE TECHNOLOGY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe the classifications and fundamental concept of automotive system.
LO2 Analysis the assembly and disassembly process of automotive system or components.
LO3 Review the technological advances in any automotive system in modern vehicle supporting Energy Efficient Vehicle (EEV).

SYNOPSIS

This course covers automotive configurations, basic operation of automotive system and components such as engine and power train system, electric and electronic system, suspension, brake, steering, fuel and lubricants.

REFERENCES

a. Halderman, J.D., 2009, *Automotive Technology: Principles, Diagnosis and Services*, 3rd Edition, Prentice Hall.
b. Erjavec, J., 2010, *Automotive Technology 5e: A Systems Approach*, 5th Edition, Thomson Delmar Learning, New York.
c. Duffy, J.E., 2009, *Modern Automotive Technology*, 7th Edition, Goodheart-Willcox Publisher.

BMCG 2XX3 SOLID MECHANICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Describe and apply the basic concepts and fundamental principles of solid mechanics.
LO2 Analyse and solve the state of stress and strain in elastic structural members under various loading conditions.
LO3 Analyze and determine the principle stresses for plane stress problem due to combine loading.

SYNOPSIS

Introduction to various types of structures and type of supports. Concepts of stress, strain, shear force and bending moment. Theory on torsion. Pure bending on a structure. Combination of loads. Transformation of stress.

REFERENCES

a. Beer, F.P., Johnston E.R., Jr, John, T., Dewolf, Kazurek, D. F., 2012, *Mechanics of Materials*, 6th Edition (Global Edition) , McGraw-Hill.
b. Hibbeler, R.C., 2011, *Mechanics of Materials*, 8th Edition in SI Unit, Prentice Hall.
c. Gere, J.M., 2004, *Mechanics of Materials*, Thomson.

d. Vable, M., 2002, *Mechanics of Materials*, Oxford University Press.
e. Shames, I.H., 2000, *Introduction to Solid Mechanics*, Prentice Hall.

BMCK 2XX3 VEHICLE ELECTRICAL AND ELECTRONICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 To describe the types and characteristics of energy accumulators in motor vehicles. (PO11, LL2).

LO2 To explain the principles behind the design of energy converters in motor vehicles. (PO1, C5, A3).

LO3 To demonstrate how the electrical/ electronic equipment work in motor vehicles using the principles of electricity. (PO2, CTPS3).

SYNOPSIS

This course covers vehicle electrical and electronics systems comprising energy accumulators (batteries), energy converters (alternators) and energy consumers (electrical/electronic equipment). It includes vehicle level integration requirements to individual subsystem and component design validation for powertrain, body, chassis, safety, and entertainment electrical and electronic systems hardware and software.

REFERENCES

a. Denton, T., Automobile Electrical and Electronic System Automotive Technology: Vehicle Maintenance and Repair, 4th Edition, Routledge, New York, 2012.
b. Hollembeak, B., Automotive Electricity & Electronics: Classroom Manual, 5th Edition, Delmar, Cengage Learning, New York, 2011.
c. Robert Bosch GmbH, SAE Automotive Handbook, 7th edition, SAE International, Warrendale, 2007.
d. Denton, T., Automobile Electrical and Electronic System, 3rd Edition, Elsevier Butterworth-Heineman, Oxford, 2004.
e. Robert Bosch GmbH, Automotive Electrics Automotive Electronics, 4th edition, Professional Engineering Publishing, 2004.

YEAR 2 COURSES – MATHEMATICS, STATISTICS AND COMPUTING

BMFG22X3 ENGINEERING MATHEMATICS II

LEARNING OUTCOMES

Upon completion of this subject, students should be able to:

LO1 Describe the fundamental concepts of multivariable functions, multiple integrals and vector calculus.

LO2 Solve the mathematical problems that involve function of several variable, multiple integrals and vector calculus.

LO3 Apply the knowledge of advanced engineering mathematics to deal with the engineering problems.

SYNOPSIS

This course consists of three chapters: Function of Several Variables: Functions of Two or More Variables, Limit and Continuity, Partial Derivatives, Total Differential, Chain Rule, Implicit Differentiation and Local Extrema.

Multiple Integrals: Double Integral, Double Integral Over Non-rectangular Regions, Double Integral in Polar Coordinates, Triple Integral, Triple Integral in Cylindrical and Spherical Coordinates and Moment and Centre of Gravity.

Vector Calculus: Vector fields, Line integral, Green's theorem, Curl and Divergence, Parametric surfaces and their Areas, Surface integrals, Stoke's theorem and Divergence theorem.

REFERENCES

a. Yusof, Y. M., Baharun, S. And Rahman, R. A., 2013. Multivariable calculus for Independent learners. Pearson, Malaysia.

b. Croft, A., Davison, R., Hargreaves, M. and Flint, J., 2012. Engineering Mathematics. Pearson Higher Ed, USA.

c. Anton, H., Bivens, I., and Davis, S., 2010. Calculus Multivariable, 8th edition. John Wiley & Sons, USA.

d. Stewart, J., 2015. Calculus. Cengage Learning, USA.

e. Colley S. J., 2012. Vector Calculus 4th Edition. Pearson, Boston.

YEAR 3 COURSES - UNIVERSITY COMPULSORY

BLHW 3403 ENGLISH FOR PROFESSIONAL COMMUNICATION

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Produce a recommendation report based on a given scenario using appropriate tenses, parallel structures, and modifiers.

LO2 Demonstrate professional communication skills in oral presentation and job interview.

LO3 Role-play and conduct meetings in groups.

LO4 Compose a resume and an application letter relevant to the respective job.

LO5 Differentiate between facts and opinions, and use vocabulary relevant to its context.

SYNOPSIS

This course is designed to develop students' written and oral communication skills, as well as to enhance their level of English literacy which will be beneficial to their professional careers. Students are taught to write application letter and resume according to the format required by the workplace. In addition, they are also taught to produce a recommendation report. Students also acquire effective presentation skills as well as gain experience in mock interviews and meetings prior to seeking employment. Grammar is taught implicitly. The Student-Centred Learning approach is employed in the teaching and learning process.

REFERENCES

a. Azar, B.S., 2010, Understanding and using English grammar, New York: Longman.
b. Casher, C.C. & Weldon, J., 2010, Presentation excellence: 25 tricks, tips and techniques for professional speakers and trainers, USA: CLB Publishing House.
c. Chin, F.C.J., Soo, K.S.E., & Manjuladevi, R., 2010, English for professional communication: Science and engineering, Singapore: Cengage Learning Asia Pte Ltd.
d. Khoo, M.S.L, Abdul Rahim, R., & Rajendraan, E., 2006, Communication at the work place, Melaka: Jabatan Bahasa dan Komunikasi, UTeM.

YEAR 3 COURSES - PROGRAMME CORE

BMCU 3013 INTEGRATED DESIGN PROJECT I

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain and apply an appropriate design method at the particular design phase in the course of developing a practical solution of an engineering design problem.

LO2 Develop a practical design solution through a systematic investigation of the engineering design problem.

LO3 Communicate effectively in written, oral and visual means in a technical setting.

SYNOPSIS

This course covers Integrated Design Project process started from problems analysis, Formulating Design problems, Concept Design, Configuration Design, Parametric Design, Detail Design and Prototypes Development. Suitable methods such as QFD, Weighted Objective Method will be used at the particular design stage. Engineering Economics aspect of product, human factor, ethic and safety in design is included. Design for Manufacture and Assembly (DFMA) is a part of this course. In addition students are required to carry out teamwork project and communicate effectively in written and oral in the technical setting.

REFERENCES

a. Dieter, G.E., Schmidt, L.C, 2009, *Engineering Design*, 4th Edition, McGraw- Hill/Higher Education, Singapore.
b. Ulrich, K.T. and Eppinger, S.D., 2009, *Product Design and Development*, McGraw-Hill
c. Ullman, D.G., 2004, *The Mechanical Design Process*, McGraw-Hill Education (Asia), Singapore.

BMCU 3023 INTEGRATED DESIGN PROJECT II

LEARNING OUTCOMES

At the end of this course, the student should be able to:

LO1 Design solution by synthesizing mechanical engineering knowledge that will solve complex mechanical engineering problem in accordance with relevant standards.

LO2 Utilize modern engineering and IT tools in facilitating solutions to complex mechanical engineering problems with an understanding of the limitations.

LO3 Evaluate the impact of the design product, component or processes in term of safety, environmental and sustainability factors.

LO4 Demonstrate effectively teamwork skill in completing the IDP.

LO5 Apply project management and financial knowledge effectively in completing the IDP.

SYNOPSIS

Integrated Design Project is a course where students have to design a mechanical engineering project, including project management, project planning, project feasibility study, design selection, design costing and sizing, analysis and evaluation. The course focuses on the implementation and integration of product/conceptual design development to produce a comprehensive final technical report, including engineering proposals and drawings, specifications and bills of quantities, cost estimates of development projects given to students, working in groups. Apart from basic mechanical design, students are also required to integrate their knowledge of other engineering disciplines such as (but not limited to) structural analysis and design, including material selections, project scheduling techniques and sustainable development considerations into their overall project work. At the end of this course, the students will be able to comprehend the needs and requirements for product design procedures and are able to appreciate the importance of integration and synthesis of various disciplines of mechanical engineering knowledge.

REFERENCES

a. International Engineering Alliance, Graduates attributes and professional competencies, version 3, June 2013.

b. Richard G. Budynas and J. Keith Nisbett, Shigley's Mechanical Engineering Design (McGraw-Hill Series in Mechanical Engineering) 10th Edition, January 27, 2014.

c. Peter R. N. Childs BSc. and D.Phil, 2013, Mechanical Design Engineering Handbook Butterworth-Heinemann; 1 edition (November 18, 2013).

d. Michael F. Ashby., 2010, Materials Selection in Mechanical Design, Fourth Edition 4th Edition, Butterworth-Heinemann; 4 edition (October 5, 2010).

BMCU 3935 INDUSTRIAL TRAINING

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Acquire on-job training or in-plant training in a working environment relevant to the field of mechanical engineering.

LO2 Develop appropriate soft skills and professional engineering environment exposure throughout the duration of industrial training.

LO3 Apply all knowledge in order to solve common industrial problems as an individual and as a leader in a group or a member of a team.

LO4 Practice the ethics of social, environmental and cultural responsibilities appropriately during industrial training.

SYNOPSIS

Students in third year are required to undergo industrial training for a minimum of 10 weeks at the designated organisation. During the industrial training, students are given continuous supervision by an industrial supervisor as well as supervisor appointed by the faculty. Daily activities throughout the industrial training must be recorded in a log book provided by the faculty, which will be evaluated by the supervisors. Five credit-hours are given for this industrial training. Students must show satisfactory attendance and discipline in order to pass this course. The faculty' supervisor may visit the students during the training period.

YEAR 3 COURSES - COURSE CORE

BMCG 3223 CONTROL ENGINEERING

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Derive mathematical model and obtain transfer function of dynamic systems.

LO2 Explain stability of control system using standard techniques in times domain and analyze the time response of the system.

LO3 Utilize frequency response techniques and its relative stability to control the dynamic systems.

SYNOPSIS

Introduction to open loop and closed-loop control systems. Modeling of real system using differential equations to obtain the transfer function of dynamic systems and utilization of block diagrams for the closed-loop control system. Analysis of system for stability in time and frequency domains, final value, steady-state error, overshoot and settling time. Application of controller such as, P, PI and PID algorithms to achieve the desired system response.

REFERENCES

a. Mohd Khairi Mohamed Nor, Mohd Azli Salim, Md Fahmi Abd Samad @ Mahmood, Zairulazha Zainal, Nor Salim Muhammad, 2017, Control Engineering, Penerbit UTeM. (main text)

b. Andrea-Novel, B. and Lara, M., 2013, Control Theory for Engineers: A Primer, Springer-Verlag Berlin Heidelberg.

c. Dorf, R.C. and Bishop, R.H., 2011, Modern Control Systems, 12th Edition, Pearson Education Inc.

d. Jamaluddin, H., Yaacob, M.S. and Ahmad R., 2011, Introduction to Control Engineering, Johor Bahru, Johor: Penerbit UTM Press.

e. Nise, S.N. 2015, Control Systems Engineering, 7th Edition, Wiley.

BMCG 3233 MECHANICAL VIBRATION

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1. Apply the fundamental principles of vibration of one-and two-degree-of-freedom systems in engineering practice.

LO2. Identify the vibration characteristics of a vibrating system

LO3. Design basic techniques of vibration control.

SYNOPSIS

Fundamental of vibration. One-degree-of-freedom system: free vibration of an undamped and damped systems. Harmonically excited vibration: forced undamped and damped systems; unbalance rotating mass; base excitation. Two-degree-of-freedom system: natural frequencies and mode shapes. Continuous structures: beam, string and plates. Design of vibration suppression: vibration isolation and vibration absorber.

REFERENCES

a. Rao, S.S., 2011, *Mechanical Vibrations*, 5th edition: Prentice Hall.
b. Kelly, S.G., 2011, *Mechanical Vibrations: Theory and Applications*, Cengage Learning.
c. Meirovitch, L., 2010, *Fundamental of Vibration*, McGraw-Hill.
d. Inman, D.J., 2008, *Engineering Vibrations*, 3rd edition, Pearson Education Inc.
e. Kelly, S.G., 2006, *Schaum's Mechanical Vibrations,* McGraw-Hill.
f. Putra, A., Ramlan, R., and Ismail, A.Y., 2014, *Mechanical Vibrations*: Teaching Modul and Learning Series, UTeM.

BMCG 3713 HEAT TRANSFER

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Solve problems on steady state and unsteady state on one dimension and multiple dimension heat transfer.

LO2 Determine the heat transfer coefficient for natural or forced convection in dimensionless parameter in thermal system.

LO3 Determine of energy exchanges between black and grey surfaces at different temperatures.

SYNOPSIS

Introduction to heat transfer, steady state conduction-one dimension and multiple dimensions, unsteady state conduction. Numerical analysis for solving heat transfer problems, forced convection in laminar and turbulent flow on plate and pipe, natural convection, phase changes of heat transfer, thermal radiation on black body and surface, and boiling and condensation

REFERENCES

a. Chengel, Y.A., & Ghajar, A., 2014, *Heat and Mass Transfer: Fundamentals & Applications*, 5th Ed., McGraw-Hill.
b. Incropera, F.P. & Dewit, D.P., 2011, *Fundamentals of Heat and Mass Transfer*, 7th Ed., John Wiley & Sons.
c. Holman, J., 2009, *Heat Transfer*, 10th Ed., McGraw-Hill.

BMCK 41X3 VEHICLE DYNAMICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain the basics of vehicle handling/ride and primary factors that affect it.
LO2 Develop physical and mathematical model to predict the dynamic response of a vehicle.
LO3 Design vehicle components and subcomponents that meet certain vehicle dynamics performance criteria.

SYNOPSIS

To discuss an introduction and the basic concept of vehicle dynamics, fundamental approach towards vehicle dynamics modeling, vehicle response to various driver and ambient inputs, road loads, mechanics of tyre, relation between ride and handling, steering and suspension system.

REFERENCES

a. Wong J. Y. (2014) Theory of Ground Vehicles, 3rd Ed. John Wiley & Sons.
b. Georg Rill (2012) Road Vehicle Dynamics – Fundamental and Modeling, CRC Press Taylor & Francis Group.
c. Karl Popp and Werner Schiehlen (2010) Ground Vehicle Dynamics, Springer.
d. Thomas D. Gillespie (1992) Fundamentals of Vehicle Dynamics, Society of Automotive Engineers.
e. Rao V. Dukkipati, Jian Pang, Mohamad S. Qatu, Gang Sheng and Zuo Shuguang (2008) Road Vehicle Dynamics, Society of Automotive Engineers.
f. Milliken W.F. and Milliken D.L. (1995) Race Car Vehicle Dynamics, Society of Automotive Engineers.

BMCK 33X3 INTERNAL COMBUSTION ENGINES

SYNOPSIS

This subject introduces students to the fundamentals of internal combustion engines (ICE). Thermodynamic operating principles are used to solve problems on spark ignition and compression ignition engines that operate on four-stroke or two-stroke cycles. The scope of the subject includes all ICE with an emphasis on reciprocating engines used in automobiles as well as rotary engine with similar applications. Topics include engine configuration, thermodynamics parameter, engine cycles, thermochemistry, fuel-air cycles, supercharger and turbocharger and emissions. Detailed analysis of the 1st Law of Thermodynamics on unsteady processes open systems or in differential form to closed systems and reacting gas mixtures. Thermochemistry analyses of the engine fuels as well as performance analysis of supercharged and turbocharged engine are also covered. The latest automotive technologies are also discussed in relevant topics such as hybrid vehicles, higher voltage electrical systems, and electronic valve actuation.

REFERENCES

a. H.N Gupta, 2013, 2nd Edition, Fundamental of Internal Combustion Engines, Asoke K Ghosh, PHI Learning Private Limited

BMCK 31X1 AUTOMOTIVE LABORATORY I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Observe discipline in attending laboratory sessions, applied safety precautions before, during and after conducting experiments in terms of experimental procedures and aware of the general experimental ethics.

LO2 Demonstrate and understand the concept vehicle system operation such as brake system, steering system, suspension system, and also engine lubrication system.

LO3 Conduct basic vehicle maintenance such as engine service, brake service, suspension service, wheel & tyre balancing and alignment.

SYNOPSIS

To demonstrate the principle operations of the vehicle systems such as internal combustion engine system, suspension system, braking system, steering systems, and wheel & tyre service. Students will practically expose to the basic vehicle maintenance such as engine lubrication, engine top overhaul, brake service, and wheel balancing & alignment.

REFERENCES

a. May Ed, 2009, Automotive Mechanic – Volume 1, 7th Edition, McGraw-Hill.
b. Crouse, W. H. and Anglin, L. A., Automotive Mechanics, 10th Edition, McGraw-Hill.

BMCK 32X1 AUTOMOTIVE LABORATORY II

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 To describe the working principles of experimental apparatus used to measure the engine performance and engine breathing

LO2 To explain the principles behind the design of internal combustion engines

LO3 To demonstrate how to set up the apparatus to measure the engine performance and engine breathing.

SYNOPSIS

This course covers the aspects of engine performance and engine breathing. It includes the soaking process, instrumentation and data collection. Students will learn how to set up the apparatus as well as running the experiment to obtain reliable data.

REFERENCES

a. Robert Bosch GmbH, SAE Automotive Handbook, 8th edition, SAE International, Warrendale, 2011.
b. Anthony J. Wheeler and Ahmad Ganji, Introduction to Engineering Experimentation, Prentice Hall, 2010.

BMCK 32X3 VEHICLE SYSTEM MODELING & SIMULATION

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Develop mathematical models for a given vehicle application or analysis. (PO2)

LO2 Simulate and analyze the model using vehicle dynamics simulation software (PO5)

LO3 Evaluate and translate computer simulation result based on knowledge in mechanical engineering field (PO1)

SYNOPSIS

This course is intended to introduce vehicle dynamics modelling and simulation. Mathematical models will be developed in order to predict the vehicle behaviour in longitudinal, lateral and vertical directions. Tire modelling will cover both linear and non-linear tire models. Validation and limitations of vehicle models will be discussed. These models will be used to evaluate the performance of tire,

ride and handling. For vehicle handling assessment, steady-state and transient tests will be described. Modeling and simulation of vehicle systems in MATLAB/SIMULINK environment will be used extensively in class notes and assignments.

REFERENCES

a. Wong J. Y. (2014) Theory of Ground Vehicles, 3rd Ed. John Wiley & Sons.
b. Abe. M. (2009) Vehicle Handling Dynamics – Theory and Applications, Elsevier Butterworth-Heinemann
c. Hibbeler R C (2002) Engineering Mechanics – Static, 2nd Ed. PearsonRajamani, R., 2006, Vehicle Dynamics and Control, 1st Ed., Springer, New York, USA.

YEAR 3 COURSES – MATHEMATICS, STATISTICS AND COMPUTING

BENG 2143 ENGINEERING STATISTICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Identify clearly the concept of probability for a range of discrete and continuous random phenomena.

LO2 Apply the concept of sampling distribution, estimation and hypothesis testing to draw valid conclusion in solving engineering problems.

LO3 Analyze and interpret data by using simple linear and multiple linear regression techniques to forecast and produce statistical information.

LO4 Perform the given tasks that pertain to the engineering problems by using the knowledge of statistics.

SYNOPSIS

Topics covered: data description, measurement, probability, discrete random variable, continuous random variable, sampling distribution, estimation, hypothesis testing, simple linear regression and multiple linear regression. The students are required to use SPSS and Minitab software to analyze and interprete the real engineering data. Applications of statistics in engineering are also explained in this course.

REFERENCES

a. Walpole, R.E, et al, 2011, *Probability & Statistics for Engineers & Scientists*, 9th Edition, Pearson Prentice Hall.
b. Sara, S., et al, 2008, *Introduction to Statistics & probability A Study Guide*, Pearson Prentice Hall.
c. Hayter, A. J., 2012, *Probability and Statistics for Engineers and Scientists*, 4th Edition, Thomson Brooks/Cole.
d. Montgomery, D.C., 2011, *Design & Analysis of Experiments*, 7th Edition, John Wiley & Sons, Inc.
e. Ledolter, J., & Hogg, R.V., 2010, *Applied Statistics for\engineer and Physical Scientists*, 3rd Edition. Pearson Prentice Hall.

YEAR 4 COURSES - UNIVERSITY COMPULSORY

BTMW 4012 ENTREPRENEURSHIP TECHNOLOGY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Recognize the importance of entrepreneurship, the role of entrepreneurship in today's society, and the technical knowledge of the entrepreneurial process.

LO2 Explain the basic concepts of interdisciplinary competences in management, and create technology-based businesses.

LO3 Present a business plan project and develop an entrepreneurial profile.

SYNOPSIS

The course provides students with technological knowledge about entrepreneurship as well as the skills to turn such knowledge into practice. The teaching and learning (T&L) activities include case study and field work with the aim to inculcate entrepreneurship values and entrepreneurship acculturation with a view to successfully launch and subsequently manage their enterprises. Students will be exposed with the support systems available or government agencies in starting new ventures, including the tactics commonly employed by entrepreneurs starting a business. The course allows students to critically evaluate business in terms of technical feasibility, investment potential, and risks.

REFERENCES

a. Barringer, B.R., and Ireland, R.D., 2012, *Entrepreneurship*, 4th Edition, Pearson.

b. Scarborough, N.M., 2011, *Essentials of Entrepreneurship and Small Business Management*, 6th. Edition, Pearson.

c. UiTM Entrepreneurship Study, 2010, *Fundamentals of Entrepreneurship*, Pearson.

BLHC 4032 CRITICAL AND CREATIVE THINKING

LEARNING OUTCOMES

Pada akhir mata pelajaran ini, pelajar akan dapat:

LO1 Membincangkan prinsip asas kemahiran pemikiran kritis & kreatif dalam menyelesaikan masalah harian.

LO2 Memberi maklum balas dalam perbincangan kumpulan terhadap isu berkaitan perkembangan kemahiran pemikiran kritis & kreatif.

LO3 Menyelesaikan masalah melalui kajian kes terhadap isu semasa yang berkaitan bidang pengajian mereka.

LO4 Menganalisis kehendak pasaran akan datang dan mencadangkan penyelesaian berasaskan produk.

SYNOPSIS

Mata pelajaran ini direka untuk memberi pendedahan kepada pelajar tentang prinsip-prinsip asas dalam pemikiran kritis & kreatif. Pelajar akan mengaplikasikan kaedah pemikiran kritis & kreatif dalam penyelesaian masalah. Pelajar akan dipandu di dalam projek akhir di mana penganalisaan keperluan produk dari pelbagai perspektif dan pemikiran di luar batasan akan diaplikasikan.

REFERENCES

a. Yahya, A., Abdullah, A.N., Hasan, H., & Rahman, R.R.R.A., 2011, *Critical and Creative Thinking Module 2*, Melaka, Penerbit UTeM.

b. Buzan, T., & Buzan, B., 2006, *The Mind Map Book, Essex: BBC Active*, Pearson Education.
c. Claxton, G., & Lucas, B., 2007, *The Creative Thinking Plan*, London: BBC Books.
d. Fisher, A., 2011, *Critical Thinking: An Introduction*, London: Cambridge University Press.

YEAR 4 COURSES - PROGRAMME CORE

BMCU 4972 FINAL YEAR PROJECT I

LEARNING OUTCOMES

After completing the course, students should be able to:

LO1 Formulate a problem statement and design a project methodology to fulfill objecives of the project.
LO2 Conduct initial measurements and/or predictive studies to meet objectives of the project.
LO3 Present a project report in written and oral forms.

SYNOPSIS

The student needs to plan and implement the project individually that related to the mechanical engineering field. It covers problem statement, literature review, methodology to overcome the problem. The student needs to achieve the objective of the project and presented it in the report.

BMCU 4984 FINAL YEAR PROJECT II

LEARNING OUTCOMES

At the end of this course, students will be able to:

LO1 Carry out project management based on the principle of engineering.
LO2 Conduct initial measurements and/or predictive studies to meet objectives of the project.
LO3 Analyze data and interpret results.
LO4 Present a full project report in written and oral forms.

SYNOPSIS

The student needs to plan and implement the project individually that related to the mechanical engineering field. It covers problem statement, literature review, methodology to overcome the problem. The student needs to achieve the objective of the project and presented it in the report.

BMCU 4011 ENGINEERING SEMINAR

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Identify the professional engineering knowledge, practices and responsibilities.
LO2 Gather and sort relevant information with regard to the given technical talk.
LO3 Discuss current engineering issues and practices in small group and present the reflection in a forum or short report.

SYNOPSIS

A series of technical talks will be organised and the attendance is compulsory. The technical talks will dwell on engineering profession that relates to the technology advancement, economy issues, technopreneurship, environment, sustainability

and safety aspects. Reflection of the seminar will be discussed in a forum and short report will be produced by the students

BENG 4322 ENGINEER AND SOCIETY

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Relate the effect and impact of technology on society, culture and environment.

LO2 Demonstrate as a responsible professional, abiding to the code of professional ethics.

LO3 Demonstrate effectively the assignment given in a group or individual.

LO4 Response critically and handle social, cultural and global issues as well as environment, occupational health & safety issues.

SYNOPSIS

Role of engineer in Nation Building, evaluation of engineering, National development Role of engineers in society, laws related to public safety, health & welfare, future engineers, professionalism and codes of ethics, definition of professionalism, understanding engineering as a profession, ethical theories, IEM and BEM code of ethics. Ethical problem solving techniques analysis of issues in ethical problems, line drawing, flow charting, learn to handle conflicting problems, application in bribery and accepting gifts situation. Ethics practice in Occupational Safety and Health at work. Rights and responsibilities of engineers. Quality from engineering perspective. Carrier guidance and project management.

REFERENCES

a. The Institution Of Engineer, Engineering Professionalism and Ethics, 4th Ed, 1995.
b. Fleddermann, C.B., 2008, *Engineering Ethics*, 3rd Ed, Prentice Hall.
c. Martin, M.W., & Schinzinger, R., 2005, *Ethics in Engineering*, 4th Ed, McGraw-Hill.
d. Harris JR, C.E., Pritchard, M.S., Rabin, M.J., 2003, *Engineering Ethics*, 2nd Ed, Thomson and Wadsworth.
e. Canning, J., 2007, Workplace Safety for Occupational Health and Safety (Safety at Work Series V4).
f. Safe Work in 21st Centuries (Educational and Training for the Next Decade Occupational Health and Safety Personnel) National Academy Press, 2006
g. Idrus, A., Sulaiman, S.A., Khamidi, M.F., 2010, *Engineers in Society*, Mc Graw Hill Education.

BMFG 4623 ENGINEERING MANAGEMENT AND ECONOMY

LEARNING OUTCOMES

At the end of this course, student should be able to:

LO1 Explain the core concepts and principles in project management and engineering economics.

LO2 Construct critical decision-making tools in an engineering project by analysing project management and financial elements.

LO3 Generate a comprehensive & viable Project Proposal and justify by a presentation in group discussion session.

SYNOPSIS

This course covers engineering economics and managing risk in an organization. Engineering economics discusses about the time value of money and interest relationships, which are useful to define

certain project criteria that are utilised by engineers and project managers to select the best economic choice among several alternatives. Projects examined will include both product and service-producing investments. The effects of escalation, inflation, and taxes on the economic analysis of alternatives are also discussed. Management of risk incorporates the concepts of probability and statistics in the evaluation of alternatives. This allows management to determine the probability of success or failure of the project.

REFERENCES

a. Blank, L., and Tarquin, A., 2012, *Engineering Economy*, 7th Edition, McGraw Hill.
b. Sullivan, W.G., Wicks, E.M., and Koelling, C.P., 2012, *Engineering Economy*, 15th Edition, Pearson.
c. Park C.S., 2011, *Contemporary Engineering Economics*, 5th Edition, Pearson.
d. Whitman, D., and Terry, R., 2012, *Fundamentals of Engineering Economics and Decision Analysis*, Morgan & Claypool Publishers.

YEAR 4 COURSES - COURSE CORE

BMCK 4XX3 VEHICLE AERODYNAMICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 To explain the concept of major theories, approaches and methodologies used in CFD (PO1)
LO2 To conduct the actual implementation of CFD methods in using commercial CFD codes (PO5)
LO3 To be able to interpret and present the results in an appropriate professional context (PO9)

SYNOPSIS

The fundamental principles of fluid mechanics are conservation of mass, momentum and energy. Engineering students must understand and be able to apply these basic principles before designing fluids engineering systems. Hence, this course is designed for undergraduate students tend to pursue industrial employment after graduation. The course is focused on two areas: the fundamental of the method and the correct way of conducting the analysis using readily available software, i.e. ANSYS Version 16.

REFERENCES

a. Chung, T.J. 2014. *Computational Fluid Dynamics* Second Edition, Cambridge University Press: United States of America.
b. Anderson, J.D. 2006. *Computational Fluid Dynamics The Basic with Application*, McGraw-Hill: Singapore.
c. Tannehill, J.C., Anderson, D.A., and Pletcher, R.H. 1997. *Computational Fluid Mechanics and Heat Transfer* Second Edition, Taylor and Francis: USA.

BMCK 43X3 VEHICLE CONTROL SYSTEM

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Explain the function, principal and theory for each of the subsystem covered in the syllabus (PO12).

LO2 Develop mathematical models of the related vehicle subsystem (PO1) LO3 Design and integrate simulation models with controller to evaluate the performance of system using computer-aided tools. (PO5).

SYNOPSIS

This course is intended to introduce control systems for vehicles including vehicle longitudinal control, lateral control and vertical control. Vehicle longitudinal control will include topics such as anti-lock braking, traction control, cruise control and adaptive cruise control. Topics on vehicle lateral control that will be covered are active front wheel steering, four wheel steering and electronic stability control. For vehicle vertical control, focus will be given on both semi-active and active suspension systems. Advanced topics such as steer-by-wire and brake-by-wire will be briefly described. MATLAB/ SIMULINK software will be introduced for the simulation works.

REFERENCES

a. Ribben, W.B., 2017, *Understanding Automotive Electronics*, 8th Ed., Butterworth, USA.
b. Rajamani, R., 2014, *Vehicle Dynamics and Control*, 2nd Ed., Springer, New York, USA.

BMCK 42X3 VEHICLE AUTONOMOUS SYSTEM

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Explain the fundamental concept and theory in autonomous vehicle as well as the features and function of sensors and actuators involved (PO12)

LO2 Create and evaluate control system for autonomous vehicle system (PO2)

LO3 Apply and analyze fundamental methods in autonomous vehicle, such as motion planning, obstacle avoidance, localization and mapping using simulation software. (PO5)

SYNOPSIS

This subject discusses the state of the art of autonomous systems, examines some promising autonomy technology that will be available in the near future, and identifies some shortfalls in autonomy capability that need to be alleviated. The subject goes on to explore the level of autonomy as a design choice and autonomy technologies.

REFERENCES

a. Fossen, Thor I., Pettersen, Kristin Y., Nijmeijer, Henk. (2017). Sensing and Control for Autonomous Vehicles. Sringer
b. Maurer, M., Gerdes, J.C., Lenz, B., Winner, H. (2016). Autonomous Driving. Springer.
c. Agus B. and Muljowidodo K.(2013). Autonomous Control Systems and Vehicles: Intelligent Unmanned Systems. Springer.
d. Rao V. Dukkipati, Jian Pang, Mohamad S. Qatu, Gang Sheng and Zuo Shuguang (2008) Road Vehicle Dynamics, Society of Automotive Engineers.

BMCK 42X1 AUTOMOTIVE LABORATORY III

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Observe discipline in attending laboratory sessions, applied safety precautions before, during and after conducting experiments

in terms of experimental procedures and aware of the general experimental ethics. (PO8)

LO2 Demonstrate and understand the concept vehicle system operation such as brake-by-wire system, steer-by-wire system and throttle-by-wire system.(PO1)

LO3 Conduct a laboratories testing on how to develop the x-by-wire system, especially in term of control strategy, apparatus and assessment method by using a necessary simulation software and Hardware in the loop simulation system.(PO4)

SYNOPSIS

To demonstrate the principle operations of the vehicle autonomous systems based on throttle, brake and steering systems. The students will be practically exposed to develop the autonomous systems by specifying automated control of the steering, break and throttle system.

REFERENCES

a. May Ed, 2009, Automotive Mechanic – Volume 1, 7th Edition, McGraw-Hill.

b. Crouse, W. H. and Anglin, L. A., Automotive Mechanics, 10th Edition, McGraw-Hill.

YEAR 4 COURSES - ELECTIVE

BMCK 4X13 NOISE, VIBRATION & HARHNESS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 To demonstrate understanding of fundamental principles of acoustics and noise relating to automotive including designing and evaluating its control measure. (PO1).

LO2 To demonstrate understanding of fundamental principles of vibration relating to automotive including designing and evaluating its control measure (PO2).

SYNOPSIS

This subject introduces the fundamental concept of noise and vibration and their generation and propagation in motor vehicles. It is then followed by the control measures to reduce both the noise and vibration in engineering practice.

REFERENCES

a. Fahy, F.J. and Thompson, D. J., 2016, *Fundamental of Sound and Vibration*, 2nd Ed, CRC Press, London.

b. Inman, D.J, 2014, *Engineering Vibration*, 4th Ed. Pearson, USA.

c. Wang, X., 2010, *Vehicle Noise and Vibration Refinement*, Woodhead Publishing Ltd, UK.

d. Harrison, M., 2004, *Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles*, Elsevier.

BMCK 4X23 VEHICLE POWERTRAIN SYSTEMS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 To analyse and evaluate the vehicle road loads and to determine the appropriate engine matching (PO1).

LO2 To demonstrate the knowledge and understanding the mechanism of vehicle transmission system and to be able to calculate the basic design of transmission gear design that satisfies the vehicle requirements or engine specifications (PO2).

LO3 To analyse and evaluate vehicle driveline dynamics of contemporary technologies (PO5).

SYNOPSIS

To introduce and discuss the basic concept of automotive power train, fundamental approach towards engine and transmission matching, powertrain functions, torque converter, automatic & manual transmission, transmission friction elements and transmission gear design.

REFERENCES

a. Eriksson, L., Nielsen, L. 2014. *Modeling and Control of Engines and Drivelines*, John Wiley & Sons, USA.
b. Martin, G.G. 2012. *Design practices: Passenger Car Automatic Transmissions* Fourth Edition, SAE International, Warrendale, USA.
c. Hiller, V.A.W. & Coombes,P. 2012. *Hiller's Fundamentals of Motor Vehicle Technology*. 6th Edition. Nelson-Thornes Ltd:United Kingdom.
d. Carmo, J.P. 2012. *New Advances in Vehicular Technology and Automotive Engineering*, InTech, USA.
e. Grolla, D.A. & Mashadi, B. 2011. *Vehicle Powertrain Systems: Integration and Optimization*, John Wiley & Sons, USA.
f. Naunheimer, H., Bertsche, B., Ryborz, J. & Novak, W. 2010. *Automotive Transmission Fundamentals, Selection, Design and Application*, Springer, USA.

BMCK 4X33 VEHICLE STRUCTURE ANALYSIS

LEARNING OUTCOMES

At the end of this course, student should be able to:

LO1 To design solution to determine the performance of vehicle structure.

LO2 To investigate the effect of each element of the structure that will affect the performance of the structure.

LO3 To predict the performance of vehicle structure using finite element software.

SYNOPSIS

In this course, student will learn about various loads that acting to vehicle structure that should be considered in designing vehicle structure. From this loading condition, students need to use analytical formulation they have learned in previous courses to predict the performance of the structure. Then, the will be exposed the modern tool in predicting the vehicle structure using finite element software.

REFERENCES

a. James M.Gere and Stephen P. Timoshenko. (2014). *Strength of Material.(3rd Ed)*. 2-6 Boundary Row, London: Chapman & Hill.
b. Donald E. Malen (2011). *Fundamentals of Automobile Body Structure Design*. 400 Commonwealth Warreendale, PA 15096-0001 USA.

BMCK 4XX3 VEHICLE ERGONOMICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Identify and evaluate major qualitative and human factors consideration in vehicle design.
LO2 Evaluate human factors and how it is related to the commercial success of automotive industries.
LO3 Synthesize ergonomics solutions for a case study of vehicle design.

SYNOPSIS

Ergonomics refers to human and aesthetic factors that influence the design of vehicles, systems and environments. These factors are supported by the use of anthropometric, psychological and sensory data gathering and analysis techniques. Understanding spatial relationships between people, objects and their environments is important when considering human factors in vehicle design. This course introduces understanding and applicability of ergonomics in vehicle design. This is held by identifying and evaluating major qualitative human factors considerations in vehicle design. This course also include topics such as driver's and passenger's comfort, interior features and safety issues that could be incorporated in practical designs, graphical skills, modelling as a mechanism for developing and evaluating vehicle design.

REFERENCES

a. Wickens, C.D., Liu, J.L.D.Y and Becker S.E.G., 2015. *An Introduction to Human Factors Engineering*, Pearson Prentice Hall, New Jersey.
b. Cristy Ho, Charles Spenser, 2014. *The multisensory drives: Implication for ergonomics car interface design*. Publisher CRC press.
c. Brian Peacock, Waldemar Karwowski, 2014. *Automobile ergonomics*. Publisher: CRC; 1 edition.
d. S.P. Taylor C.M. Haslegrave, 2014. *Vision in Vehicles VI*. Publisher: North Holland, 1 edition.
e. Salvendy, G., 2012. *Handbook of Human Factors and Ergonomics*, John Wiley and Sons.
f. V.D. Bhise, 2011. *Ergonomics in the Automotive Design Process*, CRC Press.
g. Lehto, M. and Landry, S.J. 2012. *Introduction to Human Factors and Ergonomics for Engineers*. 2nd Edition. CRC Press, Boca Raton.
h. A.G. Gale, I.D. Brown, C.M. Haslegrave, S.P. Taylor, 2012. *Vision in Vehicles: Volume VIII*. AVRC: Loughborough University, UK.

BMCK 4X53 ELECTRIC PROPULSION SYSTEM

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 To analyse and evaluate the vehicle road loads and to determine the appropriate engine matching (PO1).
LO2 To demonstrate the knowledge and understanding of electric and hybrid electric vehicle powertrain system that satisfies the vehicle performance requirements (PO2).
LO3 To analyse and evaluate vehicle performance by accommodating appropriate major components size (PO5).

SYNOPSIS

To introduce and discuss the basic concept of electrified powertrain systems include electric vehicle, hybrid powertrain architectures, dynamics of hybrid transmissions, energy storage systems and power management.

REFERENCES

a. Liu W. 2017. Hybrid Electric Vehicle System Modeling and Control, Wiley, USA b. Nikowitz,

M. 2016. *Advanced Hybrid and Electric Vehicles*, Springer.
b. Guzella, L. & Sciaretta, A. 2013. *Vehicle Propulsion Systems: Introduction to Modeling and Optimization*, Springer.
c. Miller, J.M. 2004. *Propulsion Systems for Hybrid Vehicles*, The Institutions of Electrical Engineers, UK.

BMCK 4X63 AUTOMOTIVE MANUFACTURING SYSTEMS

SYNOPSIS

Automotive manufacturing is among the core activities in vehicle development. Many manufacturing system are developed and implemented by automakers such as lean manufacturing to ensure the highest quality and quantity of product are achieved with minimum cost and waste. This subject covers the topic on automotive manufacturing system, with emphasize on lean manufacturing technique. Among the contents covered are value stream mapping, kaizen, continuous flow manufacturing cell, kanban, pull system, 5s, 7 wastes, single minute exchange die (SMED) and total preventive maintenance (TPM).

REFERENCES

a. Shigeo Shingo, 2017. *Fundamental Principles of Lean Manufacturing*, Productivity Press, USA.
b. Andrea Pampanelli, Neil Trivedi, & Pauline Found. 2016. *The Green Factory: Creating Lean and Sustainable Manufacturing*, CRC Press, USA.
c. Mike Elbert. 2013. *Lean Production for the Small Company*, CRC Press, USA.
d. Tina Agustiady, & Adedeji B. Badiru. 2013. *Sustainability: Utilizing Lean Six Sigma Techniques*, CRC Press, USA.
e. Shigeo Shingo, & Andrew P. Dillon. 1989. *A Study of the Toyota Production System: From an Industrial Engineering Viewpoint*, Productivity Press, USA.

4.3 Diploma of Mechanical Engineering Programme (DMC)

PRELIMINARY SPECIAL SEMESTER - UNIVERSITY COMPULSORY

DLHW 1012 FOUNDATION ENGLISH

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Interpret information from various types of oral texts.
LO2 Express ideas and thoughts orally in group discussions.
LO3 Distinguish different types of reading texts of varying length and complexity.
LO4 Produce an article based on non-linear texts in pair.
LO5 Apply appropriate grammar elements in quizzes.

SYNOPSIS

This course is designed to help students improve their proficiency in the English language and to

communicate effectively in both spoken and written forms. Five main aspects: listening, speaking, reading, writing and grammar are taught in an integrated approach so as to build confidence among the learners to become efficient speakers of English in their tertiary education.

REFERENCES

a. Azar, B., & Hagen, S., 2003, Fundamentals of English Grammar, 3rd Ed. Workbook, Longman, USA.
b. Dobiecka, K., & Wiederholt, K., 2008, Well Read: Skills and Strategies for Reading, Oxford University Press, China.
c. Freira, R., & Jones, T., 2011, Q: Skills for success Listening and Speaking, Oxford University Press, China.
d. Ling, K. S., 2011, Effective Text MUET, Penerbit Ilmu Bakti, Subang Jaya.

DLHW 1742 KEPIMPINAN

LEARNING OUTCOMES

Pada akhir kursus ini, pelajar akan dapat:

LO1 Mengenal pasti dan menerangkan konsep utama dalam kepimpinan.
LO2 Menunjukkan kemahiran interpersonal dalam melaksanakan tugasan kumpulan.
LO3 Mengubung kait peranan dan kepimpinan dan kepengikutan.

SYNOPSIS

Kursus ini membincangkan konsep-konsep kepimpinan, kemahiran interpersonal dalam kepimpinan, kerja berpasukan, kepengikutan, budaya kepimpinan dan kepelbagaian budaya/etika organisasi. Tujuan kursus ini ialah memberi kefahaman dan penghayatan aspek kepimpinan dalam diri pelajar. Pengajaran dan pembelajaran akan dilaksanakan dalam bentuk pembelajaran berasaskan pengalaman melalui aktiviti berpasukan di dalam dan di luar kuliah. Pada akhir kursus ini, pelajar diharapkan dapat membentuk keyakinan diri, kesedaran kendiri, etika dan profesionalisme disamping dapat mengaplikasi kemahiran komunikasi, kepimpinan dan kerja berpasukan dalam mengurus kehidupan seharian mahupun dalam mengurus organisasi.

REFERENCES

a. Abdul Halim el-Muhammady. (1996) Pengurusan dalam Islam, Persatuan Bekas Mahasiswa Islam Timur Tengah.
b. Adair, J. (2016) *Develop Your Leadership Skills*: Koogan Page.
c. Lusier, R. N. Dan Achua, C.F (2009). *Leadership: Theory, Application, Skill Development*. International Edition, Cincinnati: South Western College Publishing.
d. Syed Ismail Syed Mustafa dan Ahmad Subki Miskon. (2015). Asas Kepimpinan & Perkembangan Profesional: Penerbitan Multimedia.
e. Choi, C.H. (2004) Aspek-Aspek Kepimpinan dan Prestasi Organisasi, Johor: Universiti Teknologi Malaysia.
f. Razali Mat Zin. (1996) Kepimpinan dalam Pengurusan, Kuala Lumpur: Utusan Publications and Distributors.

DLHW 1032 PENGAJIAN MALAYSIA

LEARNING OUTCOMES

Pada akhir kursus ini, pelajar akan dapat:

LO1 Menilai kepentingan identiti kebangsaan ke arah mengukuhkan semangat patriotism.

LO2 Membina hubungan dan interaksi sosial dalam kalangan pelajar.

SYNOPSIS

Kursus ini menghuraikan tentang warganegara Malaysia yang berwawasan dan mampu menghadapi cabaran ke arah mencapai kesejahteraan hidup serta dapat menghayati peranan Malaysia di peringkat antarabangsa. Kursus ini memberi penghayatan tentang sejarah dan politik, perlembagaan Malaysia, kemasyarakatan dan perpaduan, pembangunan negara dan isu-isu keprihatinan negara. Kursus ini bertujuan melahirkan graduan yang mempunyai identiti kebangsaan dan semangat patriotism yang unggul.

REFERENCES

a. Mardiana Nordin dan Hasnah Hussin. (2018). Pengajian Malaysia. Oxford Fajar.
b. Zaid Ahmad, Ruslan Zainudin, Ahmad Tarmizi Talib, dan Nazri Muslim. (2013) Hubungan Etnik di Malaysia. Oxford Fajar.
c. Zainal Abidin Wahid. (2010). Sejarah Malaysia Sepintas Lalu. Kuala Lumpur. Dewan Bahasa dan Pustaka.
d. Ruslan Zainuddin. (2010). Kenegaraan Malaysia. Oxford Fajar.

YEAR 1 COURSES - UNIVERSITY COMPULSORY

DTKW 1012 ASAS PEMBUDAYAAN KEUSAHAWANAN

LEARNING OUTCOMES

Di akhir kursus ini pelajar akan dapat:

LO1 Menerap budaya keusahawanan berdasarkan teori keusahawanan, revolusi usahawan, sejarah pembangunan usahawan dan perkembangan keusahawanan di Malaysia.

LO2 Memperakui dan mengaplikasikan kemahiran keusahawanan seperti kreativiti, inovasi, pro-aktif, mengambil risiko, mengenalpasti peluang, pemasaran, dan rangkaian untuk memasuki/menembusi pasaran.

LO3 Melaksanakan penganjuran seminar keusahawanan dan kerja lapangan perniagaan di samping membuat pembentangan projek perniagaan serta berkongsi pengalaman berkaitan perlaksanaan projek perniagaan kumpulan masing-masing.

SYNOPSIS

Kursus ini akan membekalkan pelajar dengan motivasi dan kemahiran utama keusahawanan. Disamping itu, pelajar juga akan mendapat kemahiran tentang prinsip-prinsip dan amalan yang diperlukan untuk memulakan, mengembangkan dan memperkukuhkan sesebuah perniagaan. Aktiviti pengajaran, pembelajaran dan aplikasi yang menerapkan teori dan amalan akan membantu pelajar menguasai kompetensi yang perlu sebelum menceburkan diri dalam bidang perniagaan. Kursus ini juga membantu pelajar membentuk jaringan/rangkaian perniagaan melalui perbincangan perniagaan, similasi dan seminar. Pelajar akan didiedahkan dengan isu-isu

yang berkaitan dengan pemasaran, pengurusan strategi dan risiko. Disamping itu, pelajar akan dibekalkan dengan kemahiran yang perlu untuk menyediakan penyata aliran tunai dan asas dalam membangunkan menyediakan perancangan perniagaan.

REFERENCES

a. Hisrich, D.R., Peters, M.P., and Shepherd, D.A, 2005, Entrepreneurship, McGraw Hill IE.
b. UiTM Entrepreneurship Study Group, 2004, Fundemental of Entrepreneurship, Prentice Hall.
c. Mankani, D., 2003, Technopreneurship, Prentice Hall.
d. Yusof, A.A., 2003, Prinsip Keusahawan, Prentice Hall.
e. Buang, N.A., 2002, Asas Keusahawanan, Penerbit Fajar Bakti Sdn. Bhd.
f. Kuratko, D.F., and Hodgetts, R.M., 2001, Entrepreneurship: A Contemporary Approach, 5th Edition, South-Western: Ohio.

DKKX XXX1 CO-CURRICULUM I

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Understand a balanced and comprehensive education hence generating a more mature student.
LO2 Develop leadership aspects stressing on disciplines and cooperation within a group or organisaton.
LO3 Build personality and character guided by rules of conduct.
LO4 Foster cooperation and unity in multi-racial society.

SYNOPSIS

a. Culture
Choir, *Gamelan, Cak Lempung, Nasyid, Khat*, Acting, Art, Debate *(Bahasa Malaysia)*, Debate, Interior Design and *Kompang*.
b. Entrepreneurship
Video, Film & Photography, Journalism and Publication, e-computer and Technopreneurship.
c. Community
Fiqh Muamalat, Fiqh Amali, Translation of Al-Quran & Recitation of Yaasin and Peer Group Programmes (PRS) & *Sahabat Khidmat*.
d. Sports
Swimming (Male), Volleyball, Golf, Kayak, *Sepak Takraw*, Swimming (Female), Aerobics, Badminton, Football and Netball.
e. Martial Arts
Silat Gayong, Karate-Do and Taekwando.

DKKX XXX1 CO-CURRICULUM II

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Understand a balanced and comprehensive education hence generating a more mature student.
LO2 Develop leadership aspects stressing on disciplines and cooperation within a group or organisaton.
LO3 Build personality and character guided by rules of conduct.
LO4 Foster cooperation and unity in multi-racial society.

SYNOPSIS

a. Culture
Choir, *Gamelan, Cak Lempung, Nasyid, Khat*,

Acting, Art, Debate *(Bahasa Malaysia)*, Debate, Interior Design and *Kompang*.

b. Entrepreneurship
Video, Film & Photography, Journalism and Publication, e-computer and Technopreneurship.

c. Community
Fiqh Muamalat, Fiqh Amali, Translation of Al-Quran & Recitation of Yaasin and Peer Group Programmes (PRS) & *Sahabat Khidmat*.

d. Recreation
Go-Kart, Adventure dan Cycling

e. Sports
Swimming (Male), Volleyball, Golf, *Kayak*, *Sepak Takraw*, Swimming (Female), Aerobics, Badminton, Football and Netball.

f. Martial Arts
Silat Gayong, Karate-Do and *Taekwando*

DLHW 2422 ENGLISH FOR EFFECTIVE COMMUNICATION

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Perform oral skills through impromptu speech.

LO2 Give descriptions of a product through informative speech.

LO3 Describe processes from manual instructions in an oral presentation.

LO4 Demonstrate oral social skills (role-play) based on a situational context.

SYNOPSIS

This course is designed to provide students with the necessary communication skills to communicate effectively. The skills covered are speaking, reading and writing. The elements of grammar are taught to complement the topics covered in this course. The documents covered are product descriptions and manual instructions. Students demonstrate interpersonal skills through speeches and role-play. The elements of problem-based learning (PBL) are especially exercised during the oral presentation of the product and manual descriptions as well as role-play.

REFERENCES

a. Azar, B. S., 2010, *Understanding and using English grammar*, New York: Longman.

b. Dobrin, S.I., Keller, C.J., & Weisser, C.R., 2008, *Technical communication in the twenty-first century*, New Jersey: Pearson Prentice Hall.

c. Gerson, S.J., & Gerson, S.M., 2010, *Workplace writing: Planning, packaging and perfecting communication*, US: Prentice Hall.

d. Osman, H., et al., 2011, *Effective communication skills*, Shah Alam: UPENA.

e. Lannon, J.M., & Gurak, L.J., 2011, Technical Communication, US: Longman.

f. Mohd Nor, N., Mansor, S., & Atin, J., 2010, Technical English Skills, Malaysia: August Publishing Sdn. Bhd.

YEAR 1 COURSES - PROGRAMME CORE

DMCU 1012 EXPERIMENTAL METHOD

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Describe clearly basic mechanical quantity, measurement techniques, procedures and devices.

LO2 Apply the mechanical measurement knowledge through the problem given.

LO3 Analyze collected experimental data, thus recognizing the important point of the data through discussion.

LO4 Communicate in writing and produce proper laboratory report that meets the requirement format.

SYNOPSIS

Introduction to the experiment and measurement concept. Experimental data properties and graphical presentation of the data. Dealing with hysteresis and uncertainty. This course also covers experiment data processing which consists of using statistical method for irregular data, regression line, and using spreadsheet in data analysis. Introduction to the basic knowledge about measurement devices.

REFERENCES

a. Beckwith, T.G., Marangoni, R.D., & Lienhard, V.J.H., 2007, *Mechanical Measurement*, 6th Edition, Prentice Hall.

b. Holman, J.P., 2001, *Experimental Methods for Engineers*, 7th Edition, McGraw Hill.

c. Bolton, W., 1996, *Experimental Method*, Newness, Butterworth-Heinemann.

d. Doeblin, O.E., 1995, *Engineering Experimentation: Planning, Executing and Reporting*, McGraw Hill.

e. Kirkup, L., 1994, *Experimental Methods: An Introduction to the Analysis and Presentation of Data*, John Wiley and Sons.

DMCU 1233 CHEMISTRY

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Describe (C1) and Explain (C2) fundamental of chemistry principle.

LO2 Solve (C3) and Analyze (C4) various engineering problems using relevant chemistry principles.

LO3 Demonstrate (P1 – P4) chemistry principles through laboratory experiment.

SYNOPSIS

This course will discuss about the concepts in Chemistry: The Study of Change; Atoms, Molecules and Ions; Chemical Reaction; Structure of Atoms; The Periodic Table; Chemical Bonding; Properties of Matter; and Thermochemistry.

REFERENCES

a. Chang, R., 2013, *Chemistry*, 12th Ed., McGraw Hill, USA.

b. N. J. Tro (2009). "*Introductory Chemistry*". 3rd Ed. Pearson Education International.

c. Petrucci, R.H., & Hill, J.W., 2002, *General Chemistry: An Integrated Approach*, Prentice Hall, USA.

d. Halimaton H., et al., 2001, *Kimia Asas Sains dan Kejuruteraan*, Johor Bahru.

DACS 1263 FUNDAMENTAL PHYSICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Define the basic laws and comprehend the basic concepts in physics.

LO2 Apply the laws and the concepts systemtically in problem solving.

LO3 Relate between the various topics covered and their application in the field of engineering.

LO4 Make accurate measurement and present result in a proper scientific report.

SYNOPSIS

The topics cover in this course are: forces, acceleration and Newton's second law of motion, motion with a changing velocity, circular motion, conservation of energy, linear momentum, fluids, heats, temperature, electric forces and fields, capacitor, electric current and circuits, reflection and refraction of light.

REFERENCES

a. Giambatista A., Richardson, B.M., & Richardson, R.C., 2007, College Physics, 2nd Edition, Mc-Graw Hill.

b. Walker, J.S., 2007, Physics, 3rd Edition Addison Wesley.

c. Cutnell, J.D., & Johnson, K.W., Physics, 7th Edition, Wiley, 2006.

d. Bueche, F. J., & Hecht, E., 2005, Sachaum's Outline of College Physics, 10th Edition, Mc-Grw Hill.

DEKG 2113 ELECTRICAL & ELECTRONIC PRINCIPLES

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Understand the fundamental concepts of electricity (DC and AC).

LO2 Understand the uses of electrical and electronics circuits.

LO3 Familiarize with integrated and digital circuits.

SYNOPSIS

This module provides knowledge relating to electrical units and parameters, direct and alternating current sources, Ohm's Law, passives components like resistor and capacitors in parallel and series connections, sine wave characteristic, transformers, actives components (integrated circuit) like diode, transistor, operational amplifier, digital circuits and their application.

REFERENCES

a. Hughes, E., 2002, Electric and Electronic Technology, Prentice Hall.

b. Robbins, H., and Miller, W.C., 2004, Circuits Analysis: Theory and Practice, 3rd Edition, Thomson Delmar Learning.

c. Boylstead R., Nashelsky L., 2002, Electronics Devices and Circuit Theory, 8th Edition, Prentice Hall.

d. Codgell, J.R., 1999, Foundation of Electrical Engineering, 2nd Edition, Prentice Hall.

e. Irwin, J.D., Kerns, JR., D.V., 1995, Introduction to Electrical Engineering, Prentice Hall.

DMCU 1912 TECHNOLOGY AND ENGINEERING WORKSHOP PRACTICE I

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Identify common shop hazards and common workshop safety equipments.

LO2 Demonstrate the proper and correct tools and safety equipments usage for a given job.

LO3 Produce products during welding, fabrication and fitting projects.

LO4 Prepare reports on all projects.

SYNOPSIS

a. Welding

This course is designed to provide students with a fundamental understanding of gas welding, arc welding (SMAW) and MIG welding (GMAW), welding safety, welding machines (gas, arc, MIG), electrode classifications and electrode selection. Training to develop the basic welding skills in basic joint configurations such as butt joint and tee joint.

b. Fabrication

Covers layout, cutting, forming and joining of basic sheet metal and use of hand tools and equipment to develop and fabricate basic sheet metal project based on drawing of the project.

c. Fitting

This course is designed to give students a good appreciation on the various types of hand tools commonly used for measurement, marking out, and metal removal. This course also let the students understand the uses of common hand tools and appreciate the important of fitting work in the finishing product. Through the hands-on practice given, the students will acquire some of the basic skills and technique involved with these hand processes.

REFERENCES

a. Mike, T., 2004, *Basic Manufacturing*, 3rd Edition Butterworth-Heinemann.

b. Kibbe, R.R., Meyer, R.O., White, W.T., and Neely, J.E., 2009, *Machine Tool Practices*, 9th Edition, Prentice Hall.

c. Kalpakjian, S., 2009, *Manufacturing Engineering and Technology*, 6th Edition, Prentice Hall.

d. Amstead, B.H., 1977, *Manufacturing Processes*, John Woley & Son.

e. Black, B.J., 2010, *Workshop Processes, Practice and Materials* (4th Edition), Newnes.

DMCS 1313 STATICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Identify vector signs to represent the vector quantities of a force and moment in 2-D and 3-D, and determine the magnitude and direction of resultant forces in 2-D and 3-D.

LO2 Construct Free Body-Diagram in order to solve engineering mechanics of statics problems correctly.

LO3 Apply the principle of equilibrium in order to calculate forces acting on particles and rigid bodies, in structures, frames and machines problems.

LO4 Apply the concept of dry friction in machines.

LO5 Determine the center of gravity/mass and centroid of a body, volume, area and line.

SYNOPSIS

The introduction and the basic concept of statics as physical sciences, System of Units, Scalars and Vectors, Free body diagram, Forces system, Force system resultants and Moment, Equilibrium of a particle, Equilibrium of a rigid body, Structural analysis (trusses analysis and simple frames and machines), Friction and Center of gravity and Centroid.

REFERENCES

a. Hibbeler, R.C., 2004, Engineering Mechanics – Statics, 3th Ed. Prentice Hall.
b. Beer, F.P., and Johnston, E.R., 2000, Vector Mechanic for Engineer, McGraw-Hill.
c. Meriam, J.L., & Kraige, L.G., 1987, Engineering Mechanics – Static, John Wiley & Sons.
d. Schmict and Boresi, 2000, Engineering Mechanics- Statics, Thomson Learning.
e. Pitel and Kiu, 1999, Engineering Mechanics- Static, Thomson Learning.

DMCU 1323 MANUFACTURING PROCESS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Recognize and explain very well on the issues and aspects of manufacturing.
LO2 Identify and select the most suitable manufacturing processes in producing a particular product without ignoring the safety, economic and environment aspects.
LO3 Identify and select the most suitable material for a particular manufacturing process.
LO4 Identify and select the most suitable machines for a particular manufacturing process.

SYNOPSIS

This course covers manufacturing and the aspects of manufacturing, joining processes and equipments, metal casting processes and equipments, metal and plastic forming processes and equipments, material removal processes and machines, and modern machining processes.

REFERENCES

a. Groover, M.P., 2012, Introduction to Manufacturing Process, John Wiley & Sons Inc.
b. Groover, M.P., 2010, Fundamentals of Modern Manufacturing, John Wiley & Sons Inc.
c. Kalpakjian, S., and Schmid, S. R., 2009, Manufacturing Processes for Engineering Materials, Prentice Hall International.
d. Schey, J.A., 2008, Introduction to Manufacturing Processes, McGraw Hill.

DMCD 1543 ENGINEERING GRAPHICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Use standard drafting tools to draw engineering drawing.
LO2 Produce geometric, orthographic, isometric, section cut and detail drawing using manual technique or CAD.
LO3 Use CAD software in order to produce 2D drawing and 3D solid modelling.
LO4 Produce accurate engineering drawing base on project given.

SYNOPSIS

In the first part of this course; geometric, orthographic, dimensioning, isometric, sectional view and assembly drawing will be explains using manual drafting technique. In the second part, CAD

software will be used in order to generate those drawing. Additional 3D solid modeling also will be introduced in this course.

REFERENCES

a. Goetsch, D.L., Nelson, J.A. and Chalk, W.S., 2000, Technical Drawing, 4th Ed., Delmar.
b. Jenson, C., Helsel, J.D., and Short, D.R., 2008, Engineering Drawing and Design, McGraw Hill.
c. Zainal, M.R., Ghani, B.A., and Samian, Y., 2000, Lukisan Kejuruteraan Asas, Penerbit UTM.
d. Alkahari, M.R., 2009, Modul Lukisan Berbantu Komputer, Penerbit UTeM.

DMCU 2922 TECHNOLOGY AND ENGINEERING WORKSHOP PRACTICE II

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Define, understand and apply fundamentals of machining process on conventional and CNC machining.
LO2 Apply the knowledge of cutting and machine parameters in machinng activities.
LO3 Understand and creating programming cycle for CNC machine.
LO4 Respond to the project procedures given in the workshop and report in the appropriate scientific manner as a team.

SYNOPSIS

a. Conventional Machine

Introduction to fundamentals of machining process on conventional (Lathe and Milling) machines and its application, such as in handling aspect, safety factor, main function and machining/manufacturing process includes in conventional lathe and milling machining.

b. CNC Machine

Covers fundamentals of machining process on advance machine as CNC lathe machine, CNC milling machine, EDM machine and wire cut machine and its applications such as in handling aspect, safety factor, main function and machining/manufacturing process with high accuracy and complex method.

REFERENCES

a. Kibbe, Neely, Meyer and White, 2009, Machine Tool Practices, 9th Edition, Prentice Hall, New York.
b. Fakulti Kejuruteraan Mekanikal, Modul Latihan Praktikal dalam Kampus, Universiti Teknologi Malaysia.
c. Rajput, R.K., 2008, A Textbook of Manufacturing Technology, Firewall Media.

DMCU 2423 MATERIALS SCIENCE

LEARNING OUTCOMES

At the end of this course, students should be able to: -

LO1 Describe the classifications, structures and applications of metals, ceramics and polymers correctly.
LO2 Analyze deformations behavior and strengthening mechanisms relying to its structure and properties of materials clearly.
LO3 Apply Fick's Law in calculating the diffusion process and its mechanism in solids properly.
LO4 Demonstrate appropriate test methods in determining mechanical properties.

LO5 Apply the relation between composition, microstructure and properties of metallic materials by using apposite phase diagram and heat treatment process.

SYNOPSIS

Introduction to fundamentals of Materials Science and its applications, atomic structure, crystal structure, solidification, imperfections and solid diffusion, mechanical and physical properties, phase diagrams and transformation, types and applications of materials.

REFERENCES

a. Calister, W.D., 2008, *Materials Science and Engineering: An Introduction*, 6th Edition, John Wiley & Sons.
b. Smith, W.F., 2004, *Foundation of Materials Science and Engineering*, 4th Edition, McGraw Hill.
c. Shackelford, J.F., 2000, *Introduction to Materials Science for Engineers*, 5th Edition, Prentice Hall.
d. Askeland, D.R., 1994, *The Science and Engineering of Materials*, 3rd Edition, PWS Publication Co.
e. Budinski, K.G. and Budinski M.G., 1999, *Engineering Materials: Properties and Selection*, 6th Edition, Butterworth-Heinemann UK.

YEAR 1 COURSES - MATHEMATICS, STATISTICS AND COMPUTING

DMCU 2052 ENGINEERING MATHEMATICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe the concepts of multivariable functions, multiple integrals and vector-valued function.

LO2 Solve the differentiation and integration problems using the knowledge of multivariable functions, multiple integrals and vector-valued function.

LO3 Apply the knowledge of engineering mathematics in particular engineering problems.

SYNOPSIS

This subject consists of three chapters: Multivariable Functions, Multiple Integrals and Vector-Valued Functions. The syllabus is developed by introducing the concepts of the functions with several variables, double and triple integrations and also vector-valued function, followed by learning various techniques in solving the problems and its application in physical and engineering fields.

REFERENCES

a. Muzalna Mohd Jusoh, Irma Wani Jamaludin, Rahifa Ranom, & Norazlina Abd Razak.(2012). *Engineering Mathematics*. Pearson.
b. Abd Wahid Md Raji, Ismail Kamis, Mohd Nor Mohamad, & Ong Chee Tiong. (2016). *Advanced Calculus for Science and Engineering Students*, UTHM & UTM.
c. James, G., *Modern Engineering Mathematics*, 5th edition, Pearson, 2015.

d. Larson, R., & Edwards, B., *Calculus*, 10th edition, Cengage Learning, 2014.

DMCU 1042 CALCULUS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Define limits and continuity of functions using computational methods of limits.

LO2 Select differentiation and integration techniques to solve the mathematical problems.

LO3 Apply differentiation and integration techniques in solving advance mathematics, and engineering problems.

SYNOPSIS

This course will discuss about the concepts of Limits & Continuity; The Derivatives; Applications of Differentiation; Integration; and Applications of Integration.

REFERENCES

a. Abd. Wahid Md. Raji, Hamisan Rahmat, Ismail Kamis, Mohd. Nor Mohamad & Ong, C.T. (2008). *Calculus for Science and Engineering Students*. Johor: Penerbit Universiti Tun Hussien Onn Malysia.

b. Anton H. (1995). *Calculus*. Fifth Edition. New York: John Wiley and Sons, Inc.

c. Finney R.L., Weir M.D. & Giordano F.R.(2003). Thomas's *Calculus*. Tenth Edition. Pearson Education, Inc.

d. Thomas et al. (2014). Thomas's *Calculus Early Transcendental*. Twelfth Edition. Pearson Education, Inc.

DMCU 1032 FUNDAMENTAL MATHEMATICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Explain fundamental knowledge of mathematics that is used in engineering field.

LO2 Solve simple engineering problem by providing a suitable formulation.

LO3 Apply knowledge acquired in advanced mathematic courses: e.g. Calculus, Engineering Mathematics and Differential Equation.

SYNOPSIS

This course discuss about Real Number System; Complex Numbers; Matrices; Geometric Coordinates; Functions and Graph;Trigonometry; and Polynomials.

REFERENCES

a. Zuraini Othman & Sharifah Sakinah Syed Ahmad. (2008). Module of Fundamental Mathematics, UTeM.

b. Barnett, R.A., Ziegler, M.R. & Byleen, K.E. (2008). Precalculus. Sixth edition. McGraw-Hill.

c. Faires, J.D. & Defranza, J. (2012). Precalculus. Fifth edition. Brooks/Cole, Cangage Learning.

d. Davis, M.E. & Edward, C.H. (2007). Elementary Mathematical Modeling: Functions and Graphs. Second edition. Pearson Prentice Hall.

DITG 1113 COMPUTER PROGRAMMING

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Explain and describe the language elements in C++ programming language.

LO2 Solve programming problems and discover alternative solution by developing the algorithm.
LO3 Modify and reproduce a simple program using programming structures such as conditionals, loops and functions.

SYNOPSIS
This course discusses about the basic principles of computers, software development methodology and basic programming principles such as syntax, semantic, compiling, and linking. Programming techniques using C++ such as data type and operator, selection, repetition, function, array, file, structure and pointer are learnt towards the end of this course.

REFERENCES
a. Gaddis, T., 2011, Starting Out with C++ Brief Version: From Control Structures Through Objects, 7th. Edition, Pearson Education.
b. Ibrahim, Y., et. al, 2009, Module 1 Problem Solving using C++: A Practical Approach, FTMK, UTeM
c. Friedman, Koffman, 2010, Problem Solving, Abstraction, and Design Using C++, 6th Edition, Pearson.
d. Savitch, Walter, 2006, Absolute C++, Addison Wesley.
e. Deitel, H.M., Deitel, P.J., 2005, C++ How To Program, Prentice Hall.
f. Forouzan, A., Behrouz, 2000, A Structured Programming Approach Using C++, Brooks/ Cole Thomson Learning.

YEAR 2 COURSES - UNIVERSITY COMPULSORY

DLHW 3432 ENGLISH FOR MARKETABILITY

LEARNING OUTCOMES
At the end of the course, students should be able to:
LO1 Produce a reflective writing (A2), resume, job application letter/ online job application letter and short report.
LO2 Response appropriately to questions during mock interview session.
LO3 Analyse possible solutions based on the given problem in a group discussion.
LO4 Use appropriate types of communication using a variety of sentences based on the workplace contexts.

SYNOPSIS
This course aims to introduce and expose students to the basic tenets of communication specifically the oral and written communication required at the workplace. Students will be provided with the opportunity to produce a reflective writing, resume, job-application letter, e-message and report. They will also be able to participate in an interview, and to discuss and explain information in group discussions. Students will be exposed to situations where they learn to function as individuals and team members by communicating in spoken and written forms using appropriate language in a variety of workplace contexts.

REFERENCES

a. Dobrin, S.I., Keller, C.J., & Weisser, C.R., 2008, Technical communication in the twenty-first century, NJ: Pearson Prentice Hall.
b. Fisher, R., Larkin, S., & Jones, S., 2010, Using talk to support writing, UK: Sage Publication Limited.
c. Gail, F., & Lockwood, J., 2010, Globalization, communication and the workplace: talking across the world, UK: Continuum International Publishing.
d. Gerson, S.J., & Gerson, S.M., 2010, Workplace writing, New Jersey: Prentice Hall.
e. Osman, H., et al., 2011, Effective communication skills, Shah Alam: UPENA.
f. Samsiah, A.H., Rosyati, A.R., 2012, Mastering English for employment, Cengage Learning Asia.
g. Rizvi, M.A., 2008, Resumes and interviews: The art of winning Interview, New Delhi: Tata McGraw Hill.
h. Timm, P.R., & Bienvenu, S., 2010, Straight talk: written communication for career, UK: Routledge.
i. White, P., 2012, The 5 languages of appreciation in the workplace: empowering organizations by encouraging people, UK: Northfield Publishing.

YEAR 2 COURSES - PROGRAMME CORE

DMCT 2133 THERMODYNAMICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Define basic terms of thermodynamics and identify systems, properties and processes.
LO2 Use property tables and draw property diagrams of pure substances to define the state of the system.
LO3 Apply the concept of First Law of Thermodynamics in Closed Systems and Control Volumes.
LO4 Use the concept of Second Law of Thermodynamics to determine the performance of heat engines, refrigerators and heat pumps.
LO5 Determine the entropy change of the pure substance based on related principles.

SYNOPSIS

This course covers the basic concepts and definitions of engineering thermodynamics, energy, work and heat, properties of pure substances (relationships of P-V, T-V, P-T and T-s diagrams), First Law of Thermodynamics, Second Law of Thermodynamics and Entropy.

REFERENCES

a. Cengel, Y.A. and Boles, M.A., 2011, Thermodynamics: An Engineering Approach, 7th ed, McGraw Hill. Singapore.
b. Gupta, S.C., 2008, Thermodynamics, 1st ed, Pearson Education (Singapore) Pte. Ltd
c. Sonntag, R.E., Borgnakke, C., Van, W., and Gordon, J., 2008, Fundamentals of Thermodynamics, 7th ed, John Wiley & Sons, Inc. New York.

DMCS 2333 SOLID MECHANICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Use concept of stress-strain relationship and factor of safety appropriately in engineering design.

LO2 Sketch normal force, shear force and bending moment diagrams in determining stresses and displacement appropriately.

LO3 Determine stresses within structure courseed to torsion correctly.

LO4 Analyse the slope and displacement of a continuous beam due to static loading using singularity function correctly.

SYNOPSIS

This course introduces to the various types of structures and type of supports. Understand the concepts of stress, strain, shear force and bending moment. It also covers the theory of torsion, shear flow with combination of loads, including the deflection of beams.

REFERENCES

a. Beer, F.P., et al., 2006, *Mechanics of Materials* 4th Edition in SI Units, McGraw-Hill.
b. Hibbeler, R.C., 2004, *Mechanics of Materials SI Edition*, Prentice Hall.
c. Gere, J.M., 2004, *Mechanics of Materials,* Thomson.
d. Vable, M., 2002, *Mechanics of Materials*, Oxford University Press.

DMCM 2713 DYNAMICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 To apply the concept of position, velocity and acceleration in determine the motion of particle and rigid body.

LO2 Apply equation of motion in solving the particle and rigid body motion.

LO3 Solve the problem involving rectilinear and curvilinear motion.

LO4 Analyze dynamics problem using principle of work and energy.

LO5 Analyze reaction of forces and acceleration for a translating and rotating rigid body using Newton's law of motion.

SYNOPSIS

This course introduce to the principle of dynamics based on kinematics and kinetic. Understand the concept of position, velocity and acceleration, application of Newton second law, principle of work and energy, principle of impulse and momentum for particle and rigid body.

REFERENCES

a. Beer, F.P., 2010, *Vector Mechanics for Engineers, Dynamics SI Units*, 9th Edition, McGraw-Hill.
b. Hibbeler, R.C., 2010, *Engineering Mechanics, Dynamics*, 12 Editions, Prentice Hall.
c. Bedford, A., and Fowler, W., 2008, *Engineering Mechanics, Dynamics,* 5th Edition, Prentice Hall.

DMCF 2223 FLUID MECHANICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Use fluid and its properties equation in the context of fluid mechanics application.

LO2 Apply fluid mechanics equations in solving fluid statics and dynamics problems.

LO3 Respond to the procedure that has been given in laboratory as a team.

LO4 Interpret the experimental data accordingly and to report the results in the appropriate scientific manner.

SYNOPSIS

This course introduces the basic properties of fluids. It covers the definition to the pressure, heads, the derivation of hydrostatic equation and its application in pressure measurement, static forces analysis on immersed surface and also buoyancy analysis. The course also introduces fluid dynamics, fluid flow analysis, derivation of flow equations, the application of the energy equation, Bernouli equation in the calculation of flow velocity, discharge, heat lost in piping systems, dimensional analysis and also its application.

REFERENCES

a. Munson, B.R., Young, D.F. and Okiishi, T.H., 2006, *Fundamentals of Fluid Mechanics*, 5th Ed., John Wiley & Sons, Inc, Asia.

b. Som, S.K., and Biswas, G., 2004, *Introduction to Fluid Mechanics and Fluid Machines*, 2nd Ed., Tata McGraw-Hill, New Delhi.

c. Douglas, J.F., Gasiorek J.M. and Swaffield, J.A., 2001, *Fluid Mechanics*, 4th Ed., Prentice Hall, Spain.

d. Cengel, Y.A. and Cimbala, J.M., 2006, *Fluid Mechanics: Fundamentals and Applications*, International Edition, McGraw-Hill, Singapore.

e. Streeter, V.L. and Wylie, E.B., 1983, *Fluid Mechanics*, First SI Metric Ed., McGraw-Hill, Singapore.

DENG 2223 FUNDAMENTAL ELECTRIC AND MICROPROCESSOR

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe and identify the application of digital circuits in microprocessor.

LO2 Classify the numbering systems such as binary, decimal and hexadecimal.

LO3 Describe the concept and differentiate the basic electronic component.

LO4 Perform experiments and present technical report.

LO5 Demonstrate effectively throughout an individual assignment.

SYNOPSIS

This course will be divided into two sections; basic electronics and microprocessor technology. The first section covers the topic on concept and function of electronic components in a computer system (resistor, capacitor, inductor, transformers, fuse, cable, diode, and transistor). The next section will deal with topics such as system numbers, logic gates, Boolean operation, combination logic (type of flip flop), register and digital circuit application in microprocessor.

REFERENCES

a. Gates, E.D., 2007, *Introduction to Electronic*, 5th Edition, Delmar Thomson Learning.

b. Schuler, C.A., 1999, *Electronics, Principles and Application*, 5th Edition, Mc-Graw-Hill.

c. Crisp, J., 2000, *Introduction to Digital Systems*, Newness.

d. Tocci, R.J., *Digital System, Principles and Application*, 4th Edition, Prentice Hall.

e. Green, D.C., *Digital Electronics*, 5th Edition, Addison Wesley Longman.

DMCM 3723 MECHANIC OF MACHINES

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Demonstrate kinematics principle to solve flat and V-belt problems.

LO2 Apply the concept of gear transmission system in the real world applications.

LO3 Solve related problems in balancing system of rotating body using graphical or trigonometric method.

LO4 Demonstrate the usage of free body diagram to solve problems in flywheel and governor and explain its functionality.

LO5 Analyze the effect of gyroscopic couple to the real world applications.

LO6 Evaluate the natural frequency in free vibration system using either Energy Conservation Method, Equivalent Method or Newton's Law Method.

SYNOPSIS

This course will cover the power transmission system (belt drive, gears application, gear efficiency), Dynamic system balancing (rotor balancing such as planar and multi planar and reciprocating balancing such as in-line engine, radial and V-engine), Governors (Flywheel and Porter governor), Gyroscope, Free vibration (pendulum system, spring-mass system and shaft-inertia system by using energy conservation method, equivalent method and Newton's Law method), Free vibration with viscous damping (basic principle).

REFERENCES

a. Sawhney, G.S., 2009, *Fundamentals of Mechanical Engineering: Thermodynamics, Mechanics, Theory of Machines and Strength of Materials*, New Delhi: PHI Learning.

b. Cleghorn, W.L., 2009, *Mechanics of Machines,* New York: Oxford University Press.

c. Ramamurti, V., 2010, *Mechanics of Machines*, Manohar Puslisher & Distributor.

d. Gupta, B.V.R., 2011, *Theory of Machines: Kinematics and Dynamics,* I. K. International Publishing House Pvt. Ltd.

e. Balakannan, K., 2011, *Mechanics of Machines*, Lambert Academic Publishing.

DMCD 3523 ENGINEERING DESIGN

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Recognize terminology used in machine components and its design.

LO2 Explain the type of failures of machine components design.

LO3 Apply the formulation of the safe design for machine components.

LO4 Design the most suitable size and shape of machine components.

LO5 Analyze and design machine components under different loads and conditions.

SYNOPSIS

This course covers Introduction to Engineering Design, Design of Static and Fatigue Strength, Design of Threaded and Welded Joints, Bearings, Shafts/rods, Gears and Springs. Student will learn to design a simple machine applying foundation of mechanical engineering concept. A part from that,

a topic on sustainability of design is introduced for eco-friendly design.

REFERENCES

a. Budynas, R.G., Nisbett, K., 2011, *Shigley's Mechanical Engineering Design*, Nineth Edition in SI Units, McGraw-Hill, Singapore.
b. Mott, R.L., 2013, *Machine Elements in Mechanical Design in SI Units*, Fifth Edition, Pearson Education, Singapore.
c. Norton, R.L., 2010, *Machine Design: An Integrated Approach*, Fourth Edition, Prentice Hall, Singapore.
d. Juvinall, R.C. & Marshek, K.M, 2011, *Fundamentals of Machine Component Design*, Fourth Edition, John Wiley & Sons, Inc., New York.

DMCD 2512 OCCUPATIONAL SAFETY AND HEALTH (OSH)

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Identify the different requirements and regulations of safety legislation and codes of practice
LO2 Identify the various safety, health, and environment hazards that affect human being.
LO3 Apply various requirements on safety and health principles on the working environment that is related to mechanical engineering

SYNOPSIS

The basic principles of occupational safety and health is discussed in this course. The subject of occupational safety and health (OSH) is significant to the engineering field owing to the rapid technological changes, which have introduced new hazards in the workplace.

REFERENCES

a. Goetsch, D. L. (2015). Occupational Safety and Health for Technologists, Engineers, and Managers, 8th Edition, Upper Saddle River, NJ: Prentice Hall.
b. Goetsch, D. L. (2010). The Basics of Occupational Safety, NJ: Prentice Hall.
c. Reese, C. D. (2003). Occupational Health and Safety Management, A Practical Approach. Lewis Publishers, A CRC Press Company.
d. Undang-undang Malaysia, (2005). Akta Keselamatan dan Kesihatan Pekerjaan 1994 dan peraturan-peraturan, MDC Publishers Sdn. Bhd.

DMCF 2233 HYDRAULIC AND PNEUMATICS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe fundamental principles that govern the behavior of systems
LO2 Explain the common hydraulic and pneumatic components, their use, symbols and their application in the industry
LO3 Analyze hydraulic and pneumatic circuit
LO4 Design hydraulic and pneumatic system manually and using related computer software

SYNOPSIS

This course covers the introduction of the hydraulic and pneumatic systems, types of pump, compressor and their working principles, types of valve, actuator, and their usage, performance of the

system, others fluid power system ancillaries and sensors, fluid power circuit design and analysis with manual control and electrical control. Computer software is used to design and simulate the system circuit. The electro-mechanical is also embedded in circuit design and the application of fluid power in robotic and mobile hydraulics.

REFERENCES

a. Ilango S. 2007. Introduction to Hydraulics and Pneumatics. Prentice Hall-India. New Delhi.
b. Esposito A. 2003. Fluid Power with Applications. 6th Ed. Prentice Hall. New Jersey.
c. Johnson, J.L. 2002. Introduction to Fluid Power. Delmar. New York.
d. Majumdar SR. 2002. Oil Hydraulic System Principles and Maintenance. Tata-McGraw Hill. New York.
e. Hehn A.H. 2000. Fluid Power Handbook.Vol 1. Gulf Publishing Company. Texas.

DMCU 2982 DIPLOMA PROJECT I

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Apply basic science, mathematics and mechanical engineering knowledge.

LO2 Design and analysis which is utilise appropriate modern tools technology in some aspect of the work, emphasising the need for technicians.

LO3 Present the design analysis and results solution of well-defined engineering problem in written and oral presentation.

SYNOPSIS

The students need to solve a well-defined mechanical engineering problem by design a mechanical product, process or system. Students are required to plan and implement the project that related to mechanical engineering field in a form of group, but the assessment will be individually. It covers initial report writing for design and analysis. The students need to achieve the objective of the project and present it in the report and oral presentations.

REFERENCES

a. Karl T. Ulrich and Steven D. Eppinger. 2012. *Product Design and Development*. McGraw-Hill, Columbus OH.
b. Richard G. Budynas and J. Keith Nisbett, Shigley's *Mechanical Engineering Design (McGraw-Hill Series in Mechanical Engineering) 10th Edition*, January 27, 2014.
c. Bahar Martonosi. 2015. How to Give a Good Presentation. Princeton University.
d. Damith C. Rajapakse. 2015. *Chapter 14: Project Presentation*. National university of Singapore. [http://www.comp.nus.edu.sg/~damithch/guide3e/Ch14.html].
e. T. Chang. 2005. *Report Writing*. Monash University,Australia [http://www.monash.edu.au/lls/llonline/writing/engineering/technical-report/index.xml].

DMCU 2992 DIPLOMA PROJECT II

At the end of this course, students should be able to:

LO1 Carry out project management based on the principle of engineering.

LO2 Conduct the fabrications method to meet objectives of the project.

LO3 Conduct the functionality test of the fabricated product.

LO4 Present a full project report in written and oral forms.

SYNOPSIS

The student continues the project activities according to the design and analysis done in Project I DMCU 2982 in the previous semester. The Project II activities cover the fabrication of the design done and followed by presenting the product in a report. The students must also present and defend the functionality of the product in an oral presentation during the exhibition.

REFERENCES

a. Karl T. Ulrich and Steven D. Eppinger. 2012. *Product Design and Development*. McGraw-Hill, Columbus OH.
b. Richard G. Budynas and J. Keith Nisbett, Shigley's *Mechanical Engineering Design (McGraw-Hill Series in Mechanical Engineering) 10th Edition*, January 27, 2014.
c. Bahar Martonosi. 2015. How to Give a Good Presentation. Princeton University.
d. Damith C. Rajapakse. 2015. *Chapter 14: Project Presentation*. National university of Singapore. [http://www.comp.nus.edu.sg/~damithch/guide3e/Ch14.html].
e. T. Chang. 2005. *Report Writing*. Monash University,Australia [http://www.monash.edu.au/lls/llonline/writing/engineering/technical-report/index.xml].

YEAR 2 COURSES - MATHEMATICS, STATISTICS AND COMPUTING

DMCU 3082 STATISTICS

LEARNING OUTCOMES

At the end of the course, students should be able to:

LO1 Describe the basic concept of descriptive, probability and inferential statistics.
LO2 Identify an appropriate statistical technique to solve descriptive, probability and inferential statistics problems.
LO3 Apply the concept of descriptive, probability and inferential statistics in solving engineering problems

SYNOPSIS

This course covers Data description and Numerical Measures, Probability, Random Variables and Probability Distributions, Sampling Distributions, Estimation, Hypothesis Testing, Simple Linear Regression.

REFERENCES

a. Devore, J.L., 2008, *Probability and Statistics for Engineering and the Sciences*, 7th Edition, Thomson – Duxbury.
b. Montgomery, D.C., Runger, G.C., 2007, *Applied Statistics and Probability for Engineers*, 5rd Edition, John Wiley.
c. Hayter, Anthony, J., 2007, *Probability and Statistics for Engineers and Scientists*, 3rd Edition, Thomson Brooks.
d. Mann, P.S., 2005, *Introductory Statistics Using Technology*, 5th Edition, John Wiley.

DMCU 2062 DIFFERENTIAL EQUATIONS

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe the basic concept and solution of Differential Equations, Laplace transform and Fourier series.
LO2 Select an appropriate technique to solve problems involving differential equations.

LO3 Apply the concept of differential equation in solving engineering problems.

SYNOPSIS

This course provides basic concepts of Differential Equations and its techniques. The students are introduced to the first order differential equations and solve using analytical methods. Upon completion, the students are then introduced to the second order linear differential equations with constant coefficients and learn the methods of solving and its applications. The course is extended to the following chapters which include Laplace transform and Fourier series.

REFERENCES

a. Muzalna M. J., Irmawani J., Rahifa R. & Nurilyana A. A. (2018). Module 2: Differential Equations, Penerbit UTeM.
b. Abd Wahid M.R. & Mohd Nor M. (2016). Differential Equations For Engineering Students. UTHM & UTM, Johor.
c. Edwards C. H. & Penny D.E. (2014). Differential Equations and Boundary Value Problems, Sixth Edition. Pearson Education Inc.
d. Zill D.G. & Cullen M.R. (2005). Differential Equations with Boundary-Value Problems, Sixth Edition. Thomson Learning, Inc.

YEAR 3 COURSES - PROGRAMME CORE

DMCU 2968 INDUSTRIAL TRAINING

LEARNING OUTCOMES

At the end of this course, students should be able to:

LO1 Describe relevant process in company through report writing, interview and presentation session.

LO2 Apply theory and skills acquired in class, workshop and labs in actual industrial environment.

LO3 Solve the given technical problem during the industrial training.

LO4 Cooperate in a team and contribute to project outcome.

LO5 Adopt professional practice and ethics in work. Obey company rules and regulations.

LO6 Seek additional relevant information from various sources related to the problem independently to make improvement.

SYNOPSIS

All students are required to undergo industrial training as part of their curiculum to complete their three (3) years course for the Diploma of Mechanical Engineering. It is compulsory for all diploma program students to undergo the Industrial Training Programme. Duration of the training is 16 weeks and it will be taken place during semester 5.

REFERENCE

UTeM Guideline Handbook for Industrial Training.

5 ACADEMIC SYSTEM GUIDELINE

5.1 Study Period

The maximum study period in semester system for the normal entry students are 12 semesters for Bachelor of Mechanical Engineering and Bachelor of Automotive Engineering. For Diploma of Mechanical Engineering, the maximum study period in semester system for the normal entry students is 10 semesters.

Maximum study period in semester system for Bachelor and Diploma Programmes are shown in Table 5.1 and Table 5.2, respectively.

Table 5.1 Maximum study period for Bachelor Programme

Entry Method	Entry to year	Maximum Study Period in Semester System
Normal Entry	1	12
Direct Entry	2	10

Table 5.2 Maximum study period for Diploma Programme

Entry Method	Entry to year	Maximum Study Period in Semester System
Normal Entry	1	10

5.2 Credit for Study Progress

The status of a student's academic year is based on the total Credit Earned, KD (Kredit Dapat). The formula to determine the status of academic year is as follows:

$$KD \geq JKL - 6$$

where JKL = Total Number of Regular Credits (Jumlah Kredit Lazim) decided by the faculty.

Table 5.3 and **Table 5.4** shows the credit for study progress and the procedure to promote to the next academic year for Bachelor of Mechanical Engineering (BMCG) and Bachelor of Automotive Engineering programmes (BMCK), respectively

Table 5.3 Credit for Study Progress Details for Year Promotion
(Bachelor of Mechanical Engineering)

Academic Year	Semester	Credit Load	JKL	Total KD for Year Promotion
YEAR 1	Sem. 1	16	32	26 promote to YEAR 2
	Sem. 2	16		
YEAR 2	Sem. 3	17	65	59 promote to YEAR 3
	Sem. 4	16		
YEAR 3	Sem. 5	17	104	98 promote to YEAR 4
	Sem. 6	17		
	Short Sem	5		
YEAR 4	Sem. 7	16	135	End of Study
	Sem. 8	15		

Table 5.4 Credit for Study Progress Details for Year Promotion
(Bachelor of Automotive Engineering, BMCK)

Academic Year	Semester	Credit Load	JKL	Total KD for Year Promotion
YEAR 1	Sem. 1	17	33	27 promote to YEAR 2
	Sem. 2	16		
YEAR 2	Sem. 3	16	66	60 promote to YEAR 3
	Sem. 4	17		
YEAR 3	Sem. 5	16	103	97 promote to YEAR 4
	Sem. 6	16		
	Short Sem	5		
YEAR 4	Sem. 7	15	135	End of Study
	Sem. 8	17		

Table 5.5 shows the credit for study progress and the requirement to promote to the next academic year for Diploma of Mechanical Engineering.

Table 5.5 Credit for Study Progress Details for Year Promotion
(Diploma of Mechanical Engineering)

Academic Year	Semester	Credit	JKL	Total KD for Year Promotion
Year 1	Sem. 0	6	48	42 promote to year 2
	Sem. 1	18		
	Sem. 2	17		
	Short Sem	7		
Year 2	Sem. 3	18	83	77 promote to year 3
	Sem. 4	17		
Year 3	Sem. 5	8	91	End of study

5.3 Teaching and Learning

Teaching and learning (T&L) activities are conducted in Semester 1 and Semester 2 every year. The T&L activities are planned by Academic Management Division (BPA) on yearly basis and presented in the academic calendar. The academic calendar shows the detail of T&L activities including lectures, semester break, final examination and etc.

Teaching and learning are based on specific recognized techniques by which the knowledge is conveyed in an effective manner to the students. The programme will adopt a unique strategy for effective teaching and learning that includes the following aspects:

a. Computer-based teaching

This is based on teaching process through computer-based knowledge presentation and computer-based interactions for knowledge acquisition. The objective is to teach the students through the optimum usage of computer to help them acquire specific information on any topic of interest and develop understanding on specific knowledge in any particular course. Example of related course is Computer Programming.

b. Problem-based learning

Problem-based learning is an instructional approach that has been used successfully for over 30 years and continues to gain acceptance in multiple disciplines including mechanical engineering. It is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution

to a defined problem. This experience will help elucidate how actual engineering problems are solved. The example of course is Mechanical Design.

c. Project-based learning

Project Based Learning is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an engaging and complex engineering questions and problems. The example of course is Integrated Design Project (IDP).

d. Simulation

Simulation-based teaching is another teaching practiced by UTeM academic staff in conducting lectures, tutorials and laboratory sessions. This technique aims at supporting the tutorials and laboratory sessions by facilitating a better understanding on the course materials. It consolidates the learning process of the course. Simulation is more relevant to the physical modelling of the problems in certain domains such as those involving dangerous, intricate or expensive processes. Examples of courses using this technique are Computer Aided Design and Manufacturing, Mechanism Design and Vehicle System Modelling and Simulation.

e. Industrial application software

In addition to the normal educational software, specific industry application software, are also used for teaching and learning activities. Lecturers and tutors apply industry-based software packages in their respective courses to expose students to the use of industry-related tools. The industry-based and academic-based teaching and learning tools are combined for the purpose of enriching students' technical competencies in the courses studied. The examples of the related software are Solidworks, AutoCAD, ANSYS, ABAQUS and MATLAB & SIMULINK.

f. Industrial exposure

Industrial exposure is also given to students. Arrangement is made to enable students of the department to have visit to various relevant manufacturing and engineering companies. These educational visits give the opportunity to students to have some ideas of how engineering knowledge is applied in the industries. Apart of that, there are several technical talks organized by the faculty. The speakers that are invited have vast experience in the industry.

g. Projects

It is a learning technique based on conducting specific activities in order to find out the solution of a problem under consideration. This learning process may involve theoretical, experimental, simulation, industrial exposure, industrial application software and any other teaching and learning techniques practiced. Conducting a project is one of the ways to solve an outstanding problem. It is therefore one of the more effective teaching and learning techniques adopted by UTeM. Final Year Project (Projek

Sarjana Muda) and Diploma Project (Projek Diploma) are the best example of this method. Projects allows students to apply the basic engineering problem solving skills, which they have learned before.

h. Tutorials

Tutorials are carried out regularly to provide continuous exercise/practice to enhance students' understanding after lecture on each chapter had been completed. In addition to lectures and other activities, tutorial adds up to the required student learning time.

5.4 Assessment

The assessment on learning outcomes in semester system is performed continuously based on the students' works during the lecture weeks in a semester. Students are expected to be ready for any kind of assessment being held during the semester. The methods for assessment are through coursework and final semester examination. The final examination is comprehensive in the sense that it covers the entire syllabus learned in the semester. The coursework assessment is a continuous process carried out to evaluate student's performance throughout the semester. Coursework encompasses, among others, Problem Based Learning (PBL), quiz, mid semester examination, assignment, practical work, project, case studies, industrial visit etc.

5.4.1 Coursework

Coursework is assessed by not more than 40% for degree programme and 60% for diploma programme. Normally the coursework is categorized as:

a. Mid Semester Examination

Mid semester examination is conducted to find out what the students have learned during the first half of the semester. The format of examination may be in form of multiple choice questions, calculation or open-ended questions. The processes of conducting of the mid semester examination is similar to the final examination procedures. The marks allocated for this exam is 20% to 30% of the overall marks. Generally, the duration of the examination is from 1 hour to 1.5 hours. The tentative date of the examination will be announced in the teaching plan which is distributed during the first lecture.

b. Quizzes

Quizzes consist of short questions, objective questions, questions with "fill in the blanks" techniques or simple question/calculations which are designed to evaluate students' understanding during the lecture. Time allocated is approximately 15 minutes.

c. Projects

Project or assignment is an efficient way to strengthen the understanding of students for a particular

course. It also provides research skill to the students. Project involves activities, such as literature survey, methodology and some design stages. The project generally requires the students to apply the theory in the real engineering field. At the end of the project, students must submit a project report and present the project.

d. Assignments / Lab Report

Assignments or Lab Report are for training individual students for using references and research works and able to present their works in an academic report form. It is also formulated for training the students in solving problems related to the topic given and hence updating students' lecture notes. Coursework could be given to the students in several forms:

i. Design, essay forms or report on specific topic;
ii. Research works through references, computer software and programming for problem solving.
iii. Technical report i.e. formal report for experiment/practical works.

The laboratory works are either in the form of prescriptive work (diploma) or open-ended (bachelor).

Other kinds of assessments on coursework can also be considered upon faculty approval.

5.4.2 Final Examination

The Final Examination is held for two weeks at the end of the semester. It is the final evaluation on courses as set by the Faculty. For bachelor degree programme, the weightage of the Final Examination shall be no less than 60%. On the other hand for the diploma programme, the Final Examination shall be no less than 40%. The duration of the Final Examination depends on the credit hours of the course.

5.4.2.1 Conditions for Final Examination

Students are expected to attend all lectures being held in the semester. The student whose attendance is less than 80% from the total lecture hours of any course may be barred from sitting for the final examination. This regulation can be referred to the Guidelines for the Academic Regulation System, UTeM.

5.4.2.2 Special Examination

Students are allowed to request for a Special Examination of a course subject to approval of the Senate. The Academic Management Division will send an official letter to the faculty to offer and run the special examination to the affected students. The special examination for Semester I shall be no later than 2 weeks after Semester II begins. For the semester II, the special examination should be held no later than 3 weeks after the Semester II examination's result is released.

Special examination is carried out during the semester break for the student with medical reason and for the final semester student based on the following cases:

a. Medical Reason
   i. Student who is unable to sit for the Final Examination after being issued a Medical Certificate by the University Medical Officer or a Government Hospital/ Clinic, must submit the Medical Certificate to the Faculty within 24 hours after the start of the Final Examination of a course, unless there is a reason acceptable to the University. If the Medical Certificate is from a Private Hospital/ Clinic, it has to be verified by the University Medical Officer or a Government Hospital/ Clinic.
   ii. The student's result states Incomplete (TS) until the results of the Special Examination is announced.
   iii. Special Examination results will be counted in the calculation of the Credit Earned and Credit Counted in determining the GPA, CGPA and Academic Standing.
b. Cases of the Final Semester Student
   i. Final semester student who has passed with Good Academic Standing (KB) but has failed one repeated course with the condition that the student has repeated the same course everytime it was offered.
   ii. The Special Examination results shall be stated in the examination result's transcript as "Special Examination Passed (LPK)" with HL grade for those who passed or "Special Examination Failed (GPK)" with HG grade for those who failed the course. If the student passes, the course credit will be counted as Credit Earned but not counted in the calculation of the GPA and CGPA. The original coursework marks shall not be considered.
   iii. If the student fails, the candidate will have to repeat the course in the next semester when offered and the student will have to register as full-time student as long as he/she has not utilized the maximum duration of study.
   iv. The Faculty has the authority to register the student as Special Student. It is not compulsory for the student to attend any teaching and learning activities. The assessment will be based on previous semester's coursework marks and final examination marks of the current semester.
   v. Special examination is not applicable for course that is assessed by 100% coursework.

5.5 Grading System

Student's performance in a course is evaluated based on the grade obtained. Grading system is shown in **Table 5.6**. Generally, minimum passing grade for a course is Grade D. However Grade D up to C- are categorised as Conditional Pass and the students are allowed to improve their grade by repeating the course only once.

Table 5.6 Grading System

Grade (Achievement)	Relations Between Marks And Grade Point Value	
	Marks Percentage	Grade Point Value
A (Distinction)	80 – 100	4.0
A- (Distinction)	75 – 79	3.7
B+ (Credit)	70 – 74	3.3
B (Credit)	65 – 69	3.0
B- (Pass)	60 – 64	2.7
C+ (Pass)	55 – 59	2.3
C (Pass)	50 – 54	2.0
C- (Conditional pass)	47 – 49	1.7
D+ (Conditional pass)	44 – 46	1.3
D (Conditional pass)	40 – 43	1.0
E (Fail)	0 – 39	0.0

The status for each course is summarized in **Table 5.7**.

Table 5.7 Course Status

Grade/ Status Acronym	Explanations
HW = Compulsory Attendance Courses (*Matapelajaran Hadir Wajib*)	HW status is given to the course that the credit is not counted in the GPA and CGPA calculations but counted for KD. For this course, the results are graded as Attendance Pass, HL (Hadir Lulus) or Attendance Fail , HG (*Hadir Gagal*)
UM = Repeat Course (*Ulang Matapelajaran*)	UM status is given to the course that is repeated by the students who failed in that course previously. The credits for UM will not be counted for CGPA calculations.
HWUM = Compulsory Attendance Repeat Course (*Hadir Wajib Ulang Matapelajaran*)	HWUM status is given to the Compulsory Attend course for students who previously failed the course.
UG = Repeat Grade (*Ulang Gred*)	UG status is given to the repeated course for students who want to improve their grade.
TM = Redeem Course (Tebus Matapelajaran)	TM status is given to the course for repeating student who holds Conditional Academic Standing (KS).

The academic standing for each student is determined by the examination results obtained at the end of every semester. The status is shown in Table 5.8.

Table 5.8 Academic Standing

Grade/Status Acronym	Explanations
KB = Good Academic Standing (*Kedudukan Baik*)	Students with CGPA ≥ 2.00
KS = Conditional Academic Standing (*Kedudukan Bersyarat*)	Students with CGPA 1.70 ≤ CGPA < 2.00
KG = Failed Academic Standing (*Kedudukan Gagal*)	Students with CGPA < 1.70, or students with KS three times consecutively
TD = Course Withdrawal (*Tarik Diri*)	Students withdrew from any registered course except for University Compulsory course
TS = Incomplete (*Tidak Selesai*)	Students unable to sit an examination due to illness certified by Medical Officer
KBA = Good Academic Standing Award (*Kedudukan Baik Anugerah*)	Students passed all the required courses and obtained KB.

5.6 Credit Transfer

Student can apply for credit transfer if they pass the same or equivalent course or possess experiences recognized by the faculty. Credit transfer can be granted to the student who had passed with minimum grade of C according to the University grading system. The application for credit transfer must be done within 2 weeks after the beginning of the first semester. The policy is as follows:

a. Credit transfer is a total credit that has been approved to the student based on certain courses taken by him/her at any other Institution of Higher Learning (IHL) either local or overseas. All the courses taken must be recognized by the university as equivalent and fulfil the curriculum of the chosen programme.
b. Credit transfer can be granted to the student that has taken the similar course and pass according to the UTeM grading system provided that the course content is 80% equivalent.
c. Educational level permitted for credit transfer must be equivalent with UTeM educational programme curriculum in terms of academic load and credit hours calculation.
d. With University's permission, students are allowed to take course in other IHL and can apply for credit transfer for those courses. The approved credit transfer will be accounted into their GPA and CGPA calculations.

e. Students are not allowed to complete their final semester study in other IHL.
f. The approval of credit transfer application will be announced to the students by the Academic Management Division (*BPA*). Granted credit transfer courses are recorded in the *Sistem Maklumat Pelajar* (SMP).

NOTE:
Any conflict in the interpretation of the above mentioned policy must be referred to The Academic Rules and Regulations for the Bachelor Degree and Diploma Programmes.

5.7 Credit Exemption

Credit exemption can be granted to the student who has taken similar and equivalent course and passed with respect to UTeM grading system. Application for credit exemption must be done within two (2) weeks after the beginning of the first semester.

a. Provision for the Credit exemption is outlined in the The Academic Rules and Regulations for the Bachelor Degree and Diploma Programs to shorten the duration of study.
b. Credit exemption is a total credit that has been exempted for degree/diploma award that is granted based on the diploma qualification or equivalent experience that is recognised by the University.
c. The maximum credit exemption allowed must not exceed 30% of the overall credit required for a programme.
d. The application for credit exemption must be submitted to FKM within the first two (2) weeks of the first semester.
e. Credit exemption can be granted to student who has taken the same course or equivalent and passed with the minimum grade of C+ according to the university grading system with the condition that the course contents is 80% equivalent.
f. Educational level permitted for credit exemption must be equivalent to the UTeM educational programme curriculum in terms of academic load and credit hours calculation.
g. A transfer student from other IHL either local or overseas is eligible to apply for credit exemption. Upon submission, FKM will determine the courses that can be exempted.
h. For the award of degree, the total credit gain needed for credit exempted-students is the difference between the overall credit and the exempted credit.
i. The approval of credit exemption application will be announced to the students by the Academic Management Division (BPA). Granted credit transfer courses are recorded in the SMP.
j. The combination of credit exemption and credit transfer must **not exceed 30%** of the total credit stipulated for the award of the degree programme.

5.8 Grade Point Average

GPA (Grade Point Average) is an average grade point values earned by a student in a semester. It is calculated as below:

Total Grade Point Value / Jumlah Mata Nilai, (JMN) = $k_1 m_1 + k_2 m_2 + \ldots\ldots + k_n m_n$

Total Credit Counted / Jumlah Kredit Kira, (JKK) = $k_1 + k_2 + \ldots\ldots + k_n$

$$GPA = \frac{JMN}{JKK}$$

$$= \frac{k_1 m_1 + k_2 m_2 + \ldots + k_n m_n}{k_1 + k_2 + \ldots + k_n}$$

where

k_n = Credit for n^{th} course.
m_n = Grade point value earned for n^{th} course.

Example 1 GPA Calculation

BMCG YEAR 1 (SEMESTER I)

CODE	COURSE	GR	MN	KR	JMN	ST
BLHW 1442	ENGLISH FOR ACADEMIC PURPOSE	A	4.0	2	8.0	
BLHW 1702	ISLAMIC AND ASIAN CIVILISATIONS	B+	3.3	2	6.6	
BMFG 1113	ENGINEERING MATHEMATICS I	C	2.0	3	6.0	
BMCG 1523	ENGINEERING GRAPHICS AND CAD	B-	2.7	3	8.1	
BMFG 1213	ENGINEERING MATERIALS	A	4.0	3	12.0	
BMCG 1113	STATICS	B	3.0	3	9.0	
	TOTAL			**16**	**49.7**	

	CURRENT SEMESTER	ALL SEMESTER
KD	16	16
KP		0
KK	16	16
JMN	49.7	
GPA	3.11	
CGPA		3.11
FINAL RESULT		
Good Academic Standing (KB)		

GPA for Semester 1

Total Grade Point Value (JMN) = 49.7

Total Credit Counted (JKK) = 16

GPA = 49.7 / 16 = 3.11

5.9 Cumulative Grade Point Average

CGPA (Cumulative Grade Point Average) is an average grade point earned by a student through out all semesters undertaken. It is calculated as below:

$$CGPA = \frac{(JMN)_1 + (JMN)_2 + ... + (JMN)_n}{(JKK)_1 + (JKK)_2 + ... + (JKK)_n}$$

where

$(JMN)_n$ = Total grade point value earned in n^{th} semester.
$(JKK)_n$ = Total credit counted in n^{th} semester.

Example 2 CGPA Calculation

BMCG YEAR 1 (SEMESTER 2)

CODE	COURSE	GR	MN	KR	JMN	ST
BKKX XXX1	CO-CURRICULUM I	B+	3.3	1	3.30	
BMCG 1013	DIFFERENTIAL EQUATION	B	3.0	3	9.00	
BEKG 1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	C-	1.7	3	5.10	
BMCG 2713	THERMODYNAMICS I	A	4.0	3	12.00	
BMCG 1213	DYNAMICS	E	0.0	3	0.00	
BMCG 2021	MECHANICAL ENGINEERING WORKSHOP	B-	2.7	1	2.70	
BMCG 2312	MANUFACTURING PROCESS	C+	2.3	2	4.60	
	TOTAL			**16**	**36.7**	

	CURRENT SEMESTER	ALL SEMESTER
KD	13	29
KP		0
KK	16	32
JMN	36.7	86.4
GPA	2.29	
CGPA		2.70
FINAL RESULT		
Good Academic Standing (KB)		

*Continuation from Example 1

GPA for Semester 2

Total Grade Point Value (JMN) = 36.7

Total Credit Counted (JKK) = 16

GPA = 36.7 / 16 = 2.29

CGPA for all semester (1 and 2)

Total Grade Point Value (JMN) = 49.7 + 36.7 = 86.4
Total Credit Counted (JKK) = 16 + 16 = 32
CGPA = 86.4 / 32 = 2.70

5.10 Course Withdrawal

The students are entitled to Course Withdrawal (TD) from any course if they feel that their performance is poor. **The last date for course withdrawal is in week thirteen (13).** The students are allowed to sit or repeat the course if it is offered by the faculty. With the verification from the Academic Advisor, students can withdraw any registered course provided that the minimum load of 12 credit hours remains.

If the credit hour taken is less than 12 credits and the student decided to withdraw any course, the Faculty's Dean approval is required.

The normal guideline for course withdrawal is as follows:

a. Course withdrawal is allowed within the period regulated by the University. Withdrawal is not encouraged as it reflects the student's weaknesses in planning for course enrolment and failure to follow the projected credit hours. The Course Withdrawal (TD) status will be printed in the programme registration slip and final transcript.
b. The student is not allowed to withdraw any co-curriculum course.
c. The students are required to re-register for the course that they had withdrawn, except the elective course which can be substituted with other elective courses.
d. Any tuition fees paid (if relevant) prior to withdrawal, will not be refunded.

Below are examples of student who wants either to withdraw or continue taking any particular course during the same semester as shown in Examples 5 and 6.

Students who withdraw the course (i.e. BMCG 2113) will be exempted from taking the final examination and the credit hour for that course will not be considered in the GPA calculation for that particular semester.

Example 3 Course Withdrawal GPA Calculation

BMCG YEAR 2 (SEMESTER 3)

CODE	COURSE	GR	MN	KR	JMN	ST
BLHW 2712	ETHNIC RELATIONS	A-	3.7	2	7.4	
BEKG 2443	ENGINEERING MATHEMATICS II	A	4.0	3	12.0	
BEKG 1123	PRINCIPLES OF ELECTRIC AND ELETRONICS	C	2.0	3	6.0	
BMCG 1011	MECHANICAL ENGINEERING LABORATORY I	C	2.0	1	2.0	
BMCG 2113	SOLID MECHANICS I	TD	-	-	-	
BMCG 2613	FLUID MECHANICS I	C	2.0	3	6.0	
BLHL 1XX2	LANGUAGE ELECTIVE	B	3.0	2	6.0	
	TOTAL			**14**	**39.4**	

	CURRENT SEMESTER	ALL SEMESTER
KD	14	43
KP		0
KK	14	46
JMN	39.4	125.8
GPA	2.81	
CGPA		2.73
FINAL RESULT		
Good Academic Standing (KB)		

*Continuation from Example 1

GPA for Semester 3

Total Grade Point Value (JMN) = 39.4

Total Credit Counted (JKK) =14

GPA = 39.4 / 14 = 2.81

CGPA for all semester (1, 2 dan 3)

Total Grade Point Value (JMN) = 49.7 + 36.7 + 39.4 = 125.8
Total Credit Counted (JKK) = (16+ 16) + 14 = 46
CGPA = 125.8 / 46 = 2.73

Example 4 GPA Calculation if the Student Continue Taking the Course (No Withdrawal)

For student who decided NOT to withdraw the course (i.e BMCG 2113) then the credit hours for that course will be counted for the GPA calculation for Semester 3.

BMCG YEAR 2 (SEMESTER 3)

CODE	COURSE	GR	MN	KR	JMN	ST
BLHW 2712	ETHNIC RELATIONS	A-	3.7	2	7.4	
BEKG 2443	ENGINEERING MATHEMATICS II	A	4.0	3	12.0	
BEKG 1123	PRINCIPLES OF ELECTRIC AND ELETRONICS	C	2.0	3	6.0	
BMCG 1011	MECHANICAL ENGINEERING LABORATORY I	C	2.0	1	2.0	
BMCG 2113	SOLID MECHANICS I	E	0.00	3	0.0	
BMCG 2613	FLUID MECHANICS I	C	2.0	3	6.0	
BLHL 1XX2	LANGUAGE ELECTIVE	B	3.0	2	6.0	
	TOTAL			**17**	**39.4**	

	CURRENT SEMESTER	ALL SEMESTER
KD	14	43
KP		0
KK	17	49
JMN	39.4	125.8
GPA	2.32	
CGPA		2.57
FINAL RESULT		
Good Academic Standing (KB)		

GPA for Semester 3

Total Grade Point Value (JMN) = 39.4

Total Credit Counted (JKK) = 17

GPA = 39.4 / 17 = 2.32

CGPA for all semester (1, 2 and 3)

Total Grade Point Value (JMN) = 49.7 + 36.7+ 39.4 = 125.8
Total Credit Counted (JKK) = (16+ 16) + 17 = 49
CGPA = 125.8 / 49 = 2.57

Examples 3 and 4 have shown that the student's results are affected when the student decides to either withdraw (TD) or continue taking the course. In Example 4, the student's GPA will be drastically dropped to 2.32 as compared to 2.81 in Example 3. The withdrawal will also affect the CGPA from 2.73 to 2.57. Therefore the student has to consider carefully when deciding whether or not to withdraw.

5.11 Course Repeating

Students are allowed to repeat any failed course if the course is offered by the faculty. The repeating grade will be the official grade in the transcript if it is higher than the previous one, otherwise the previous grade prevails.

Referring to Examples 2 and 3, assuming that the student wants to resit for BMCG 1213, CGPA calculation is shown as below:

Example 5 CGPA Calculation for Resitting

BMCG YEAR 2 (SEMESTER 4)

CODE	COURSE	GR	MN	KR	JMN	ST
BLHW 2452	ACADEMIC WRITING	A-	2	3.7	7.4	
BKKX XXX1	CO-CURRICULUM II	B+	1	3.3	3.3	
BENG 2143	ENGINEERING STATISTICS	B-	3	2.7	8.1	
BEKG 2433	ELECTRICAL SYSTEMS	B+	3	3.3	9.9	
BMCG 2011	MECHANICAL ENGINEERING LABORATORY II	A	1	4.0	4.0	
BMCG 3113	SOLID MECHANICS II	C+	3	2.3	6.9	
BMCG 2513	COMPUTER AIDED DESIGN AND MANUFACTURING	B+	3	3.3	9.9	
BMCG 1213	DYNAMICS	C+	3	2.3	6.9	UM
	TOTAL		**19**		**56.4**	

	CURRENT SEMESTER	ALL SEMESTER
KD	19	62
KP		0
KK	19	65
JMN	56.4	182.2
GPA	2.97	
CGPA		2.94
FINAL RESULT		
Good Academic Standing (KB)		

Semester 1,2 and 3

Total Grade Point Value (JMN) = 49.7 + 36.7 + 39.4 = 125.8

Total Credit Counted (JKK) = (16+ 16) + 14 = 46

GPA for Semester 4

Total Grade Point Value (JMN) = 56.4
Total Credit Counted (JKK) = 19
GPA = 56.4 / 19 = 2.97

CGPA for all semester (1, 2, 3 and 4)

Total Grade Point Value (JMN) = 49.7 + 36.7 + 39.4 + 56.4
= 182.2
Total Credit Counted (JKK) = 16 + 16 + 14 + 19 - 3 = 62
CGPA = 182.2 / 62 = 2.94

For CGPA calculation, the course BMCG 1213 is a repeat course (from Semester 2 and the previous grade obtained is E). The previous grade and credit (3) should be discarded for the CGPA calculation in Semester 4.

5.12 Failed Academic Standing (KG)

Example 6 Failed Academic Standing (KG) - Dismissal

BMCG YEAR 1 (SEMESTER I)

CODE	COURSE	GR	MN	KR	JMN	ST
BLHW 1442	ENGLISH FOR ACADEMIC PURPOSE	C-	1.7	2	3.4	
BLHW 1702	ISLAMIC AND ASIAN CIVILISATIONS	C-	1.7	2	3.4	
BMFG 1113	ENGINEERING MATHEMATICS I	D+	1.3	3	3.9	
BMCG 1523	ENGINEERING GRAPHICS AND CAD	C-	1.7	3	5.1	
BMFG 1213	ENGINEERING MATERIALS	D	1.0	3	3.0	
BMCG 1113	STATICS	D	1.0	3	3.0	
	TOTAL			**16**	**21.8**	

	CURRENT SEMESTER	ALL SEMESTER
KD	16	16
KP		0
KK	16	16
JMN	21.8	21.8
GPA	1.36	
CGPA		1.36
FINAL RESULT		
Failed Academic Standing (KG)-Dismissal		

GPA for Semester 1

Total Grade Point Value (JMN) = 21.8
Total Credit Counted (JKK) = 16
GPA = 21.8 / 16 = 1.36

In Example 6, the GPA and CGPA of the student is 1.36. Even if the student passed all the courses with a minimum of D grade, the student will still be dismissed since CGPA is less than 1.70.

5.13 Conditional Academic Standing (KS)

Example 7 Conditional Academic Standing (KS)

BMCG YEAR 1 (SEMESTER I)

CODE	COURSE	GR	MN	KR	JMN	ST
BLHW 1442	ENGLISH FOR ACADEMIC PURPOSE	C-	1.7	2	3.4	
BLHW 1702	ISLAMIC AND ASIAN CIVILISATIONS	C	2.0	2	4.0	
BMFG 1113	ENGINEERING MATHEMATICS I	C-	1.7	3	5.1	
BMCG 1523	ENGINEERING GRAPHICS AND CAD	C	2.0	3	6.0	
BMFG 1213	ENGINEERING MATERIALS	D+	1.3	3	3.9	
BMCG 1113	STATICS	C-	1.7	3	5.1	
	TOTAL			**16**	**27.5**	

	CURRENT SEMESTER	ALL SEMESTER
KD	16	16
KP		0
KK	16	16
JMN	27.5	27.5
GPA	1.72	
CGPA		1.72
FINAL RESULT		
Conditional Academic Standing (KS)		

GPA for Semester 1

Total Grade Point Value (JMN) = 27.5

Total Credit Counted (JKK) = 16

GPA = 27.5 / 16 = 1.72

Conditional Academic Standing is the result for students who gets CGPA below 2.00 but not in KG status ($1.70 \leq CGPA < 2.00$). The student is allowed to continue the study with a maximum of 12 credit hours for the following semester until the student achieve Good Academic Standing (KB).

Normally the sponsors have the right to suspend the financial support for the students until they improve their study by getting CGPA > 2.0. If the Conditional Academic Standing (KS) is repeated 3 times consecutively, then the candidate will be dismissed.

5.14 Good Academic Standing (KB)

Example 8 Good Academic Standing (KB)

BMCG YEAR 1 (SEMESTER 1)

CODE	COURSE	GR	MN	KR	JMN	ST
BLHW 1442	ENGLISH FOR ACADEMIC PURPOSE	E	0.0	2	0.0	
BLHW 1702	ISLAMIC AND ASIAN CIVILISATIONS	B+	3.3	2	6.6	
BMFG 1113	ENGINEERING MATHEMATICS I	B+	2.0	3	6.0	
BMCG 1523	ENGINEERING GRAPHICS AND CAD	B+	2.7	3	8.1	
BMFG 1213	ENGINEERING MATERIALS	A-	4.0	3	12.0	
BMCG 1113	STATICS	A	4.0	3	12.0	
	TOTAL			**16**	**44.7**	

	CURRENT SEMESTER	ALL SEMESTER
KD	14	14
KP		0
KK	16	16
JMN	44.7	44.7
GPA	2.79	
CGPA		2.79
FINAL RESULT		
Good Academic Standing (KB)		

GPA for Semester 1

Total grade points (JMN) = 44.7

Total calculated credit (JKK) = 16

GPA = 44.7 / 16 = 2.79

This student passed 5 (KD = 14) out of 6 courses (KK = 16) taken. The student obtained KB with GPA = 2.79.

But he/she failed in the BLHW 1442 English for Academic Purpose course, which is the pre-requisite for BLHW 2452 Academic Writing. The student **MUST RESIT** the BLHW 1442 English for Academic Purpose course until he/she get at least a minimum of D grade in order to take BLHW 2452 Academic Writing course. The student may be expected to extend his/her duration of study, depending on the total credit hours required to graduate.

5.15 Dean's List Award

Example 9 Good Academic Standing (KB) with Dean's List Award

BMCG YEAR 1 (SEMESTER I)

CODE	COURSE	GR	MN	KR	JMN	ST
BLHW 1442	ENGLISH FOR ACADEMIC PURPOSE	A	4.0	2	8.0	
BLHW 1702	ISLAMIC AND ASIAN CIVILISATIONS	A-	3.7	2	7.4	
BMFG 1113	ENGINEERING MATHEMATICS I	B+	3.3	3	9.9	
BMCG 1523	ENGINEERING GRAPHICS AND CAD	A	4.0	3	12.0	
BMFG 1213	ENGINEERING MATERIALS	B+	3.3	3	9.9	
BMCG 1113	STATICS	A-	3.7	3	11.1	
	TOTAL			**16**	**58.3**	

	CURRENT SEMESTER	ALL SEMESTER
KD	16	16
KP		0
KK	16	16
JMN	58.3	58.3
GPA	3.64	
CGPA		3.64
FINAL RESULT		
Good Academic Standing (KB)		

GPA for Semester 1

Total grade points (JMN) = 58.3

Total calculated credit (JKK) = 16

GPA = 58.3/ 16 = 3.64

Example 9 above shows an excellent result obtained by the student. With GPA ≥ 3.5, the student will be awarded with Dean's List Award for his/her outstanding achievement which will be stated in the result transcript.

5.16 Graduation Requirements and Class

Students deserve to be awarded with certificate (Bachelor Degree/Diploma) upon satisfying the following requirements:

a. Student must obtain a Good Academic Standing (KB) in the final semester.
b. Student has passed all courses required by the programme and obtained Good Academic Standing Award (KBA). Please refer to Table 5.9 for total credit numbers based on course categories for KBA.

Table 5.9 Credit number for Graduation status

Course Category	UNIVERSITY COMPULSORY	PROGRAMME & COURSE CORE	MATHEMATICS, STATISTICS AND COMPUTING	ELECTIVE*	TOTAL
BMCG	14	90	15	16	135
BMCK	16	96	15	8	135
DMC	14	64	13	-	91

* 12 credits for Programme Elective, 2 for Language Elective and 2 for General and Open Elective (BMCG)
* 6 credits for Programme Elective and 2 for Language Elective (BMCK)

c. Student has applied for graduation status, approved by faculty and endorsed by University Senate.
d. Student has passed MUET and obtain band specified by the University.
e. Student has fulfilled other requirements as specified by the University.

The award of certificate will be classified according to the graduation class given in **Table 5.10** and **Table 5.11**. However, the graduation class is not stated in academic transcript.

Table 5.10 Graduation Class (Degree)

Class	Explanations
First Class with Honours	Students with CGPA $\geq$ 3.70
Second Class (Upper) with Honours	Students with CGPA 3.00 $\leq$ CGPA $<$ 3.69
Second Class (Lower) with Honours	Students with CGPA 2.00 $\leq$ CGPA $<$ 2.99

Table 5.11 Graduation Class (Diploma)

Class	Explanations
First Class	Students with CGPA $\geq$ 3.70
Second Class	Students with CGPA 2.00 $\leq$ CGPA $<$ 3.69

6 ACADEMIC ADVISORY SYSTEM

6.1 Introduction

The Academic Advisory System is established for the purpose of providing comprehensive advice in terms of education, teaching and assessment for students during their studies in UTeM.

6.2 Academic Advisory Objectives

Students in university have life that is totally different from the school environment. Being away from family, relatives and old friends, students are required to have good self motivation in order to survive and succeed in their studies. The students are also expected to gain information and to adapt quickly with the change of rules in a campus life.

Students should therefore utilize the existence of the Academic Advisory System that can help them in their academic achievement. Academic staffs shall be regarded as a friend to seek for advice and opinion.

The objectives of Academic Advisory System are:

a. To provide a proper channel for students to obtain an advice and counselling especially on academic problem.
b. To establish two ways of communications between students and faculty/university.
c. For the advisor to recognize the students' ability and capability.
d. To produce a discipline and balance attitude of students.
e. As a platform for sharing opinion, information and giving advice on the overall aspects of the student's life in university.

6.3 Academic Advisory Structure

The faculty has set the Academic Advisory System as one of the platforms to obtain feedback from students. This is important for the continuous improvement based on the positive as well as demanding feedback received from the students. The procedures of the Academic Advisory System are shown in Figure 6.1.

Figure 6.1 Academic Advisory System

There are two important components in the system. First is the meeting with the students to seek for feedback and second, is for the academics to give advice and to take action related to the student's academic problem appropriately. Student's feedback can be gathered from annual meeting and/or personal meeting. All records such as student's personal and academic information are updated during the meeting and documented in the faculty.

The Academic Advisory Committee's working procedure is as follows:

a. Students will be divided into several groups consisting of 20 to 30 students. Each group is led by one Academic Advisor (Penasihat Akademik, PA). The PA is an academic staff with teaching experience.
b. PA will remain with the students until they graduate. PA shall be regarded as a mentor for the students.
c. PA keeps and updates the students' records under his/her group. These records include academic performances of the students until they graduate. The records also include feedback, application letters as well as issues relating to academic and non-academic. These records are kept by the PA for future reference.

6.4 Student's Academic Advisory Mechanism

Each academic staff should be aware of the objectives of the Academic Advisory System. Formal and informal meeting sessions are important. Students shall be responsive to the faculty's intention to help them through the following mechanism:

a. Students can meet their PA at their own initiative. More informal meetings are encouraged.
b. Formal meeting between students and PA is made by appointment or any other methods agreed.
c. Detail of the discussion is recorded for future reference.
d. Attendance is compulsory for the meeting organized by their PA.

6.5 Academic Advisors Responsibility

PA has the responsibility to help students with poor academic achievement. Normally, good students are more approachable whilst poor students are difficult to engage for discussion and meeting. From the beginning the students must be aware that academic progress and achievement are their responsibility.

The faculty has outlined the role of PA are as follows:

a. Play an important role in giving advice, guidance and motivation to students regarding their academic and non-academic matters.
b. Monitor student's academic development, progress and performance.
c. Schedule meeting which is agreed by both parties.
d. Assist students in understanding the organization structure, method and procedure of university's administration.
e. Refer to professional counsellor in order to solve student problem, when necessary.
f. Encourage students to be involved in academic and non-academic activities organized by the university.

6.6 Student Responsibility

In the university, students are fully responsible of their achievement in their studies. The student's responsibilities are as follows:

a. Consistently meet their PA to seek for advice in solving academic and non-academic problems.
b. Discuss the study plan every semester before registering new courses for the next new semester.
c. Discuss with the PA to plan for future meeting schedule and must commit to their plan.
d. Meet the PA during free time to discuss any issue arises related to education, general knowledge, technology development and career.
e. Consider any advice given and act appropriately.
f. Regard the PA as a good friend to open-up for discussion.

6.7 Learning Guidance in University

The learning environment in university differs greatly to that in school. Students must therefore adapt to the new learning method accordingly, where most of the time, students are expected to have self motivation and self indepence to learn the materials giving in the class by the lectures. Several measures on how to succeed in the university are pointed out as follows:

a. Manage time effectively. Students should participate in positive activities and stay away from being involved in any illegal activities.
b. Plan out properly for the courses to be registered for each semester by consulting the PA.
c. Choose co-curriculum and elective courses that are suitable according to own capability and interest.
d. Well disciplined in attending lectures, tutorials, and lab sessions.
e. Motivated and highly aspired throughout the studies in university to ensure good performance in quizzes, assignments, laboratories works, tests and final exam.
f. Avoid last-minute studying. Revision should be done on a regular basis.

7 FACILITIES AND ETHICS IN LABORATORY WORK

7.1 Overview of Facilities

The facilities of FKM include lecture rooms and laboratories where most of the lecture rooms are located in Technology Campus. **Table 7.1** lists the locations of facilities in the main building of FKM in Technology Campus and Mechanical Engineering Laboratory Complex (Taman Tasik Utama). Faculty has developed the laboratories based on the courses offered. Through these laboratories, students will be exposed to the related machine handling experience as well as practical exposure on theory proofing learned in the lecture hall. This is to prepare themselves to become not only a knowledgeable engineer but also highly competitive in application and technical aspects.

Table 7.1 Locations of Facilities in FKM

No.	Name	Location	Level
1	Administration Office	FKM Main Building (Technology Campus)	3
2	Security Office		G
3	Development Office		G
4	Student Clinic		G
5	Lecture Rooms BK1-BK10 and CLeaR Room (Collaborative Learning Room)		G
6	Lecture Rooms BK11-BK17		1
7	Post Graduate Area		1
8	Faculty of Mechanical Engineering Student Association (FaMESA) room		1
9	Library		2
10	Lecturer Rooms		5 & 6
11	Lecture Rooms BK1 (KMK)-BK6 (KMK)	Mechanical Engineering Laboratory Complex	-
12	Laboratories, Workshops & Studios	Laboratory Complex of Technology Campus and Mechanical Engineering Laboratory Complex	-

The entire laboratory is managed by a Lab Coordinator with the help of Field Cluster Leader appointed among the academic staff. The lab management is also supported by technical support staff led by a Unit Leader. The tools, machines and equipments of each laboratory are developed by respective

departments. The Lab Management Committee is responsible for the daily usage, consumables and maintenance of the labs.

7.2 Objectives of Laboratory Work and Workshop

The faculty has developed laboratory work to enhance the understanding of the theory given during the lecture. The activities have been developed for the students so that it will not only provide better understanding of the concepts learned but also skills in handling the equipment and ability to solve the given problem. The laboratories are also utilised for research and consultation work for the public. Below are the objectives of the laboratory work:

a. To develop the interest of the students in engineering field by exposing them to the work procedure and equipment handling in solving engineering problem.
b. To relate the engineering theory by validating data obtained from the experiment.
c. To increase the tools-handling skill and also understanding the concept taught during the lecture.
d. To simulate and analyse engineering problems that are based on the knowledge acquired in the lecture.
e. To build up team work among the students during laboratory and workshop activities.
f. To support the research activities.
g. To provide consultation work for other institutions or agencies.

7.3 Laboratory Facilities

In line with the university's aim, the development of the facilities has rapidly increased to support teaching & learning, and research activities. As the course curriculum comprises of laboratory courses, therefore the development of the laboratory shall reflect the syllabus of the course.

Most of the laboratories are equipped with state-of-the-art facilities. These facilities are used not only for teaching and learning activities, but also for research and consultation works. In line with the Engineering Accreditation Councils (EAC) requirements, the faculty managed to reduce the ratio of students to the equipments/tools down to 1:6. Besides that, the computer facilities for the students are undergoing staggered upgrading in order to achieve the ratio of 1:1 (computer: student).

The development of the FKM laboratories has been carried out progressively. **Tables 7.2** and **7.3** show the list of existing laboratories for teaching and learning as well as research in FKM. At present, 25 laboratories have been developed for teaching and learning and 16 laboratories for research activities. Currently, there are two laboratory complexes which are located at Mechanical Engineering Laboratory Complex, Taman Tasik Utama and Technology Campus. The laboratory complex in Technology Campus is located behind the main building of Fakulti Teknologi Kejuruteraan. FKM laboratories are specifically

at Laboratory 2 (Door P4). Generally, each laboratory can accommodate at least 30 students at a time. Sample of laboratory facilities are ashown in **Figure 7.1**.

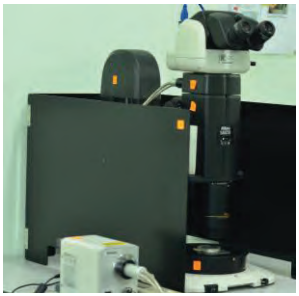
Table 7.2 List of Laboratories for Teaching and Learning

No.	Name of Laboratory	Location
1	Fluid Mechanics Lab	Mechanical Engineering Laboratory Complex, Taman Tasek Utama (TTU)
2	Fitting & Fabrication Workshop	
3	Welding Workshop	
4	Machine Workshop	
5	Computer Aided Design Studio 1	
6	Computer Aided Design Studio 2	
7	Computer Aided Design Studio 3	
8	Computer Aided Design Studio 4	
9	IDP Workshop	
10	Machine Development Workshop	
11	Heat Transfer Lab	
12	Computer Aided Engineering (CAE) Studio	
13	Material Science Lab	
14	Thermodynamics Lab	
15	Fluid Power Lab	
16	Dynamics Lab	
17	Structure Mechanics Lab	
18	Mechanics of Machine Lab	
19	Statics Lab	
20	PSM Workshop	
21	Automotive Services & Maintenance Lab	
22	Automotive Design Studio	
23	Chemistry Lab	Laboratory Complex of Technology Campus
24	Material Structure Monitoring Lab	
25	Condition Based Maintenance Lab	

Table 7.3 List of Research Laboratories

No.	Name of Laboratory	Name of Research Group	Location
1	Green Technology Vehicle Lab	Green And Efficient Energy Technology Research Group (GrEET)	Mechanical Engineering Laboratory Complex, Taman Tasik Utama (TTU)
2	Composite Lab	Advanced Materials Research Group (A-MAT)	
3	Non-destructive Test Lab	Advanced Materials Research Group (A-MAT)	
4	Refrigeration & Air Conditioning Lab	Green And Efficient Energy Technology Research Group (GrEET)	
5	Autotronic Lab	Advanced Vehicle Technology Research Group (AcTiVe)	
6	Turbo Machinery Lab	Green And Efficient Energy Technology Research Group (GrEET)	
7	Engine Performance Test Lab	Advanced Vehicle Technology Research Group (AcTiVe)	
8	Prototype & Inovation Lab	Innovation and Sustainability In Machine Technologies Research Group (i-SMAT)	
9	Research Workshop	General	
10	Advanced Materials Characterization Lab (AMCHAL)	Advanced Materials Research Group (A-MAT)	Laboratory Complex of Technology Campus
11	Tribology Lab	Green Tribology And Engine Performance Research Group (G-TriboE)	
	Maintenance Engineering Lab	Vibration And Structural Health Monitoring Research Group (ViBRO)	
12	High Performance Structure Laboratory	High Performance Structure Research Group (HiPS)	
13	Advanced Material Imaging Lab (AMIL)	Advanced Materials Research Group (A-MAT)	
14	Innovation Lab	Innovation and Sustainability In Machine Technologies Research Group (i-SMAT)	
15	Vibration and Acoustics Lab	Vibration And Structural Health Monitoring Research Group (ViBRO)	
16	Hyperworks Studio (FKM Research Studio)	Innovation and Sustainability In Machine Technologies Research Group (i-SMAT)	6th Floor, FKM Main Building

LOW POWER MICROSCOPE



TRIVECTOR WEAR DEBRIS ANALYZER

SCANNING ELECTRON MICROSCOPE

FTIR SPECTROPHOTOMETER

UNIVERSAL TESTING MACHINE

Figure 7.1 Sample of Laboratory Facilities

HIGH SPEED CAMERA

CNC LATHE MACHINE

SCANNING ELECTRON MICROSCOPE

HYDRAULIC PNUEMATIC TRAINING KIT

Figure 7.1 Sample of Laboratory Facilities (continued)

7.4 Work Ethics

All students are bound to the University Regulation & Guideline while working in the laboratory. These guidelines are meant to provide safe working environment in order to safe guard the equipments and building in the laboratory as well as to avoid accident.

The faculty has detailed out the regulations for working in laboratories as the working procedures is the fundamental aspect of laboratory activities. Students are required to follow these guidelines while they are in the laboratory or within the vicinity of the laboratory. The objectives of these guidelines are as follows:-

a. To create a secure, safe and conducive working environment during laboratory and practical works.
b. To guarantee the safety of the students and their environment.
c. To cultivate highly discipline culture among students.
d. To adapt professional working ethics.
e. To prolong the equipments' life span and also to maintain it with proper use and procedures.
f. To prevent misuse of equipments and avoid inappropriate and unnecessary damage to the equipments.
g. To make sure the practical work session is efficient without undue interference.

The working ethics are divided into three (3) categories, namely General Work Ethics, Laboratory Work Ethics and Dress Code in the Laboratory.

7.4.1 General Work Ethics

General work ethics is inevitably important. As student and future mechanical engineer are the people who will shape the national future engineering environment, general work ethics should be emphasised no matter where they are. To uphold these basic guidelines, the following instructions are enforced:

a. No entrance into the laboratory or work with the equipments without permission of laboratory manager or authorised staff.
b. No equipments are allowed to be taken out of the laboratory without prior permission from laboratory manager or authorised staff.
c. No food or drinks are allowed in the laboratory or workshops.
d. Non-related items are not allowed in the laboratory, such as bags and helmets.
e. Unacceptable behaviour or act will not be tolerated.
f. Obey the instructions given by the laboratory manager or authorised staff.
g. Adhere and understand the procedures in the laboratory such as laboratory submission procedures, equipment on loan procedures and the procedure of working during non-office hours.
h. Report any accident to the the laboratory manager or authorised staff immediately.
i. Keep the laboratory clean and safe after every laboratory session.
j. Place any laboratory leftover or waste materials in the respective bin.

7.4.2 Operational Work Ethics

The Laboratory Operational Work Ethics is one of the guideline that all mechanical engineering students should adhere to during their laboratory session. This guideline is specifically focused in handling practical works in the laboratory. Among the aspects to be observed by the students are as follows:-

a. During laboratory session, students should always be supervised by at least either a laboratory instructor or a technical staff.
b. Students should obtain a copy of laboratory sheet that could be downloaded from faculty website before starting a practical works.
c. Students should understand the working procedures of equipment before commencing laboratorial activities by referring to the work manual or instruction given by the lecturer or technical staff.
d. Students should sign attendance list distributed by the technical staff in charge.
e. Students should use and optimise the time allocated to finish off their practical works including recording observations and conclusions.
f. All laboratory reports should be submitted on time. Informal report should be handed in three (3) working days after the laboratory session took place. For formal report, it should be submitted seven (7) working days after the date of the laboratory session.
g. Laboratory reports should be submitted to the lecturer that in charge during the laboratory session.
h. For any defects found on the equipments, kindly report to the lecturer or technical staff in charge.
i. Equipments/tools must be returned to their designated location.

7.4.3 Dress Code

Dressing reflects the culture of the working environment. Irrespective of type of working environment, one must dress appropriately. The university has distributed a general guideline to the students on dress code within the university area. As far as the faculty is concerned, the dress code applies specifically for workshops or laboratories. The detail of the dress code can be referred to the Pejabat Hal Ehwal Pelajar dan Alumni. The following instruction must be carefully observed by the students while they are around or working in the laboratory.

a. Students should always display matrix cards for ease of identification.
b. Students should always wear appropriate dress corresponding to the activities undertaken.
c. Students should always wear proper personal protective equipment such as goggles, hand gloves or aprons while handling high risk equipments.
d. Students must wear covered shoes inside the laboratory. Any uncovered shoes are not allowed at all times.
e. For all activities inside the workshop, student must wear safety shoes.

f. Students are encouraged to wear workshop coat at the laboratory compound. Any collarless or round neck T-shirt is not allowed.
g. Female student with scarf should tie it at the back of her neck or tug it in her workshop coat. Loose clothing could increase possibility of accident.
h. Students are not allowed to wear any jewellery such as necklace or bracelet that will affect their safety.
i. Male students should keep their hair short. Female students with long hair should tie up their hair at the back of their head.
j. Students should always be neat and tidy.

7.5 Implementation of Laboratory Work

The purpose of laboratory work is to increase student's understanding on the course taught. A number of laboratories were developed to cater the demand for the courses. In general, the conduct of the laboratory is parallel to the course registered on that particular semester.

Each laboratory subject is conducted in a period of 14 weeks which consists of 4 laboratory sessions. During the first week before the laboratory session started, student will be briefed on the content and how the laboratory will be conducted. Some of the content during the orientation (1 week) period are as follows:

a. Name of laboratory station and how the experimental will be conducted.
b. Number and name of experimental work to be carried out.
c. Brief explanation of the laboratories work.
d. Group formation.
e. Format of report writing and marking scheme.

Each laboratory session is conducted in 3 weeks consist of activities as follows:

a. Briefing on specific experiment explained by the lecturer/the instructor
b. Students conduct the specific experiment
c. Laboratory report preparation and submission.

There are two approaches of laboratory work which are prescriptive laboratory work and open-ended laboratory work. For prescriptive laboratory activities, the students are provided with complete laboratory sheet and are fully guided by the lecturer or the instructor during the laboratory session. Prescriptive laboratory work will be conducted for diploma laboratory courses. Meanwhile, bachelor laboratory courses will implement open-ended approach. In this approach, the students will be given a very minimum

guidance from the lecturer or instructor. The laboratory sheet is given for the open ended laboratory with minimum guideline. Open ended laboratory work allows the opportunity for students to be creative about the execution, analysis and evaluation of laboratory work. Students create, for example, the evidence, the analysis, and the evaluation of laboratory work. Often synthesis is also involved in open-ended work. These processes involve interaction while in the laboratory (in-lab work) and after leaving the laboratory (post-lab work).The students are fully responsible to conduct and handle the experiment themselves after short briefing given by the lecturer or the instructor. The students work in a group of 4 to 5 persons. They need to determine the objectives, apparatus and methods as well as how to execute the experiment. A report including results, discussion, conclusion and references is submitted for evaluation.

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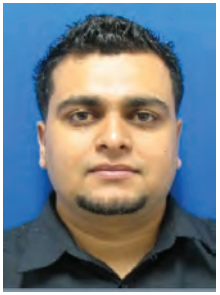

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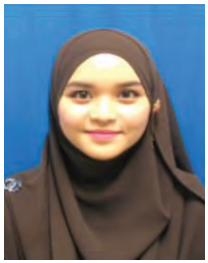

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