UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ACADEMIC HANDBOOK 2023/2024

FOR BACHELOR DEGREE AND DIPLOMA PROGRAMMES

FACULTY OF ELECTRICAL TECHNOLOGY AND ENGINEERING

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The Faculty would like to extend our gratitude and appreciation to all who have contributed to the success of Academic Handbook Session 2023/2024 completion:

And all of the parties involved.

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VISION

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

MISSION

UTeM is committed to pioneer and contribute towards the prosperity of the nation and the world by;

1. Promoting knowledge through innovative teaching and 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.

MOTTO

Excellence Through Competency.

GENERAL 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.

WELCOMING SPEECH FROM DEAN FACULTY OF ELECTRICAL ENGINEERING

Bismillahir Rahmanir Rahim
Assalamu'alaikum and a Very Good Day

All praises are due to Allah SWT, the most Gracious, and with His Mercy the Academic Handbook of Postgraduate Studies for the Academic Session of 2023/2024 has been successfully published by the Faculty of Electrical Technology and Engineering, Universiti Teknikal Malaysia Melaka.

First, I would like to congratulate all new students on your admission to UTeM and welcome to FACULTY OF ELECTRICAL TECHNOLOGY AND ENGINEERING. I can assure you that you have come to the right Institution of Higher Learning (IHL) and an exciting learning experience awaits you at this faculty.

In line with the faculty's motto "Towards Academic Excellence", we strive hard to produce a competent, capable, knowledgeable and ethical human capital that is able to assist the government and the industry in pushing our country towards better economy and lifestyle. In order to achieve this, the faculty has implement Outcome Based Education (OBE) curriculum since July 2010. We hope this approach will better equip our students with the required skills upon their graduation.

This year, the faculty offers three (3) types of Postgraduate Programmes i.e. research mode, mixed-mode and taught course which comply with the Malaysia Qualification Agency (MQA) requirements. Programmes of Doctor of Philopsophy (Ph.D), Doctor of Engineering (D.Eng) and Master of Science (M.Sc) are conducted by research mode.

For programme Master of Electrical Engineering (Industrial Power) or MEKP, the combination of research and taught course or so called mixed-mode is offered in FTKE. For Master of Electrical Engineering (MEKG) and Master of Mechatronics Engineering (MEKH), these 2 programmes are conducted in full taught course.

This handbook provides a brief overview about the faculty, entry requirement, duration of studies, curriculum structure, the PEOs and POs, and course summary which serves as a reference for the new intake of Academic Session of 2023/2024. Hopefully, it will provide guidance for students in planning their studies systematically in order to achieve academic excellence and eventually graduate on time with good grades.

Last but not least, I would like to extend my thanks and gratitude to all the committee members for their hard work, support and effort towards publishing this handbook.

Wassalam.

“Towards Academic Excellence”

ASSOCIATE PROF. DR. HIDAYAT BIN ZAINUDDIN
Dean,
Faculty of Electrical Technology and Engineering
Universiti Teknikal Malaysia Melaka

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KETUA JABATAN
DIPLOMA

FACULTY AT A GLANCE

Faculty of Electrical Technology and Engineering (FTKE) was established in early 2001 and officially began to operate from 22nd June 2001 after obtaining an authorization from Malaysia Ministry of Education. Initially, the faculty's temporary campus was situated at Taman Tasik Utama, Ayer Keroh and later was allocated to the UTeM's main campus at Durian Tunggal.

The Faculty of Electrical Technology and Engineering offers three (3) Undergraduate Programmes and three (3) types of Postgraduate Programmes:

Undergraduate Programmes:

1. Bachelor of Electrical Engineering with Honours (BELG)
2. Bachelor of Mechatronics Engineering with Honours (BELM)
3. Bachelor of Electrical Engineering Technology (Industrial Power) with Honours (BELK)
4. Bachelor of Electrical Engineering Technology (Industrial Automation & Robotic) with Honours (BELR)
5. Bachelor of Electrical Engineering Technology with Honours (BELT)
6. Bachelor Technology of Electrical System Maintenance with Honours (BELS)
7. Diploma of Electrical Engineering (DEL)

Postgraduate Programmes:

1. Electrical Engineering & Mechatronics Engineering (Research Mode)
   a) Doctor of Philosophy (Ph. D)
   b) Doctor of Engineering (D. Eng)
   c) Master of Science (M.Sc.)

2. Electrical Engineering (Mixed-Mode)
   a) Master of Electrical Engineering (Industrial Power) - MEKP

3. Electrical Engineering (Taught Course Mode)
   a) Master of Electrical Engineering – MEKG
   b) Master of Mechatronics Engineering – MEKH

FACULTY MISSION, MOTTO AND OBJECTIVES

FACULTY'S MISSION

The Faculty's mission is to provide quality technical education and professional services through broad-based knowledge, innovation and creativity based on expertise and latest technology in enhancing excellent work culture, mutual understanding and cooperation while upholding moral values in line with the national aspirations.

FACULTY'S MOTTO

Towards Academic Excellence

FACULTY'S OBJECTIVES

1. To conduct academic programs recognized by professional bodies that meet the global standards.
2. To produce competent and responsible professionals.
3. To provide balanced academic programs in terms of theory and practical based on Outcome Based Educations (OBE).
4. To enhance smart partnerships between the Faculty with the industry through services, consultancies, and research activities.
5. To create a conducive teaching and learning environment.
6. To produce knowledgeable, outstanding visionary individuals instilled with moral values.
7. To promote a culture of publication amongst academics.

CURRICULUM STRUCTURE

DIPLOMA PROGRAMME

During the first year of study, the student will be equipped with fundamental courses such as mathematics, science and computer programming to provide the foundation for learning engineering courses. The student also taking introduction of electrical and electronic courses. After that, during the second year, the student shall continue learning core programme courses and undertake the diploma project. Finally, during the third year, students are required to undergo an Industrial Training for 16 weeks.

BACHELOR PROGRAMMES

The academic curriculum of the Bachelor Programmes consists of both engineering and non- engineering courses. The key elements of the curriculum include the laboratory work, industrial training, integrated design project and final year projects. In addition, engineering application, integrated exposure to professional engineering practice, including management and professional ethics are also part of the programme's curriculum. In order to expose the students to engineering practice, technical talks by guest lecturers from industry, industry visits, and courses on professional ethics and conduct, are also included.

The University's compulsory courses included English for Academic Purpose, Academic Writing and English for Professional Interaction, Ethnic Relation, and Tamadun Islam dan Tamadun Asia. On the other hand, students are exposed to the third language, engineering management skills, entrepreneurship, communication skills, co-curricular activities and personality development in order to produce engineers who are competent and able to work independently with positive attitudes.

The University offers professional certification preparatory course to increase the value and marketability of the graduates, relevant to the needs of the industries. The objectives of this course are:

- To increase the student competency in skills that are relevant to his/her future career;
- To increase the student competitiveness in securing jobs after graduation;
- To support the University initiative in producing holistic and balanced graduates in line with the first shift of the Malaysia Education Blueprint (Higher Education) 2015-2025.

The professional certification preparatory course is compulsory for all bachelor engineering degree students registered with the University starting from 2017/2018 intake and onwards. The students are expected to choose, register and complete one (1) professional certification preparation course before the end of their study. The Faculty will offer Basic Hydraulic Technology Certification Course (BELG 4710) and Programmable Logic Controller (PLC) Level 1 & 2 (BEEE 3210) from session 2019/2020.

For Engineering Technology, the professional certification will be offered under BITS 2610 Cisco Certified Network Associate Routing & Switching (Preparation), BEEE 4210 SMC MT1 - Practical Mechatronic 1, BEEE 3210 Programmable Logic Controller (PLC) Level 1 & Level 2, BEEC 2210 IoT Fundamentals: Connecting Things Professional Certification, BEEC 22200 IoT Fundamentals: Big Data & Analytics Professional Certification whereas for Technology program, the certification will be offered under BEEE 4210 SMC MT1-Practical Mechatronic 1, BEEE 3210 Programmable Logic Controller (PLC) Level 1 & Level 2, BEEC 2210 Iot FUNDAMENTALS: CONNECTING THINGS PROFESSIONAL CERTIFICATION, BEEC 22200 IoT Fundamentals: Big Data & Analytics Professional Certification.

As one of the world leading specialists for Drive and Control technology, Rexroth has a unique technologic expertise to be transferred to participants worldwide. Endorsed by the Drive & Control Academy Würzburg in Germany, a Basic Hydraulic Technology certification course provides participants with a basic hydraulic technology. In this certification course, participants will have experienced fundamental knowledge in hydrostatics, design of a hydraulic systems, graphical symbols, hydraulic fluids, hydraulic pumps and motors, hydraulic cylinders and hydraulic valves. Industrial related project will be exposed to the participants in order to imitate the real industrial environment employing hydraulic technologies. The duration of this course is 3 days.

OMRON Electronics is a leading electronics company from Japan that has been established for more than 20 years in Malaysia. In Malaysia, OMRON PLC technology is used by many companies in the manufacturing industry for process control and automation as well as the development of Industrial Revolution 4.0 technology. This course is designed to provide participants with the fundamental and hands on knowledge of Programmable Logic Controller (PLC) that used in the various field of automation industry. Participants would be exposed to theoretical and practical session about Programmable Logic Controller (PLC) from performing wiring diagram for input and output devices and develop a ladder diagram using its programming software for a specific industrial automation application task.

On top of that, faculty offers professional certification preparatory course for Electrical Energy Management that embedded in the Energy Utilization and Conservation course (BELP 4853). The course is outlined and approved by Suruhanjaya Tenaga and the students will benefit from the full appreciation of the regulation and develop the management skills required for an Energy Manager towards facilitating the green aspiration of our nation. Students who obtained at least grade B+ in the Energy Utilization and Conservation course and CGPA ≥ 2.5 will be awarded with a Certificate of Energy Management. Graduates who hold this certicate can apply to be a Registered Electrical Energy Manager (REEM) certified by the Suruhanjaya Tenaga with the following additional requirements:

i. one (1) year of working experience in the related field and
ii. submit a report related to item (i)

GRADING SYSTEM

Student's performance in every course is evaluated based on the grade obtained. Grading system is shown in **Table 1**.

Generally, minimum passing grade for a course is Grade D. However, grade D up to C- are categorized as conditional pass and the students are allowed to improve their grade by repeating the course only once.

Table 1: Grading System and Point

GRADE (ACHIEVEMENT)	RELATIONS BETWEEN MARKS PERCENTAGE AND GRADE POINT	
	MARKS PERCENTAGES	GRADE POINT
A (Excellent)	80 – 100	4.0
A- (Excellent)	75 – 79	3.7
B+ (Honours)	70 – 74	3.3
B (Honours)	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

GPA & CGPA CALCULATION

A student's overall achievement is based on Grade Point Average (GPA) obtained for a particular semester and Cumulative Grade Point Average (CGPA) for the semesters that have been completed.

Grade Point Average (GPA):

GPA is the grade point average obtained in a particular semester. It is based on the following calculations:

Total Points, JMN = $k_1m_1 + k_2m_2 + \text{........}k_nm_n$

Total Calculated Credit, JKK = $k_1 + k_2 + \text{........}k_n$

GPA = JMN / JKK
= $[k_1m_1 + k_2m_2 + \text{........}knmn] / [k_1 + k_2 + \text{........}k_n]$

Where : k_n = Credit for n subject
m_n = Points from the n subject

Cumulative Grade Point Average (CGPA):
GPA is the cumulative grade point average obtained for the semesters that have been completed. It is based on the following calculations:

GPA = $[JMN_1 + JMN_2 + \text{........}JMN_n] / [JKK_1 + JKK_2 + \text{........}JKK_n]$

Where: JMN_n = Total points obtained in n semester
JKK_n = Total credits in n semester

ACADEMIC CLASSIFICATION

A student's achievement is evaluated based on Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA). A student's academic status will be provided at the end of each semester based on CGPA as shown in **Table 2.**

Table 2: Academic Status Classification

STATUS	CGPA
Good (KB)	CGPA ≥ 2.00
Conditional (KS)	1.70 ≤ CGPA < 2.00
Fail (KG)	CGPA < 1.70

(Note: KB = Kedudukan Baik, KS = Kedudukan Bersyarat, KG = Kedudukan Gagal)

GRADUATION REQUIREMENT

PROGRAMME	GRADUATION REQUIREMENT
Diploma of Electrical Engineering	Award of a Diploma will be made in two (2) regular semesters. Students are only eligible to be awarded a Diploma after the following conditions are met: i. Students must obtain Kedudukan Baik (KB) in the last semester. ii. Minimum credit hours requirements for the award of a Diploma is 90 credits which consists of 70 credits of Core Program (P) courses including 8 credits of Industrial Training, 14 credits of Compulsory University (W) courses and 6 credits for Elective (E) courses. iii. Has applied for the award, recommended by the Faculty and approved by the Senate. iv. Other requirements set by the university.
Bachelor of Electrical Engineering with Honours	Award of a Degree will be made in two (2) regular semesters. Students are only eligible to be awarded a Degree after the following conditions are met: i. Students must obtain Kedudukan Baik (KB) in the last semester. ii. Passed all courses required for curriculum requirements: • Minimum credit hour requirements for the award of a Degree is 135 credits hour which consists of 103 credits of Core courses (P), 9 credits of Elective Program (E) courses, 4 credits of Elective University (E) courses, 5 credits of Industrial Training (P) and 14 credits of University Requirements (W) courses. iii. Has applied for the award, recommended by the Faculty and approved by the Senate. iv. Other requirements set by the university.
Bachelor of Mechatronics Engineering with Honours	Award of a Degree will be made in two (2) regular semesters. Students are only eligible to be awarded a Degree after the following conditions are met: i. Students must obtain Kedudukan Baik (KB) in the last semester. ii. Passed all courses required for curriculum requirements: • Minimum credit hour requirements for the award of a Degree is 135 credits hour which consists of 106 credits of Core courses (P), 6 credits of Elective Program (E) courses, 4 credits of Elective University (E) courses, 5 credits of Industrial Training (P) and 14 credits of University Requirements (W) courses. iii. Has applied for the award, recommended by the Faculty and approved by the Senate. iv. Other requirements set by the university.

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours	Award of a Degree will be made in two (2) regular semesters. Students are only eligible to be awarded a Degree after the following conditions are met: i. Students must obtain Kedudukan Baik Anugerah (KBA) in the last semester. ii. Passed all courses required for curriculum requirements: • Minimum credit hour requirements for the award of a Degree is **140** credits hour which consists of **82 credits of Core (K) courses, 17 credits of Program (P) courses, 9 credits of Elective Program (E) courses, 2 credits of Elective University (E) courses, 12 credits of Industrial Training (P)** and **18 credits of University Requirements (W) courses.** iii. Has applied for the award, recommended by the Faculty and approved by the Senate. iv. Other requirements set by the university.
Bachelor of Electrical Engineering Technology (Industrial Automation and Robotic) with Honours	Award of a Degree will be made in two (2) regular semesters. Students are only eligible to be awarded a Degree after the following conditions are met: i. Students must obtain Kedudukan Baik Anugerah (KBA) in the last semester. ii. Passed all courses required for curriculum requirements: • Minimum credit hour requirements for the award of a Degree is **140** credits hour which consists of **82 credits of Core (K) courses, 17 credits of Program (P) courses, 9 credits of Elective Program (E) courses, 2 credits of Elective University (E) courses, 12 credits of Industrial Training (P)** and **18 credits of University Requirements (W) courses.** iii. Has applied for the award, recommended by the Faculty and approved by the Senate. iv. Other requirements set by the university.
Bachelor of Electrical Engineering Technology with Honours	Award of a Degree will be made in two (2) regular semesters. Students are only eligible to be awarded a Degree after the following conditions are met: i. Students must obtain Kedudukan Baik Anugerah (KBA) in the last semester. ii. Passed all courses required for curriculum requirements: • Minimum credit hour requirements for the award of a Degree is **140 credits hour which consists of 78 credits of Core (K) courses, 17 credits of Program (P) courses, 9 credits of Elective Program (E) courses, 2 credits of Elective University (E) courses, 12 credits of Industrial Training (P) and 18 credits of University Requirements (W) courses.** iii. Has applied for the award, recommended by the Faculty and approved by the Senate. iv. Other requirements set by the university.

Bachelor of Technology in Electrical System Maintenance with Honours	Students are only eligible to be awarded a Degree after the following conditions are met: i. Students must acquire Kedudukan Baik Anugerah (KBA) in the last semester. ii. Have passed all the courses underlying the programme curriculum: • Minimum credit requirements for the award of a Degree is **122 credits which consists of 94 credits of Core (K) courses, 12 credits of Industrial Training (P) and 16 credits of University Requirements (W) courses.** iii. Have applied for the award as recommended by the faculty and approved by the Senate. iv. Have met other requirements set by the university.

GRADUATES CAREER PROSPECTS

DIPLOMA IN ELECTRICAL ENGINEERING

Demands for semi-professional level labour forces that are trained in electrical engineering are extremely high especially in the industrial sector. To respond to that, UTeM's Electrical Engineering diploma graduates are groomed with practical and application oriented knowledge so that they will be highly competitive in fulfilling the workforce markets.

BACHELOR IN ELECTRICAL ENGINEERING AND MECHATRONICS ENGINEERING

Vacancies within the industries for engineers that are skilled and practical-oriented is on the rise. Lots of highly trained workforces in the entire engineering sector including Industry Power, Control, Instrumentation and Automation, Power Electronics and Drive and Mechatronics in professional level are required. Job opportunities for UTeM graduates in these fields will be more desirable by the industry once they have been equipped with the technical knowledge and strong practical skills.

Field of works for Bachelor of Electrical Engineering and Mechatronics Engineering graduates include:

- Semiconductor manufacturing industries
- Electrical items manufacturing
- High and Low Voltage components manufacturing
- Renewable Energy sector
- Oil and Gas Industries
- Consultancies Companies
- High technology industries such as aerospace industries
- Automation System manufacturing industries
- Biomedical Engineering Firms
- Software Development Sector
- Research and development Sector

Some of the career fields that are suitable include Process and Manufacturing Engineer, Design and Research Engineer, Consultancies Engineer, Testing and Quality Engineer, System Engineer and Academicians.

BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY (INDUSTRIAL POWER) WITH HONOURS (BELK)
BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY (INDUSTRIAL AUTOMATION & ROBOTIC) WITH HONOURS (BELR)
BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY WITH HONOURS (BELT)

Demands for semi-professional level labour forces that are trained in electrical engineering are extremely high especially in the industrial sector. To respond to that, UTeM's Electrical Engineering diploma graduates are groomed with practical and application oriented knowledge so that they will be highly competitive in fulfilling the workforce markets.

- Building Maintenance Services
- Plant and Facilities Maintenance
- Transportation Industry
- Electrical Power Industry and Power Distribution
- Automotive Industry
- Research and Development
- Industrial Process Control
- Manufacturing Industries
- HVAC Industry
- Oil and Gas Industry

BACHELOR TECHNOLOGY OF ELECTRICAL SYSTEM MAINTENANCE WITH HONOURS (BELS)

Bachelor Technology program structure mainly focused on the job competency tailored to the specific technology areas together with the emphasis on the entrepreneurship element, it was designed with the solid support from related industries. This degree programme provides an understanding of the installation, operation, monitoring, integration, troubleshooting and maintenance of the electrical system that were operated in many areas including utilities, services, building, transportation, plants, machineries as well as in the manufacturing industries.

The graduates from this programme are expected to have the abilities of problem identification and propose the solution, come out with proof of concept, perform testing procedures, carry out verification and calibration as well as to plan maintenance schedule effectively.

Electrical Maintenance Technology

Electrical maintenance concentrates on the industrial environment and prepares students to maintain and repair electrical/electronic equipment used in government, commercial and industrial facilities. Graduates can look forward to jobs as electrical services technologist, field service technologist, electricians, electrical maintainers and or electrical equipment installers. Graduates of electrical technology programs capable of accommodating a wide range of career fields, such as:

- Building Maintenance Services
- Plant and Facilities Maintenance
- Transportation Industry
- Electrical Power Industry and Power Distribution
- Automotive Industry.
- Research and Development
- Industrial Process Control
- Manufacturing Industries
- HVAC Industry

SOFT SKILLS (KI)

Soft skills can be defined as the generic skills which have been identified as very critical in the global working environment apart from the fast pace of technological advancement.

The elements of Soft Skills that must be developed and implemented by each student are as follows:

1. Communication Skills (CS)
2. Creative Thinking and Problem Solving Skills (CTPS)
3. Teamwork Skills (TS)
4. Continual Learning and Information Management (LL)
5. Entrepreneurship Skills (ES)
6. Professional Ethics and Moral Values (EM)
7. Leadership Skills (LS)

Structure of Soft Skills Development in Institutional of Higher Learning Education:

1. Soft Skills Development via Formal Teaching and Learning Activities:
    - Stand Alone Course Model
    - Embedded Model
    - Combination of Embedded Model & Stand-Alone Course Model

2. Soft Skills Development via Supporting-Oriented Programme
    - Academic-Focused Supporting Programme
    - Non-Academic-Focused Supporting Programme

3. Soft Skills Development via Campus Activities and Lifestyle
    - Residential College
    - Campus Environment

ACADEMIC ADVISORY SYSTEM

In UTeM students are free to take courses offered by the Faculty at every semester based on their capability, as long as they comply with the rules and regulations set up by the Faculty and university academic rules. Students need to plan their own study carefully with the guide of their Academic Advisor during their study in the university.

CHARACTERISTICS OF THE SEMESTER SYSTEM

- Students are free to take any courses offered in each semester sequentially based on their ability and conditions of course selection determined by the Faculty and university's academics regulations.
- Students should plan programs of study and learning appropriate which will need the advices from Academic Advisor during the studies.
- Students who obtained UM (Ulang Mata pelajaran) status for a given course (Grade E), should retake the course in the following semester or when offered by the faculty.

THE IMPORTANCE OF AN ACADEMIC ADVISOR (PA)

- Students need to be given a proper advice in term of courses taken under the semester system, where they are free to determine the number of courses to be taken based on their capability or in the case the student obtained a Conditional Position in the previous semester. They need to plan carefully to take courses which are suitable for them to carry and fully aware on its implication to their whole study period in the university.
- Semester system is a flexible system for a student with high, moderate or less capability to complete their study based on their own capability comply to the maximum study period set up by the university.
- The Academic Advisor is able to provide an advice not only in the academic matter, but also in the aspects of how the students can adapt themselves to the semester system, culture shock of studying in the university, time management and private matters that may affect the students' study performance.
- In the condition where the student is not with the same batch of other students during the study period due to difference in the courses taken, difficulty may be expected for him/her to discuss on the matter of study with the others. Here, the Academic Advisor is importance to provide a proper guidance.

ROLES AND RESPONSIBILITIES OF STUDENT AND ACADEMIC ADVISOR/PENASIHAT AKADEMIK (PA) IN THE ACADEMIC ADVISORY SYSTEM ARE AS FOLLOW:

Roles/Responsibilities of Academic Advisor/ Penasihat Akademik (PA)	Roles/Responsibilities of Student
• Conduct a meeting with the students at least two times for every semester.	• Always be open minded when meeting with the Academic Advisor.
• Make sure to student understand the academic system in UTeM.	• Attend meeting with the Academic Advisor at least two times for every semester.
• Provide an advice and make sure student's courses registration is based on his/her current academic result.	• Make the Academic Advisor as a mentor and always get an advice on the academic matter.
• Supervise the student study progress and provide guidance in making a good study planning.	• Make sure to have a good understanding on the academic system.
• Provide student to always be motivated in their study etc.	• Provide a copy of examination result to the Academic Advisor at each semester.
• Supervise the student record and file to be always updated – make sure no course is missed to fulfil the requirement for degree award.	• Get the certification of registration form, copy of certificates and reference letter from the Academic Advisor.
• Refer the student to the head of department for further action if necessary.	• Always keep a record on all courses that already been taken during the period of study to prevent missed course and fulfill the requirement for degree award.
• Advice &monitor the student to keep record of their obtained grades for a given course as shown in Appendix A, B & C (Student Audit Form).	• Students are required to keep record of their obtained grades for a given course as shown in Appendix A, B & C (Student Audit Form).

FLOW OF ACADEMIC ADVISORY SYSTEM IN UTeM

1. Academic Advisor/ Penasihat Akademik (PA)
2. Head of Department
3. Deputy Dean (Academic)
4. Dean

LISTS OF THE FACULTY'S EXTERNAL EXAMINER, VISITING PROFESSOR, ADJUNCT PROFESSOR AND INDUSTRIAL ADVISORY PANEL

List of External Examiner

EXTERNAL EXAMINER	QUALIFICATIONS	APPOINTMENT PERIOD	PROGRAM
Prof. Ir. Dr. Hazlie Bin Mokhlis	The University of Manchester, UK PhD in Electrical Engineering	01.10.2023 - 30.09.2025	BELG
Prof. Ir. Dr. Khairul Salleh Bin Mohamed Sahari	Kanazawa University, Japan PhD in Engineering	01.09.2022 - 31.08.2024	BELM
Profesor Ts. Dr. Wan Zuha bin Wan Hasan	Universiti Putra Malaysia	01.05.2022- 30.04.2024	BELR
Profesor Madya Ts. Dr. Baharuddin bin Ismail	Universiti Malaysia Perlis	01.03.2022- 29.02.2024	BELS
Prof. Madya Ir. Dr. Ahmad Farid Bin Abidin	Universiti Kebangsaan Malaysia PhD in Electrical Engineering	01.12.2023 - 30.11.2025	DEL
Prof. Dr. Amir Akramin Bin Shafie	University of Dundee, United Kingdom PhD in Mechatronics Engineering	01.12.2021 - 30.11.2023	MEKH
Prof. Ir. Ts. Dr. Ismail Bin Musirin	Universiti Teknologi MARA PhD in Electrical Engineering	01.12.2021 - 30.11.2023	MEKG

List of Industrial Advisory Panel

INDUSTRIAL ADVISORY PANEL	POSITION	APPOINTMENT PERIOD	PROGRAM
Dr. Ir. Kenny Ang Teoh Ong	Post: Director Company: Control Easy Technology Sdn. Bhd.	01.09.2023 - 31.08.2025	BELG
Mr. Chai Seang EE	Post: Managing Director Company: Hitachi Cable (Johor) Sdn. Bhd.	01.09.2023 - 31.08.2025	BELG
Mr. Mohammad Faizal Ali	Post: Co-Founder and CEO Company: Vectolabs Sdn. Bhd.	01.09.2023 - 31.08.2025	BELG
Ir. Dr. Harriezan Ahmad	Post: Factory Manager/Director Company: Distribution Division, TNB	01.09.2023 - 31.08.2025	BELG
Ir. Mohd Tajuddin Romli	Post: Managing Director Company: TRMS Engineering Sdn. Bhd.	01.09.2023 - 31.08.2025	BELG
Ir. Mohd Yusrizal Mohd Yusof	Post: Managing Director Company: TNBRenewables Sdn. Bhd.	01.09.2023 - 31.08.2025	BELG
Ir. Rajmal Buang	Post: Director Company: RBW Engineering Sdn. Bhd.	01.09.2023 - 31.08.2025	BELG
Ir. Ts. Mohd Azlan Othman	Post: Chief of Electrical Engineer Company: JKR Melaka	01.09.2023 - 31.08.2025	BELG
Ir. Zaki Kudus	Post: Managing Partner Company: AHAR Consultants Sdn. Bhd.	01.09.2023 - 31.08.2025	BELG
Mr. Mohd Farius Sahari	Post: Senior Manager Company: Samsung SDIEM	01.09.2023 - 31.08.2025	BELG
Ir. Lin Shon Nyin	Post: Deputy Head Company: Health, Safety and Environment, TNB	01.09.2023 - 31.08.2025	BELG
Mr. Aminuddin Mohd Tayeb	Post: Managing Director, Company: East Automation & Engineering Sdn. Bhd.	01.12.2022-30.11.2024	BELM
Dr. Muhammad Sufyan Basri	Post: Project Consultant Company: MAP2U Sdn. Bhd.	01.12.2022-30.11.2024	BELM

INDUSTRIAL ADVISORY PANEL	POSITION	APPOINTMENT PERIOD	PROGRAM
Mr. Norazam Ismail	Post: Lean Six Sigma Manager Company: Ansell N.P Sdn. Bhd.	01.12.2022-30.11.2024	BELM
Ir. Hj. Mohd Khoushaini Hj.Mohd Naim	Post: Mechanical Engineer Company: PETRONAS Penapisan Melaka Sdn. Bhd.	01.12.2022-30.11.2024	BELM
En. Abdullah Zawawi bin Mohamed	Post: Head of Robotics and Product Development Company: Sime Darby	01.12.2022-30.11.2024	BELM
Ts. Dr. Mohd Hanafee Zin	Post: Technical Director Company: Databolt Sdn. Bhd.	01.12.2022-30.11.2024	BELM
Ir Abu Bakar bin Ishak	Post: Ketua Jurutera Mekanikal Company: Jabatan Kerja Raya Melaka	01.12.2022-30.11.2024	BELM
Mr. Vasanthan a/l Sakthi Velu	Post: Assistant Project Manager Company: Tan Chong Management Services Corporation Sdn. Bhd.	01.12.2022-30.11.2024	BELM
Ts. Mohd Hazwan Zulkefly	Post: Pegawai Eksekutif Kanan Company: SIRIM STS (Standard,Training & Consultancy Services)	01.12.2022-30.11.2024	BELM
En. Rick Loke	Post: Ketua Jualan SerantauCompany: Johnson Controls (M) Sdn. Bhd	01.12.2022-30.11.2024	BELM
Izwan bin Zainal Abidin	Post: Managing Director Company: Terra Drone Technology (M) Sdn. Bhd.	01.08.2022 -31.07.2024	BELK
Ir. Mohd. Riduan bin Mohd. Shariff	Post: Manager of Electrical Engineering Company: Petronas Penapisan (Melaka) Sdn. Bhd.	01.08.2022 -31.07.2024	BELK
Ts. Syed Zaini Putra Aljamalullail bin Syed Yusoff	Post: Director Company: Techcapital Resources Sdn. Bhd.	31.08.2020-30.08.2025	BELR

INDUSTRIAL ADVISORY PANEL	POSITION	APPOINTMENT PERIOD	PROGRAM
Ir. Dzulfarqeish bin Zainuddin	Post: Director Company: Jazro Technology Robotics Sdn. Bhd.	31.08.2020-30.08.2025	BELR
Ir. Ts. Mohamad Rhaiz bin Abdul Aziz	Post: Renewable Energy Project Engineer Company: Tenaga Nasional Bhd.	31.08.2020-30.08.2025	BELT
Ir. Ts. Dr. Mohd Firdaus bin Mohamad Idris	Post: Senior Engineer Company: Prasarana Malaysia Bhd.	01.08.2022 -31.07.2024	BELT
Ir. Ts. Nor Ziha binti Zainol Abidin	Post: Head of Technical Sales & Marketing Company: GSPARX Sdn. Bhd.	31.08.2020-30.08.2025	BELS
Shaharrudin bin Hj. Syahid	Post: Senior Equipment Engineer Company: SunPower Maxeon	31.08.2020-30.08.2025	BELS
Ir Ammar bin AlamShah	Post: enior Equipment Engineer Company: ARES Energy Sdn. Bhd	31.08.2020-30.08.2025	BELS
Encik Ghafar Bin Jenal	Post: Facilities Manager Company: Medivest Sdn. Bhd.	01.11.2022 - 31.10.2024	DEL
En. Mohd Zulkarnain Bin Rasimon	Post: Technical Executive Company: District Cooling (Putrajaya) Sdn. Bhd.	01.11.2022 - 31.10.2024	DEL
Ir. Mohamad Firdaus Bin Yon	Post: Head (Grid Solution Expertise) Company: TNB	01.09.2023 - 31.08.2025	MEKG
Ir. Azharuddin Bin Md Kassim	Post: CEO/Principal Engineer Company: Prestigious Discovery Sdn. Bhd.	01.09.2023 - 31.08.2025	MEKG
Mr. Poon Kean Yuen	Post: Pengarah Projek Company: Atlantic Blue Sdn. Bhd.	01.09.2023 - 31.08.2025	MEKG

INDUSTRIAL ADVISORY PANEL	POSITION	APPOINTMENT PERIOD	PROGRAM
Mr. Muslim Bin Abdullah Zaik	Post: Chief Executive Officer Company: Aeronerve Sdn. Bhd.	01.09.2023 - 31.08.2025	MEKH
Mr. Muhammad Arif Bin Abdul Rahman	Post: Senior Robotics Engineer Company: Petronas	01.09.2023 - 31.08.2025	MEKH
Dr. Siti Noor Aliah Binti Baharom	Post: Senior Research Officer Company: Engineering Research Centre, MARDI	01.09.2023 - 31.08.2025	Dr. Siti Noor Aliah Binti Baharom

DIPLOMA PROGRAMME
DIPLOMA IN ELECTRICAL ENGINEERING (DEL)

DIPLOMA IN ELECTRICAL ENGINEERING (DEL)

This program is intended to produce semi-professional graduates who possess strong engineering knowledge based on skills as assistant engineers. Apart from that, this program is a pathway for students with SPM qualification to further their studies to a higher level in their respective fields, especially the Electrical and Mechatronics Engineering Bachelor's Programme in UTeM.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO) - DIPLOMA PROGRAMME

Programme Educational Objective (PEO) are specific goals describing the expected achievement of graduates in their career and professional life after a few years of graduation. Below are the PEO for the Faculty of Electrical Technology and Engineering's Diploma Programme.

NO	PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
	The objectives of this program is to produce graduates that, after three to five years of completing studies,
1.	Graduates will be Assistant Engineers who are knowledgeable and technically competent in related engineering/engineering technology field, as demonstrated through career progression.
2.	Graduates will be Assistant Engineers who are able to communicate professionally with society at large and being ethical and responsible in performing leadership role in an organisation.
3.	Graduates will be Assistant Engineers who have vision in developing their self and career through lifelong learning or involve in techno-preneurs sector.

PROGRAMME OUTCOMES (PO) - DIPLOMA PROGRAMME

Programme Outcome (PO) are statements describing what students are expected to know and be able to perform or attain by the time of graduation. These are related to the knowledge profile (DK1-DK7) that students acquire throughout the programme.

Below is the list of Programme Outcomes for Faculty of Electrical Technology and Engineering's Diploma Programme:

NO	PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
	Upon graduation, graduates should be able to :-
1.	Knowledge: Apply knowledge of applied mathematics, applied science, engineering fundamentals and an engineering specialisation as specified in DK1 to DK4 respectively to wide practical procedures and practices.
2.	Problem analysis: Identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity (DK1 to DK4).
3.	Design/development of solutions: Design solutions for welldefined 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 (DK5).
4.	Investigation: Conduct investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements.
5.	Modern Tool Usage: Apply appropriate techniques, resources, and modern engineering and IT tools to well-defined engineering problems, with an awareness of the limitations (DK6).
6.	The Engineer and Society: 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 (DK7).
7.	Environment and Sustainability: Understand and evaluate the sustainability and impact of engineering technician work in the solution of well-defined engineering problems in societal and environmental contexts (DK7).
8.	Ethics: Understand and commit to professional ethics and responsibilities and norms of technician practice.
9.	Individual and Team Work: Function effectively as an individual, and as a member in diverse technical teams.
10.	Communications: 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.
11.	Project Management and Finance: 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.
12.	Life Long Learning: Recognise the need for, and have the ability to engage in independent updating in the context of specialised technical knowledge.

COURSE IMPLEMENTATION - DEL

The number of credits required to be awarded a Diploma is 90 credits.

This course will take two (2) years and eight (8) months minimum which emphasis on the latest technology and up to date skills. The composition of the credits is as follows:

COMPONENTS		CREDIT HOURS	PERCENTAGE
Compulsory University Course (W)		14	15.56%
Core Course (P)	Engineering	58	77.78%
	Science & Mathematics	12	
Elective (E)		6	6.66%
Total		**90**	**100%**

This course is based on practical and application oriented where the student will be involved in laboratory experiments, computer aided learning, working on practical assignments in electrical engineering workshop. UTeM is the first to conduct this type of Diploma.

CURRICULUM STRUCTURE - DEL

Students are required to keep record of their obtained grades for a given course as shown in Appendix A (Student Audit Form - DEL) for graduation purpose.

TYPE OF		YEAR 1					YEAR 2			YEAR 3	
COURSE	SPECIAL SEMESTER	SEMESTER 1		SEMESTER 2	SPECIAL SEMESTER		SEMESTER 3	SEMESTER 4		SEMESTER 5	
CORE PROGRAM (P)		DELA 1212 ALGEBRA	SEMESTER BREAK	DELA 1222 CALCULUS	DELC 1313 MICROPROCESSOR	LONG SEMESTER BREAK	DELA 2333 DIFFERENTIAL EQUATIONS	DELA 2342 ENGINEERING MATHEMATICS	LONG SEMESTER BREAK	DELU 3118 INDUSTRIAL TRAINING	
		DELA 1113 PHYSICS		DITG 1113 COMPUTER PROGRAMMING	DELA 1312 SAFETY AND HEALTH FOR ENGINEERS		DELE 2123 POWER ELECTRONICS	DELP 2213 POWER SYSTEM			
		DELE 1113 PRINCIPLE OF ELECTRICAL AND ELECTRONICS		DELE 1213 ANALOGUE ELECTRONICS			DELC 2113 CONTROL SYSTEM ENGINEERING	DELP 2214 DIPLOMA PROJECT			
		DELE 1123 DIGITAL ELECTRONICS		DELP 1213 ELECTRICAL CIRCUIT I			DELE 2113 ELECTRICAL MACHINE				
		DELC 1113 INSTRUMENTATION & MEASUREMENT		DMKU 1163 INTRODUCTION TO MECHANICAL SYSTEM			DELP 2113 ELECTRIC CIRCUIT II				
		DELP 1111 BASIC ELECTRICAL SKILL		DELP 1211 ELECTRICAL WORKSHOP			DELC 2123 AUTOMATION				
CREDIT HOUR SEMESTER		15		15	5		18	9		8	70
ELECTIVE (E)								CHOOSE 2 OUT OF 3 ELECTIVE COURSE			
								DELP 2223 RENEWABLE ENERGY AND APPLICATION			
								DELP 2233 BUILDING MAINTENANCE AND MANAGEMENT			
								DELC 2213 INDUSTRIAL ROBOTIC			
								6			6
UNIVERSITY REQUIREMENT (W)	DLLW 1112 FOUNDATION ENGLISH	DLLW 2122 ENGLISH FOR EFFECTIVE COMMUNICATION		DLLW 3132 ENGLISH FOR MARKETABILITY	DTMW 1012 FUNDAMENTALS OF ENTREPRENEURSHIP ENCULTURATION						
	DLHW 1742 LEADERSHIP	DKKX 1XX1 CO-CURRICULUM I		DKKX 2XX1 CO-CURRICULUM II							
	DLHW 2772 APPRECIATION OF ETHICS AND CIVILISATIONS										
CREDIT HOUR SEMESTER	6	3		3	2						14
TOTAL CREDIT	6	18		18	7		18	15		8	90

CREDIT HOURS - DEL

Students are required to keep record of their obtained grades for a given course as shown in Appendix A (Student Audit Form - DEL) for graduation purpose.

SEMESTER	CODE	COURSE	CATEGORY	CREDIT HOUR
SPECIAL SEMESTER	DLLW 1112	FOUNDATION ENGLISH	W	2
	DLHW 1742	LEADERSHIP	W	2
	DLHW 2772	APPRECIATION OF ETHICS AND CIVILISATIONS	W	2
			TOTAL	**6**
SEMESTER 1	DELA 1212	ALGEBRA	P	2
	DELA 1113	PHYSICS	P	3
	DELP 1111	BASIC ELECTRICAL SKILL	P	1
	DELE 1113	PRINCIPAL OF ELECTRICAL AND ELECTRONICS	P	3
	DELE 1123	DIGITAL ELECTRONICS	P	3
	DELC 1113	INSTRUMENTATION & MEASUREMENT	P	3
	DLLW 2122	ENGLISH FOR EFFECTIVE COMMUNICATION	W	2
	DKKX 1XX1	CO-CURRICULUM I	W	1
			TOTAL	**18**
SEMESTER 2	DELA 1222	CALCULUS	P	2
	DELP 1213	ELECTRICAL CIRCUIT I	P	3
	DMKU 1163	INTRODUCTION TO MECHANICAL SYSTEM	P	3
	DITG 1113	COMPUTER PROGRAMMING	P	3
	DELE 1213	ANALOGUE ELECTRONICS	P	3
	DELP 1211	ELECTRICAL WORKSHOP	P	1
	DLLW 3132	ENGLISH FOR MARKETABILITY	W	2
	DKKX 2XX1	CO-CURRICULUM II	W	1
			TOTAL	**18**
SPECIAL SEMESTER	DELA 1312	SAFETY AND HEALTH FOR ENGINEERS	P	2
	DELC 1313	MICROPROCESSOR	P	3
	DTMW 1012	FUNDAMENTALS OF ENTREPRENEURSHIP ENCULTURATION	W	2
			TOTAL	**7**
SEMESTER 3	DELA 2333	DIFFERENTIAL EQUATIONS	P	3
	DELE 2123	POWER ELECTRONICS	P	3
	DELC 2113	CONTROL SYSTEM ENGINEERING	P	3
	DELE 2113	ELECTRICAL MACHINE	P	3
	DELP 2113	ELECTRIC CIRCUIT II	P	3
	DELC 2123	AUTOMATION	P	3
			TOTAL	**18**
SEMESTER 4	DELA 2342	ENGINEERING MATHEMATICS	P	2
	DELP 2213	POWER SYSTEM	P	3
	DELP 2214	DIPLOMA PROJECT	P	4
		CHOOSE ONLY TWO (2) COURSES		
	DELP 2223	RENEWABLE ENERGY AND APPLICATION	E	3
	DELP 2233	BUILDING MAINTENANCE AND MANAGEMENT	E	3
	DELC 2213	INDUSTRIAL ROBOTIC	E	3
SEMESTER 5	DELU 3118	INDUSTRIAL TRAINING	P	8
			TOTAL	**8**
			TOTAL CREDIT	**90**

P = Core Program, W = University Requirement, E = Elective

STUDENT LEARNING TIME - DEL

Semester	Code	Course	Face-to- Face Learning				Self Learning Activities	Formal Assessment	Total
			Teacher Centered (TC)	Student Centered Learning (SCL)			Student Direct Learning/ Revision/ Exercise (hours)	Continuous Learning + Final Examination	
			Lecture (2 hours/ session)	Tutorial (1 hour/ session)	Practical (3 hours/ session	PBL/ Mini Project Other SCL Activities (3 hours/ session)			
Special Semester	DLLW 1112	FOUNDATION ENGLISH	28	3			45	4	80
	DLHW 1742	LEADERSHIP	28	3			45	4	80
	DLHW 2772	APPRECIATION OF ETHICS AND CIVILISATIONS	28	3			45	4	80
1	DLLW 2122	ENGLISH FOR EFFECTIVE COMMUNICATION	28	3			45	4	80
	DKKX 1XX1/ 2XX1	CO-CURRICULUM			40				40
	DELA 1113	PHYSICS	28	4	24		59.2	5	120.2
	DELA 1212	ALGEBRA	28	3			45	4	80
	DELE 1113	PRINCIPLE OF ELECTRICAL AND ELECTRONICS	28	4	24		59.2	5	120.2
	DELC 1113	INSTRUMENTATION & MEASUREMENT	28	4	24		59.2	5	120.2
	DELE 1123	DIGITAL ELECTRONICS	28	4	18	6	59.2	5	120.2
	DELP 1111	BASIC ELECTRICAL SKILL			25		14.5	0.5	40
2	DLLW 3132	ENGLISH FOR MARKETABILITY	28	3			45	4	80
	DELA 1222	CALCULUS	28	3			45	4	80
	DITG 1113	COMPUTER PROGRAMMING	28	4	24		59.2	5	120.2
	DMKU 1163	INTRODUCTION TO MECHANICAL SYSTEM	28	4	24		59.2	5	120.2
	DELP 1213	ELECTRICAL CIRCUIT I	28	4	24		59.2	5	120.2
	DELP 1211	ELECTRICAL WORKSHOP			25		14.5	0.5	40
	DELE 1213	ANALOGUE ELECTRONICS	28	4	24		59.2	5	120.2
	2XX1	CO-CURRICULUM II			40				40
Special Semester	DTMW 1012	FUNDAMENTALS OF ENTREPRENEURSHIP ENCULTURATION	28	3			45	4	80
	DELC 1313	MICROPROCESSOR	28	4	18	6	59.2	5	120.2
	DELA 1312	SAFETY AND HEALTH FOR ENGINEERS	28	6	3		40.75	2.25	80
3	DELP 2113	ELECTRICAL CIRCUIT II	28	4	24		59.2	5	120.2
	DELE 2123	POWER ELECTRONICS	28	4	24		59.2	5	120.2
	DELA 2333	DIFFERENTIAL EQUATIONS	42	7			64.8	6.75	120.55
	DELE 2113	ELECTRICAL MACHINES	28	4	24		59.2	5	120.2
	DELC 2123	AUTOMATION	28	4	18	6	59.2	5	120.2
	DELC 2113	CONTROL SYSTEM ENGINEERING	28	4	24		59.2	5	120.2
4	DELA 2342	ENGINEERING MATHEMATICS	28	3			45	4	80
	DELP 2213	POWER SYSTEM	28	4	24		59.2	5	120.2
	DELP 2214	DIPLOMA PROJECT				20	140		160
	CHOOSE ONLY TWO (2) ELECTIVE COURSES								
	DELP 2223	RENEWABLE ENERGY AND APPLICATION	28	4	24		59.2	5	120.2
	DELP 2233	BUILDING MAINTENANCE AND MANAGEMENT	28	4	24		59.2	5	120.2
	DELC 2213	INDUSTRIAL ROBOTIC	28	4	24		59.2	5	120.2
5	DELU 3118	INDUSTRIAL TRAINING					320		320
		TOTAL HOURS	**798**	**108**	**520**	**21**	**2025.95**	**131**	**3603.95**

COURSE DETAILS FOR DIPLOMA PROGRAMME (DEL)

DELA 1212
ALGEBRA

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe the graph of functions and perform the operation on polynomial using appropriate method.
2. Evaluate the trigonometric functions and its engineering application using trigonometric properties.
3. Solve the linear system and its engineering application using properties of matrix.
4. Solve equations of complex numbers using appropriate theorem.

Synopsis

This subject serves as a fundamental mathematics course for engineering students. This subject discusses about the functions and graphs including the unit step function, polynomials including partial fractions and numerical interpolation, matrices and systems of linear equations using analytical and numerical techniques, trigonometry and complex numbers. Through this subject, the students are exposed to various techniques in solving mathematical problems and its application in engineering fields.

References

1. James Stewart, Lothar Redlin, Saleem Watson, Precalculus: Mathematics for Calculus, Cengage Learning, 2016.
2. Robert Blitzer, Precalculus, Pearson, 2018.
3. Ron Larson, Algebra and Trig: With CalcChat and CalcView, Cencage Learning, 2016.
4. Steven Chapra, Numerical Methods for Engineers, 7th Edition, Mc Graw Hill, 2015.

DELE 1123
DIGITAL ELECTRONICS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe the concept of digital electronics system such as basic numbering system, combinational logic circuit and types of gate.
2. Solve problems based on provided information by using basic gates, MSI, flip-flop and latch.
3. Develop and construct a solution using digital logic circuit.
4. Demonstrate the ability to use appropriate engineering tool in the application of digital logic circuit.
5. Comply with the given project timeline planning.
6. Search, manage and synthesis related information in order to support the proposed solution.

Synopsis

This course will equip students with basic principle, techniques and conventions used in digital electronic circuit design. It will covers topics such as numbering systems and codes, types of basic logic gates, formulation of logic equations and logic circuits schematics, manipulations of logic expression using boolean algebra and DeMorgan' theorem, combinational logic circuits design using SOP, POS and K-Map, basic concept of integrated circuit logic families, MSI logic circuits applications and schematic circuits, and implementations counters and registers using latches and flip flops.

References

1. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson, 2015.
2. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital Systems : Principles and Applications, 12th Edition, Pearson 2017.

3. Albert, Malvino, Donald Leach, Digital Principles and Applications, 7th Edition, McGraw Hill,2010.
4. David Buchla, Experiments In Digital Fundamentals, 10th Edition, Prentice Hall 2008.
5. Floyd, Instructor's Resource Manual To Accompany Digital Fundamental, 10th edition, Pearson, 2009.

DELA 1113
PHYSICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain basic concept in physics, covering aspect such as mechanics, fluid mechanics and electric.
2. Use concepts systematically to solve problems in mechanics, fluid mechanics and electric.
3. Demonstrate the ability of performing experimental works involving mechanics, fluid mechanics and electric.

Synopsis
This course covers three major fields which are mechanics, fluid mechanics and electric. The topics covers 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, Electric Forces and Fields, Electric Potential, Electric Current and Circuits, Magnetic Forces and Fields, Electromagnetic Induction. Experiments covered Mechanics and Electricity.

References
1. Serway, R. A., Jewett, J. W., Physics for Scientists and Engineers with Modern Physics 10th Edition, Cengage Learning, 2019.
2. Robert Blitzer, Precalculus, Pearson, 2018.
3. Walker, J. S., Physics, 5th Edition, Pearson, 2016.
4. Giambatista, A., Richardson, B. M. and Richardson, R. C., College Physics, 4th Edition, Mc-Graw Hill, 2013.
5. Giancolli, D. C., Physics for Scientists and Engineers with Modern Physics, 4th Edition, Pearson Prentice Hall, 2009.

DELC 1113
INSTRUMENTATION & MEASUREMENT

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Understand of electrical measurement and instrumentation principles.
2. Analyze various methods/techniques involve in measurement and instrumentation of electrical engineering.
3. Demonstrate related experiment on measurement and instrumentation of electrical engineering.
4. Work effectively in group to complete the given tasks based on electrical engineering problem.

Synopsis
This subject discusses about units and dimensions, standards, errors, static characteristic, noise and calibration in measurement. It covers most on the measurement devices such as galvanometers, ammeters, voltmeters, AC/DC meters, sensors, transducers, signal conditioning as well as bridges. It also introduces the principle of data acquisation system used in instrumentation.

References
1. H S Kalsi, Electronic Instrumentation, Tata-McGraw-Hill Publishing, 3rd Edition, 2010.
2. UA Bakshi, AV Bakshi and KA Bakshi, Electronic Measurements and Instrumentation, Technical Publications Pune, 2009.
3. S Wolf, Richard F.M Smith, Reference Manual for Electronic Instrumentation Laboratories 2nd Ed., Prentice-Hall, 2004.
4. Calibration Book, Vaisala Oyj, Vaisala 2006.
5. BC Nakra and KK Chaudry, Instrumentation, Measurement and Analysis, 2nd Ed., Tata Mc Graw Hill, 2004.

DELE 1113
PRINCIPLE OF ELECTRICAL AND ELECTRONICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyze electrical circuits using appropriate rules and basic laws.
2. Analyze electronics circuits using appropriate rules and laws.
3. Measure electrical and electronics circuit parameters using appropriate tools.

Synopsis
This course will expose students to the fundamental knowledge in electrical and electronics engineering. It covers topics related to basic laws and introduction to electronics devices that usually used in electrical and electronic circuits. It starts with an introduction to basic element in electrical and electronics such as voltage, current and circuit elements. Then the student will be introduced to basic laws in circuit analysis such as Ohm's law, voltage, and current divider and Kirchoff's law. After that, the electronics devices will be introduced to the student including an introduction to semiconductors, diode, BJT, FET, and its analysis and applications.

References
1. C.K. Alexander and M.N.O. Sadiku, Fundamentals of Electric Circuit, 6th Ed 2017, McGraw Hill.
2. J.W. Nilson, S.A.Riedel, Electric Circuits, 10th Ed 2015, Pearson Education, Inc
3. Boylestad R., L. Nashelsky, Electronic Devices and Circuit Theory, Pearson Education Inc., Eleventh Edition 2013
4. T.L. Floyd, Principles of Electric Circuits, 9th Ed 2013, Pearson Education, Inc.

DELP 1111
BASIC ELECTRICAL SKILLS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply the knowledge of basic electronic measurement, basic microcontroller programming, and electronic soldering processes.
2. Demonstrate appropriate instruments/tools handling skills required to solve engineering problems adequetly.
3. Comply with rules, procedure and ethics skills through experiment project.
4. Cooperate effectively as a teamwork during laboratory activities.
   Search, manage and synthesis related information in order to further apprehend their laboratory activities.

Synopsis
In this workshop, students will be exposed to three basic engineering work; Basic Electronic Measurement, Basic microcontroller programming, and Basic introduction to electronic components and soldering process. For the first session, student will be introduced to use several measurement equipment such as voltmeter, ammeter, multimeter, oscilloscope, etc for a given circuit, students need to measure the current and voltage at certain load. After that, student will be exposed to the basic microcontroller programming which is able to control the circuitry design in real time hardware assembling process (arduino circuitry) is carried out and will be assess with a mini project at the end of the session.

References
1. Graphic Symbols for Electrical and Electronics Diagrams, IEEE Std 315-1975 (Reaffirmed 1993).
2. Aminurrashid N., Mohd Hanif C.H., Mohd Razali M.S., & Sulaiman, S. Proteus Professional Design, FKE Resource. UTeM.2011.
3. Arduino for Dummies, 2nd Edition. Nussey John. 2018.

DELP 1213
ELECTRICAL CIRCUIT I

Learning Outcome
Upon completion of this course, the student should be able to:
1. Introduction to basic law in electric circuit and apply method of analysis.
2. Apply and solve circuit theorems in analyzing electrical circuits.
3. Analyze circuits using appropriate simulation and hardware tools.

Synopsis
This subject starts with refresh the student on basics circuit law's using Ohm's law and Kitchhoff's Law. which will cover the active and passive elements, resistive circuit. Student also learn the analytical methods namely mesh and nodal analysis, as well as apply Thevenin's and Norton's Theorems, Superposition Theorem and maximum power transfer in circuit analysis. Power in electrical circuit and maximum power transfers. Basic concepts to two port network and also introduction to PSpice for circuit's analysis. The application of the method will be focusing only on dc circuit analysis.

References
1. C.K. Alexander and M.N.O. Sadiku, Fundamentals of Electric Circuits, 5th Ed, McGraw-Hill, (2013).
2. J.W. Nilsson and S.A. Riedel, Electric Circuits, 9th Ed, Pearson Education, Inc, (2011).
3. Boylestad R., L. Nashelsky, Electronic Devices and Circuit Theory, Pearson Education Inc., Eleventh Edition 2013.
4. T.L. Floyd, Principles of Electric Circuits, 9th Ed 2013, Pearson Education, Inc.

DELA 1222
CALCULUS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify limits and continuity of functions using computational methods of limits.
2. Solve derivatives of algebraic, trigonometric, logarithmic and exponential functions using differentiation techniques.
3. Solve integrals of algebraic, trigonometric, logarithmic and exponential functions using integration techniques.
4. Apply the knowledge of calculus to deal with the engineering problems.

Synopsis
This subject enchances two main parts in Calculus which consists of differential and integral which will be solved using analytical and numerical techniques. This subject serves to give students good understanding knowledge the basic concept of derivative and integration in solving application related to mathematics and engineering problems.

References
1. Abd Wahid et. Al, The First Course of Calculus for Science and Engineering Students, Penerbit UTHM, 2013.
2. James Stewart, Calculus, 8th Edition, Cengage Learning, 2016.
3. Ron Larson & Bruce Edwards, Calculus of a Single Variable, 11th Edition, Cengage Learning, 2018.
4. Steven Chapra, Numerical Methods for Engineers, 7th. Edition, Mc Graw Hill, 2015.

DELE 1213
ANALOGUE ELECTRONICS

Learning Outcomes
Upon completion this course, the students should be able to:
1. Define the characteristics and operation of the BJT, Power Amplifier and Operational Amplifier.
2. Analyse the characteristics and operation of the Active Filter, Voltage Regulator, and Feedback and Oscillator.
3. Conduct and demonstrates practical experiments of BJT, Power Amplifier, Operational Amplifier, Active Filter, Voltage Regulator, and Feedback and Oscillator.
4. Work effectively in group to complete the given tasks based on electrical engineering problem.

Synopsis
This subject serves as an electronic fundamental course for engineering students. The topics that will be covered including the BJT, Power Amplifier, Operational Amplifier, Active Filter, Voltage Regulator, and Feedback and Oscillator. Introduction to the use of P-Spice and Proteus simulation software for circuit designing as well as hardware experiments during laboratory will be implemented.

References
1. Boylestad R., L. Nashelsky, Electronic Devices and Circuit Theory, Pearson Education Int., Eleventh Edition 2015.
2. Thomas L. Floyd, Electronic Devices: Conventional Current Version, Pearson Education Limited, Tenth Edition, 2018.

DELP 1211
ELECTRICAL WORKSHOP

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Demonstrate appropriate troubleshoot skills on relay control circuit and domestic wiring installation.
2. Ability to apply and use engineering drawing software tools for design electrical system.
3. Demonstrate the ability to awernes the safety, regulation and responsibility through practical competence on the relay control circuit and domestic wiring installation.
4. Demonstrate the ability to work in a team for the practical competence on circuitry design.
5. Demonstrate the ability to work in a team for the practical competence on circuitry design.

Synopsis
This workshop will expose student to relay control circuit, and domestic wiring installation. Concentration is given on the safety aspects and quality of works. The students also will be exposed the basic engineering software AutoCAD where to the 2D basic engineering drawing in which involve creating, editing, plotting and electrical services system.

References
1. Ir Md Nazri, Aminudin, Md Hairul Nizam, Engineering Practice: Wiring System & Motor Starter, Modul 2, UTeM, 2007.
2. Leach, J. A. Autocad Instructor 2020: A Student Guide for In-depth Coverage of Autocad's Commands and Features, SDC Publications, 2016.
3. Garis Panduan Pendawaian Elektrik Pepasangan Domestik, Suruhanjaya Tenaga, 2016.
4. Teo Cheng Yu, Principles and Design of Low Voltage System, 2nd Ed, Byte Power Publications, Singapore, 2012.

DELC 1313
MICROPROCESSOR

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Able to describe microprocessor (Motorola 68000) architecture, its operation and the interfacing circuitry of microprocessor-based systems.
2. Develop and construct a microprocessor based system including writing instruction set in assembly language.
3. Demonstrate the ability to work in a team for the microprocessor based project.
4. Present in oral and written regarding output of microcontroller-based system project.
5. Demonstrate the basic skills of project management in managing the microprocessor based project.
6. Demonstrate the element of self learning in the microprocessor based project.

Synopsis
This course is about introduction to microprocessor architecture, instruction set, addressing mode, assembly language programming and interrupt. The course covers the concept of interfacing technique with memory device and peripheral, parallel and serial interfacing, interfacing with ADC/DAC, data sampling technique, system simulation and emulation based on actual microprocessor.

References
1. Antonakos, J. L., The 68000 Microprocessor: Hardware and Software Principles and Applications 5th edition, Prentice Hall, 2004.
2. Clements, A., Microprocessor Systems Design: 68000 Hardware, Software, and Interfacing 3rd edition, PWS, 1997.
3. Gilmore C.M., Microprocessor: Principles and Applications, McGraw Hill, 1996.
4. Short K.L., Embedded Microprocessor Systems Design, Prentice Hall, 1998.
5. Wilcox A.D., 68000 Microcomputer Systems, Prentice Hall, 1997.

DELA 1312
SAFETY AND HEALTH FOR ENGINEERS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Demonstrate an understanding of knowledge with the types of hazard and workplace injury prevention, risk management, planning, organization, training and incident investigations.
2. Identify the Occupational Safety and Health knowledge, practices and responsibilities.
3. Collect and sort the relevant to the given talk of safety standards and regulations that must be maintained in compliance with regulatory requirements and within engineering limits.
4. Discuss current engineering safety and health issues and practices that impacting engineering professionals
5. Recognize the important of safety and health that need to be engage during professional work.

Synopsis
The main purpose of this course is to instill the recognition of the need for and the ability to engage in life-long learning among students. Students will be exposed to topics such as Occupational Safety and Health, industrial safety, quality management concept and various quality tools and knowledge of contemporary safety and health issues in related to engineering fields. Presentation case study by the student with a given topic of safety and health will also be included.

References
1. Roger L. Brauer, Ph.D., CSP, PE, Safety and Health for Engineers, Second Edition, Wiley- Interscience. (2006).

2. Occupational Safety and Health Master Plan 2016-2020, Department of Occupational Safety and Health, Ministry of Human Resources, Malaysia (2016).
3. ACT 514: OCCUPATIONAL SAFETY AND HEALTH ACT 1994.
4. ACT 139: FACTORIES AND MACHINERY ACT 1967 (REVISED - 1974) Incorporating latest amendment - Act A1268 of the year 2006.

DELC 2123
AUTOMATION

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain and apply the concept of Automation, Programmable Logic Controller (PLC) and their components.
2. Analyze and solve well-defined problems based on provided information by using PLC, Pneumatic, Hydraulic and other automation components.
3. Construct and demonstrate automation system based on design requirement, symbols and schematic diagram.
4. Demonstrate an understanding and able to evaluate the sustainability and impact of the automation system design.
5. Demonstrate the ability to work in a team for the practical competence on PLC, Pneumatic and Hydraulic circuitry design.

Synopsis
This course will introduce a fundamental of the automation in manufacturing sector, their components such as actuators, sensors as well linear and rotary transportation devices. It will also cover on programmable logic controller (PLC) as the main controller including its definition, main hard components, PLC programming languages, interfacing PLC with computers. At the end of this course, students will able to solve automation problems and capable to integrate PLC hardware and software with their components.

References
1. D. Petruzella, Frank Programmable Logic Controller, 4th. Ed. McGraw Hill. 2011.
2. Mikell P. Groover, Automation, Production Systems & Computer-Integrated Manufacturing, 3rd Ed. 2008.
3. Hugh Jack, Automating Manufacturing Systems. Ver 5.0. 2007.
4. LA Bryan & EA Bryan, Programmable Controller: Theory and Implementation, 2nd Ed. Industrial Text, 2007.
5. IEC 61131 Standards for Programming Manuals.

DELC 2113
CONTROL SYSTEM ENGINEERING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe fundamental knowledge of control system and the transient response of a linear time invariant system.
2. Develop a mathematical model for a linear time invariant system.
3. Analyze a linear time invariant system in time and frequency domain.
4. Search, manage and synthesize information to solve control problems in frequency domain using root locus and/or bode plot techniques.
5. Demonstrate experiments of control systems as well as to analyze and interpret data.

Synopsis
This subject will discuss about the concepts in control system; open and closed loop system; transfer function; signal flow graphs; feedback control system; modeling for electrical system, mechanical system; analysis in time and frequency domain responses and also stability in time and frequency domain.

References

1. Nise, S Norman, Control Systems Engineering, 8th Edition, John Wiley & Sons Inc., 2019.
2. Dorf, R.C. & Bishop, R.H., Modern Control Systems, 13th Edition, Prentice Hall, 2016.
3. Kumar, A.A, Control System, 7th Edition, PHI Learning Private Limited, 2012.
4. Ogata, Katsuhiko, Modern Control Engineering, 5th Edition, Prentice Hall, 2010.
5. Syed Najib, Azrita Alias, Aliza Che Imran, Sahazati Md Rozali, Saleha Mohamed Salleh, Basic Control System, Penerbit Universiti Teknikal Malaysia Melaka, 2008.

DELE 2123
POWER ELECTRONICS

Learning Outcomes

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

1. Explain the semiconductor power switches and analyze the performance of rectifiers, choppers and inverters in power converter application.
2. Demonstrate the ability of performing experimental works involving power electronics converters and devices.
3. Demonstrate the ability of communication skills through project presentation.

Synopsis

This course is about the basic principles of power electronics, semiconductor power switches single and three- phase inverter, the application of semiconductor devices in power electronics converters such as AC to DC, AC to AC, DC to DC and DC to AC converters, circuits as DC drives, AC drives and snubbers.

References

1. Daniel W. Hart, Power Electronics International Edition, Mc-Graw Hill, 2011.
2. Muhammad H. Rashid. Power Electronics Circuits, Devices, and Applications, 3rd Edition, Pearson, 2009.
3. Issa Batarseh, Power Electronics - Circuit Analysis and Design, Springer, 2018.
4. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics Converters, Applications and Design, 3rd Edition, John Wiley and Sons, 2003.
5. V.R Moorthi, Power Electronics - Devices, Circuits and Industrial Applications, Oxford, 2005.

DELA 2333
DIFFERENTIAL EQUATIONS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe the fundamental concepts of the first and second order differential equations, Laplace transform and Fourier Series.
2. Solve differential equation using an appropriate technique.
3. Apply the knowledge of differential equation to deal with the engineering problems.

Synopsis

This subject consists of 5 chapters: First order linear differential equations, Second order linear differential equations with constants coefficients, Laplace transform, Fourier series and Partial Differential Equations. The syllabuses are developed based on these three different stages which are exposing the learner's on the fundamental concept of differential equation, various techniques to solve different equation and lastly, apply the various solving techniques to the learner's engineering problem.

References

1. Rahifa et. al, Differential Equations for Engineering Students, Penerbit UTeM 2019.

2. Abd Wahid Md Raji & Mohd Nor Mohamad, Differential Equations for Engineering Students, 2016.
3. Dennis G. Zill, Differential Equations with Boundary Value Problems, 9th Edition. Cencage Learning, 2018.
4. Steven Chapra, Numerical Methods for Engineers, 7th. Edition, Mc Graw Hill, 2015.

DELE 2113
ELECTRICAL MACHINES

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe and apply the principle of AC voltage and current in RLC single phase circuits.
2. Apply transient analysis on first order and second order electric circuits and conduct steady state analysis to solve AC circuit.
3. Demonstrate the ability to use appropriate engineering tool to analyse transient response and steady state parameters of AC circuit by simulation and hardware.
4. Search, manage and synthesize information related to AC electrical system.

Synopsis
Introduction to DC and AC type of electrical machines which cover physical construction, equivalent electrical circuit diagrams and motor starters methods as well. The machine performances like torque, speed and efficiency are investigated. The energy efficiency of machine according to the standard will also be covered.

References
1. C.K. Alexander and M.N.O. Sadiku, Fundamentals of Electric Circuit, 6th Ed 2017, McGraw Hill.
2. J.W. Nilson, S.A. Riedel, Electric Circuits, 10th Ed 2015, Pearson Education, Inc.
3. T.L. Floyd, Principles of Electric Circuits, 9th Ed 2013, Pearson Education, Inc.
4. Edward Hughes, Electrical & Electronic Technology, 12th Edition, Pearson Prentice Hall, (2016).

DELP 2113
ELECTRICAL CIRCUIT II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the basic principles of AC single phase system and apply Mesh, Nodal, Thevenin's, Norton's and Two Port Network theorems to solve related problem.
2. Apply transient analysis on first order and second order electric circuits and conduct steady state analysis to solve AC circuit.
3. Demonstrate the ability to use appropriate engineering tool to analyse transient response and steady state parameters of AC circuit by simulation and hardware.
4. Search, manage and synthesize information related to AC electrical system.

Synopsis
This subject will cover the transient analysis for first order and second order electric circuits. Then, the students will be exposed to the principle of AC voltage and current generations, RMS, average value and RLC circuits analysis. Furthermore, the basic concept and principles to conduct Nodal and Mesh analysis, Thevenin's, Norton's and Superposition Theorems on single phase AC system will be covered in this course.

References
1. C.K. Alexander and M.N.O. Sadiku, Fundamentals of Electric Circuit, 6th Ed 2017, McGraw Hill.
2. J.W. Nilson, S.A. Riedel, Electric Circuits, 10th Ed 2015, Pearson Education, Inc.
3. T.L. Floyd, Principles of Electric Circuits, 9th Ed 2013, Pearson Education, Inc.
4. Edward Hughes, Electrical & Electronic Technology, 12th Edition, Pearson Prentice Hall, (2016).

DELA 2342
ENGINEERING MATHEMATICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Recognise the multivariable function and extend the principle ideas of calculus in such function.
2. Solve the mathematical problems that involve vector calculus.
3. Apply the knowledge of engineering mathematics to deal with engineering problems.

Synopsis
This subject consists of three chapters: Multivariable Functions, Double Integral and Vector-valued Functions. The syllabus is extended from subject Calculus which emphasizing the concepts of the functions with several variables, double integrals of functions in Cartesian and polar coordinates system and also vector-valued function.

References
1. Rahifa et. al, Engineering Mathematics, Penerbit UTeM, 2021.
2. Ron Larson & Bruce Edwards, Mutivariable Calculus, 11th Edition, Cencage Learning, 2018.
3. James Stewart, Mutivariable Calculus, 8th Edition, Cencage Learning, 2016.

DELP 2213
POWER SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify the principle of basic components and its representation in single and three phase electrical power systems.
2. Explain the fundamental knowledges of per- unit method, the operating principles of the power transformers and transmission lines.
3. Analyze the fundamental knowledges of power flows and symmetrical faults analysis for electrical power system.
4. Utilize appropriate engineering tools for analysing electrical power system.
5. Search and manage to explain information related to power system issues.

Synopsis
The aim of this course is to introduce the basis of electrical power engineering in relation to energy generation, transmission and distribution system. Then, basic principle and application of per unit method for generating the impedance diagram from simple electrical network will be introduced. The student also will be exposed to the fundamental and operating principles of power transformer and transmission line. Furthermore, basic principle of Gauss Seidel and Newton-Raphson methods for power flow analysis will be discussed. Finally, the course will cover the symmetrical fault level and short circuit current calculations for simple electrical network using per-unit method.

References
1. Edward Hughes, Electrical & Electronic Technology, 12th Edition, Pearson Prentice Hall, 2016.
2. Glover and Sharma, Power System Analysis and Design, 6th Edition, Thomson Learning, 2016.
3. Hadi Saadat, Power System Analysis, 3rd Edition, 2011.
4. John J. Grainger, William D. Stevenson Jr, Power System Analysis, 2nd Edition, McGraw- Hill, 2016.

DELP 2214
DIPLOMA PROJECT

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply engineering design to solve electrical engineering problem.

2. Conduct investigation using equipment tool and methods.
3. Demonstrate responsibilities awareness for safety and health.
4. Identify and analyze electrical engineering problem.
5. Apply ethical principles in project implementation.
6. Present the results in written and in oral format effectively.
7. Identify basic entrepreneurship skills in project management.
8. Engage in independent and lifelong learning.

Synopsis
This subject gives students an opportunity to practice the knowledge that they have learnt. At the end of semester, students are required to present their project achievement in oral presentation and submit a comprehensive project report. Student's performance will be evaluated base on project achievement and project report.

References
Engineering, science and other scientific / technical resources i.e. books, journals, articles and patern.

DELP 2233
BUILDING MAINTENANCE AND MANAGEMENT

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyze relevant regulation and standard related to building maintenance and management sector.
2. Design the solution of energy management for building maintainace purpose.
3. Use appropriate engineering tools for the practical competence on building maintenance and management.
4. Apply the technical knowledge of energy audit for building energy management.
5. Understand the impact of energy usage in building towards environment and sustainability.
6. Show the ability to update technical knowledge related to building energy management.

Synopsis
This course covers the concept of building services and systems for mechanical, electrical, plumbing engineering, building floor plans and building regulations, by laws and code of practice. This includes communication lines, escalators and lifts, fire detection and protection system, water drainage and plumbing. The students are also exposed to energy conservation and energy efficiency for environmental protection. Finally, the students will be introduced to concept of the lightning protection, low voltage (LV) systems, distribution boards and switchgear, heating, ventilation and air conditioning (HVAC), security and alarm systems.

References
1. Moncef Krarti, Energy Audit of Building Systems – An Engineering Approach, CRC Pres, 2011.
2. Mechanical and Electrical Equipment for Buildings, 11th Edition, Walter T. Grondzik, Alison G. Kwok, Benjamin Stein, John S. Reynolds, John Wiley & Sons, 31 Jan 2011.
3. Stein B. Reynolds J.S. & McGuinness W.J. Mechanical and Electrical Equipment for Buildings, 7th Edition, Volume 1 & 2, John Wiley & Sons.
4. Building Maintenance Management, 2nd Edition Chanter B, Swallow P, Wiley-Blackwell, May 2008.
5. Alexander, Sadiku, Fundamentals of Electric Circuits, 5th edition, 2013.

DELC 2213
INDUSTRIAL ROBOTIC

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify, apply and analysis of basic knowledge of industrial robot system component including motion profile and mechanical aspect.
2. Apply specific robotic programming and simulations for industrial robots used in industrial automation systems.
3. Demonstrate ability to use modern tool in industrial automation system.
4. Demonstrate ability to use robotic technologies in a safety manner.
5. Demonstrate ability to use robotic technologies in a sustainable operation.
6. Demonstrate the life long learning in industrial robot system.

Synopsis
Introduction to robotics, classification of robots, basic components of robot systems, basic concepts of kinematics and dynamics, mechanical structure of robot systems, robot drives and motion control system using stepper motor, servo motor, servo amplifier and pneumatics, sensory devices such as position, force and torque, basic robot programming and industrial robot applications. Experiments will include robot programming in an industrial application setting.

References
1. Craig, J. J., Introduction to Robotics, Mechanics and Control, 3rd Ed., Addison Wesley Longman, 2014.
2. Groover, Industrial Robotics, Mc Graw Hill, 2012.
3. Man Zhihong, Robotics, Prentice Hall, 2nd ed., 2005.

DELP 2223
RENEWABLE ENERGY AND APPLICATIONS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyze the existing government policy on renewable energy and related matters to sustainability.
2. Design a renewable energy system to suit with specific need, criteria and conditions.
3. Apply an approriate technique on the installation and measurement procedure of renewable energy system.
4. Demonstrate knowledge of the impact of utilizing renewable energy towards society, in terms of health, safety and legal.
5. Demonstrate the ability of communication skills through presentation.

Synopsis
The subject intends to expose to the students the most recent development on the sustainable electrical resources. This subject also introduces the students various form of sustainable energy resources and their connection to the electrical network. The students also exposed to different types of photovoltaic materials, characteristics and the design procedure to create a photovoltaic system. In addition, there will be a brief intro to the other sustainable energy applications such as wind turbine, hydro, biomas, etc.

References
1. Emilio Ghiani, Giuditta Pisano, Chapter 2 - Impact of Renewable Energy Sources and Energy Storage Technologies on the Operation and Planning of Smart Distribution Networks, Editor(s): Kazem Zare, Sayyad Nojavan, Operation of Distributed Energy Resources in Smart Distribution Networks, Academic Press, 2018, Pages 25-48.

2. Muhammad Shahzad Nazir, Ali Jafer Mahdi, Muhammad Bilal, Hafiz M. Sohail, Nisar Ali, Hafiz M.N. Iqbal, Environmental impact and pollution-related challenges of renewable wind energy paradigm – A review, Science of The Total Environment, Volume 683, 2019.
3. SEDA Malaysia Grid-Connected PV Systems Design Course, second published 2016, www.seda.gov.my.
4. Muhammad Shahzad Nazir, Muhammad Bilal, Hafiz M. Sohail, Baolian Liu, Wan Chen, Hafiz M.N. Iqbal, Impacts of renewable energy atlas: Reaping the benefits of renewables and biodiversity threats, International Journal of Hydrogen Energy, Volume 45, Issue 41, 2020.
5. S. Sreenath, K. Sudhakar, Yusop A.F., E. Solomin, I.M. Kirpichnikova, Solar PV energy system in Malaysian airport: Glare analysis, general design and performance assessment, Energy Reports, Volume 6, 2020.

DELU 3118
INDUSTRIAL TRAINING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply appropriate techniques and technical knowledge which is relevant for student field of study.
2. Demonstrate the ability to adapt with working environment and practice working efficiently and ethically.
3. Demonstrate soft skill especially communication skill at all level.
4. Work affectively as an individual, team members and as a leader as well.
5. Acquire new knowledge, life-long learning and aware to new technology.

Synopsis
All Diploma students are required to undergo industrial training as part of their curiculum to complete their two and half (2 1/2) years course after semester 4 of studies for a 16- weeks period of training at respective industrial companies. It is compulsory for all students to undergo the Industrial Training Programme. In general, the aim of industrial training are to give exposure, experience and professional skills to various aspects of engineering discipline, in particular in electrical engineering related industries. The students are also expected to be familiarized with efficient, accountable and ethical conduct as they will be supervised directly under the company's personnel as well as supervisors from the faculty. Apart from that, the assessment will be made by the appointed faculty supervisors & the industry supervisors. A PO survey is also embedded inside the assessment form by the industry supervisors. There will also be a survey by the students prior to completion of their training. After completing the industrial training, students have to submit a formal report following the faculty format. Evaluation will be based on faculty supervisor report, industrial supervisor report and student logbook toward grading whether pass or fail.

References
1. Dasar Latihan Industri KPT, 2010.
2. Dasar Latihan Industri UTeM, 2013.
3. Dokumen Jawatankuasa Latihan Industri FTKE.

SERVICE COURSES (FKM, FPTT, PPB, FTMK, & CO-CURRICULUM UNIT)

DMKU 1163
INDTRODUCTION TO MECHANICAL SYSTEM

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Define the general terms in basic mechanical system engineering.
2. Explain the general principles of static and mechanics.
3. Analyze the mechanical properties of materials.
4. Describe the basic concepts of thermodynamics.
5. Conduct and demonstrate the basic practical works of mechanical system.

Synopsis

Introduction to basic concepts in static and mechanics as a study of physical sciences, system of units, scalars and vectors, free body diagram, various types of structures, stress, strain, principles of dynamics based on kinetic and kinematics and basic concepts of thermodynamics.

References

1. Hibbeler, R.C., 2010, Engineering Mechanics-Statics, 12th Editions, Prentice Hall.
2. Beer, F.P., 2010, Vector Mechanics for Engineers, Dynamics SI Units, 9th Edition, McGraw-Hill.
3. Hibbeler, R.C., 2010, Engineering Mechanics-Dynamics, 12th Editions, Prentice Hall.
4. Beer, F.P., Johnston E.R, DeWolf J.T and Mazurek D.F, 2009, Mechanics of Materials 5th Editions in SI Units, McGraw-Hill.
5. Cengel, Y. A. and Boles, M. A., 2011, Thermodynamics: An Engineering Approach, 7th Edition, McGraw Hill.
6. Sonntag, R. E., 2009, Borgnakke, C., and Van Wylen, G. J., Fundamentals of Thermodynamics, 7th Edition, John Wiley & Sons Inc.

DLLW 1112
FOUNDATION ENGLISH

Learning Outcomes

1. Interpret information from various types of oral texts.
2. Express ideas and thoughts orally in group discussions.
3. Distinguish different types of reading texts of varying length and complexity.
4. Produce an article based on non-linear texts in pairs.
5. Apply appropriate grammar elements in quizzes.

Synopsis

This course is designed to help students to 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 to build confidence among the learners to become efficient speakers of English in their tertiary education.

References

1. Bixby, J. & McVeigh, J. (2011). Skills for Success: Reading and Writing. New York: Oxford University Press.
2. Hooi Carol (2013). Mastering MUET. (3rd. Edition) Johor Bahru: Penerbitan Pelangi Sdn. Bhd.
3. Swan, M. & Walter, C. (2011). Oxford English Grammar Course: Basic. New York: Oxford University Press.

DLLW 2122
ENGLISH FOR EFFECTIVE COMMUNICATION

Learning Outcomes

1. Demonstrate interpersonal skills through speeches and role-play based on a situational context.
2. Explain product descriptions and manual instructions in group.

3. Apply appropriate course-verb agreement, tenses, active and passive voices as well as transitional markers in written examination.

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

1. Azar, B. S. (2010). Understanding and using English grammar. New York: Longman.
2. Dobrin, S. I., Keller, C. J., & Weisser, C. R. (2008). Technical communication in the twenty- first century. New Jersey: Pearson Prentice Hall.
3. Gerson, S. J., & Gerson, S. M. (2010). Workplace writing: Planning, packaging and perfecting communication. US: Prentice Hall.
4. Hajibah Osman et al. (2011). Effective communication skills. Shah Alam: UPENA.
5. Lannon, J. M., & Gurak, L. J. (2011). Technical Communication. US: Longman.
6. Mohd Nor, N., Mansor, S., & Atin, J. (2010). Technical English skills. Malaysia: August Publishing Sdn. Bhd.

DLLW 3132
ENGLISH FOR MARKETABILITY

Learning Outcomes

1. Produce a reflective writing, resume, job application letter/ online job application letter and short report.
2. Response appropriately to questions during mock interview session.
3. Analyse possible solutions based on the given problem in a group discussion.
4. 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

1. Dobrin, S. I., Keller, C.J., & Weisser, C. R. (2008). Technical communication in the twenty-first century. NJ: Pearson Prentice Hall.
2. Fisher, R., Larkin, S. & Jones, S. (2010). Using talk to support writing. UK: Sage Publication Limited.
3. Gail, F. & Lockwood, J. (2010). Globalization, communication and the workplace: talking across the world. UK: Continuum International Publishing.
4. Gerson, S. J. & Gerson, S. M. (2010). Workplace writing. New Jersey: Prentice Hall.
5. Hajibah Osman et al. (2011). Effective communication skills. Shah Alam: UPENA.
6. Samsiah A.H., Rosyati A.R. (2012). Mastering English for employment. Cengage Learning Asia.

DITG 1113
COMPUTER PROGRAMMING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the fundamental principle of problem solving, programming techniques and programming structures in program development.
2. Explain problem solutions based on the principles of problem solving, programming technique and programming structures.
3. Produce program codes by applying suitable programming structure and techniques.

Synopsis
This course covers the introductory topics in programming using computer 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
1. Gaddis, T., (2011), "Starting Out with C++ Brief Version: From Control Structures Through Objects 7th. Edition", Pearson Education.
2. Etter, D.M., Ingber, J.A., (2008), "Engineering Problem Solving with C++", 2nd Edition, Pearson Education.
3. Hanly, J.R, (2002), "Essential C++ for Engineers and Scientists", Addison Wesley.

DTMW 1012
FUNDAMENTALS OF ENTERPRENEURSHIP ENCULTURATION

Hasil Pembelajaran
Di akhir kursus ini pelajar akan dapat:
1. Menerap budaya keusahawanan berdasarkan teori keusahawanan, revolusi usahawan, sejarah pembangunan usahawan dan perkembangan keusahawanan di Malaysia.
2. Memperakui dan mengaplikasikan kemahiran keusahawanan seperti kreativiti, inovasi, pro-aktif, mengambil risiko, mengenalpasti peluang, pemasaran dan rangkaian untuk memasuki/ menembusi pasaran.
3. Melaksanakan penganjuran seminar keusahawanan dan kerja lapangan perniagaan di samping membuat pembentangan projek perniagaan serta berkongsi pengalaman berkaitan pelaksanaan projek perniagaan kumpulan masing-masing.

Sinopsis
Kursus ini akan membekalkan pelajar dengan motivasi dan kemahiran utama keusahawanan. Di samping 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, simulasi dan seminar. Pelajar akan didedahkan dengan isu-isu yang berkaitan dengan pemasaran, pengurusan strategi dan risiko. Di samping itu, pelajar akan dibekalkan dengan kemahiran yang perlu untuk menyediakan penyata aliran tunai dan asas dalam membangunkan/ menyediakan perancangan perniagaan.

Rujukan

1. Acs, Z.J. & Audretsch, D.B. (2011). Handbook of Entrepreneurship Research: An Interdisciplinary Survey and Introduction. 2nd Ed. Springer.
2. Read, S., Sarasvathy, S., Dew, N., Wiltbank, R. & Ohlsson A.V (2011). Effectual Entrepreneurship. Routledge: Taylor & Francis Group.
3. Hisrich, D.R., Peters, M.P. and Shepherd, D.A. (2005).Entrepreneurship, McGraw Hill IE.
4. UiTM EntrepreneurshipStudy Group. (2004). "Fundamental of Entrepreneurship" Prentice Hall.
5. Mankani, D., (2003). Technopreneurship, Prentice Hall.
6. Ab Aziz Yusof, (2003). Prinsip Keusahawanan, Prentice Hall.
7. Nor Aishah Buang, (2002). Asas Keusahawanan, Penerbit Fajar Bakti Sdn. Bhd.
8. Kuratko, D.F. and Hodgetts, R.M. (2001). Entrepreneurship: A Contemporary Approach, 5th Edition, South-Western: Ohio.

DKXX XXX1
CO-CURRICULUM I &II

Please refer to the Pusat Pembelajaran Bahasa (PPB) handbook for further information on the offered courses.

BACHELOR ENGINEERING PROGRAMME

PROGRAMME EDUCATIONAL OBJECTIVES (PEO) - BACHELOR PROGRAMME

Programme Educational Objective (PEO) are specific goals describing the expected achievement of graduates in their career and professional life after 3 to 5 years of graduation. Three main concepts for PEO for the Faculty of Electrical Technology and Engineering's Bachelor Programme consist of Apply engineering knowledge and contribution to respected field, the achievement in technical career as well as lifelong learning.

NO	BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS (BELG)
	The objectives of this programme are to produce graduates who:
1.	Practise electrical engineering knowledge creatively and innovatively in broad application.
2.	Attain a successful career, acquire leadership quality, able to work independently, act professionally and practise ethical conduct.
3.	Engage with life-long learning and adapt to constantly evolving technology and entrepreneurial skills in decision making.

NO	BACHELOR OF MECHATRONICS ENGINEERING WITH HONOURS (BELM)
	The objectives of this programme are to produce graduates who:
1.	Practise mechatronics engineering knowledge creatively and innovatively in broad applications.
2.	Attain a successful career, possess leadership qualities, able to work independently, act professionally and practise ethical conduct.
3.	Engage with life-long learning and adapt to constantly evolving technology and entrepreneurial skills in decision making.

PROGRAMME OUTCOMES (PO) - BACHELOR PROGRAMME

Programme Outcome (PO) are statements describing what students are expected to know and be able to perform or attain by the time of graduation. These are related to the Knowledge (K), Skills (S), and Attitude (A) that students acquire throughout the programme.

Below is the list of Programme Outcomes for Faculty of Electrical Technology and Engineering's Bachelor Programme:

NO	PROGRAMME OUTCOMES (PO)
1.	**Engineering Knowledge** - Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation as specified in WK1 to WK4 respectively to the solution of complex engineering problems.
2.	**Problem Analysis** - Identify, formulate, conduct research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4).
3.	**Design/Development of Solutions** - Design solutions 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 considerations (WK5).
4.	**Investigation** - Conduct investigation of complex engineering problems using research-based knowledge (WK8) and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
5.	**Modern Tool Usage** - 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 (WK6).
6.	**The Engineer and Society** - Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems (WK7).
7.	**Environment and Sustainability** - Understand and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental contexts (WK7).

8.	**Ethics** - Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (WK7).
9.	**Communication** - Communicate effectively on complex engineering activities with the 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.
10.	**Individual and Team Work** - Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
11.	**Life Long Learning** - Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
12.	**Project Management and Finance** - Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.

BACHELOR PROGRAMME BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS (BELG)

BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS (BELG)

The Bachelor of Electrical Engineering with Honours (BELG) programme is designed to produce electrical engineers who are able to work in various electrical engineering disciplines. Graduates are developed through a balanced mix of core and elective engineering courses with a combination of theoretical, practical and soft skill elements so that they become holistic engineers.

PROGRAMME IMPLEMENTATION - BELG

This programme would take four (4) years minimum and consist of at least 135 credit hours. The programme will emphasis on Electrical Engineering with the composition of the credits are as follows:

This programme emphasizes on theoretical and tutorials, computer-aided learning, and problem based learning (PBL). It also encourages active and cooperative learning activities other than carrying out assignments, job workshops, industrial training and final year project.

CURRICULUM STRUCTURE - BELG

Students are required to keep record of their obtained grades for a given course as shown in Appendix B (Student Audit Form - BELG) for graduation purpose.

COMPULSORY FOR LOCAL STUDENTS ONLY

* COMPULSORY FOR INTERNATIONAL STUDENTS ONLY

** OPTIONAL

TYPE COURSE	YEAR 1				YEAR 2			
	SEMESTER 1	SEMESTER BREAK	SEMESTER 2	LONG SEMESTER BREAK	SEMESTER 3	SEMESTER BREAK	SEMESTER 4	LONG SEMESTER BREAK
COMMON CORE & PROGRAM CORE (P)	BMIG 1313 ENGINEERING MATHEMATICS 1		BMKC 1013 DIFFERENTIAL EQUATIONS		BELG 2443 ENGINEERING MATHEMATICS 2		BERN 2143 ENGINEERING STATISTICS	
	BITG 1233 COMPUTER PROGRAMMING		BERG 1413 DIGITAL ELECTRONICS		BMKU 1313 ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN		BMKU 2432 INTRODUCTION TO MECHANICAL ENGINEERING	
	BELG 1123 PRINCIPLES OF ELECTRICAL AND ELECTRONICS		BELG 1233 PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT		BELU 2333 ELECTRICAL CIRCUIT II		BELG 2433 ELECTRICAL SYSTEMS	
	BMIG 1213 ENGINEERING MATERIALS		BELU 1123 ELECTRICAL CIRCUIT I		BELE 2333 ANALOGUE ELECTRONICS		BELP 2453 ELECTROMAGNETIC THEORY	
	BELU 1131 ENGINEERING PRACTICE I		BELU 1231 ENGINEERING PRACTICE II		BELC 2433 SIGNALS & SYSTEMS		BELC 2453 COMMUNICATION SYSTEMS	
					BELU 2331 ELECTRICAL ENGINEERING LABORATORY I		BELU 2431 ELECTRICAL ENGINEERING LABORATORY II	
CREDIT HOUR SEMESTER	13		13		16		15	
ELECTIVE (E)	BLLW 1XX2 ELECTIVE 1 (UNIVERSITY)							
	2							
UNIVERSITY REQUIREMENTS (W)	BKKX 1XX1 CO-CURRICULUM I		BKKX 1XX1 CO-CURRICULUM II		BLLW 2152 ACADEMIC WRITING		#BLHW 2772 APPRECIATION OF ETHICS AND CIVILISATIONS	
			BLHW 1762 PHILOSOPHY AND CURRENT ISSUES		** BKKX XXX1 CO CURRICULUM (SUKSIS)		*BLHW 2752 MALAYSIAN CULTURE	
			BLLW 1142 ENGLISH FOR ACADEMIC PURPOSES				** BKKX XXX1 CO-CURRICULUM (SUKSIS)	
CREDIT HOUR SEMESTER	1		5		2		2	
TOTAL CREDIT HOUR SEMESTER	16		18		18		17	

TYPE COURSE	YEAR 3				YEAR 4			
	SEMESTER 5		SEMESTER 6	SPECIAL SEMESTER	SEMESTER 7		SEMESTER 8	
COMMON CORE & PROGRAM CORE (P)	BELE 3533 ELECTRICAL MACHINES	SEMESTER BREAK	BELE 3653 ELECTRICAL DRIVES	BELU 3695 INDUSTRIAL TRAINING	BELU 4861 ENGINEERING SEMINAR	SEMESTER BREAK	BERN 3322 ENGINEER AND SOCIETY	
	BELC 3523 CONTROL SYSTEMS ENGINEERING		BELC 3663 CONTROL AND INSTRUMENTATION		BELU 4792 FINAL YEAR PROJECT I		BELU 4894 FINAL YEAR PROJECT II	
	BELC 3543 MICROPROCESSOR		BELP 3693 HIGH VOLTAGE ENGINEERING		BELP 4843 RENEWABLE ENERGY		BELP 4853 ENERGY UTILIZATION AND CONSERVATION	
	BELE 3543 POWER ELECTRONICS		BELG 3673 INTEGRATED DESIGN PROJECT		BMIU 3213 ENGINEERING ECONOMY AND MANAGEMENT			
	BELP 3673 POWER SYSTEM ANALYSIS		BELU 3551 ELECTRICAL ENGINEERING LABORATORY III					
CREDIT HOUR SEMESTER	15		13	5	9		9	
ELECTIVE(E)					BLHW 2792 INTEGRITY AND ANTICORRUPTION			
			BELX XXX3 ELECTIVE I (PROGRAM)		BELX XXX3 ELECTIVE II (PROGRAM)		BELX XXX3 ELECTIVE III (PROGRAM)	
CREDIT HOUR SEMESTER			3		5		3	
UNIVERSITY REQUIREMENTS (W)	BLLW 3162 ENGLISH FOR PROFESSIONAL INTERACTION						BTMW4012 TECHNOLOGY ENTREPRENEURSHIP	
CREDIT HOURSEMESTER	2						2	
TOTAL CREDIT HOUR SEMESTER	17		16	5	14		14	135

i. ***CHOOSE THREE (3) COURSES FROM ELECTIVE PROGRAM
ii. CHOOSE ONE (1) COURSE FROM THIRD LANGUAGE

ELECTIVE PROGRAM	INDUSTRIAL POWER	BELP 3683 DISTRIBUTION SYSTEM DESIGN	BELP 4873 POWER SYSTEM PROTECTION		
	CONTROL, INSTRUMENTATION & AUTOMATION	BELC 3673 INDUSTRIAL CONTROL AND AUTOMATION	BELC 4743 INTELLIGENT CONTROL SYSTEMS	BELC 4683 DIGITAL CONTROL SYSTEMS	BELM 4863 INDUSTRIAL ROBOTICS
	POWER ELECTRONICS & DRIVES	BELE 3673 INDUSTRIAL POWER ELECTRONICS	BELE 4763 MODERN ELECTRICAL DRIVES	BELE 4873 SPECIAL MACHINES	BELE 3663 POWER ELECTRONICS SYSTEM
ELECTIVE UNIVERSITY	THIRD LANGUAGE	BLLW 1222 MANDARIN LANGUAGE 1	BLLW 1242 KOREAN LANGUAGE 1	BLLW 1212 ARABIC LANGUAGE 1	BLLW 1252 GERMAN LANGUAGE 1
		BLLW 1232 JAPANESE LANGUAGE 1	*BLLW 1172 COMMUNICATIVE MALAY LANGUAGE 1		
	KIAR	BLHW 2792 INTEGRITY AND ANTICORRUPTION			

LIST OF UNIVERSITY COMPULSORY COURSES FOR INTERNATIONAL STUDENTS ONLY

CODE	COURSE	CATEGORY	CREDIT HOUR	PRE- REQUISITE	ATTEMPT
BLLW 1172	COMMUNICATIVE MALAY LANGUAGE I	E	2		SEMESTER 1
BKKX 1XX1	CO-CURRICULUM I	W	1		SEMESTER 1
BLHW 1762	PHILOSOPHY AND CURRENT ISSUES	W	2		SEMESTER 2
BLLW 1142	ENGLISH FOR ACADEMIC PURPOSES	W	2		SEMESTER 2
BKKX 1XX1	CO-CURRICULUM II	W	1		SEMESTER 2
BLLW 2152	ACADEMIC WRITING	W	2	BLLW 1142	SEMESTER 3
BLHW 2752	MALAYSIAN CULTURE	W	2		SEMESTER 4
BLLW 3162	ENGLISH FOR PROFESSIONAL INTERACTION	W	2	BLLW 2152	SEMESTER 5
BLHW 2792	INTEGRITY AND ANTICORRUPTION	E	2		SEMESTER 7
BTMW4012	TECHNOLOGY ENTREPRENEURSHIP	W	2		SEMESTER 8
TOTAL CREDITS			18	14(W)4(E)	

EQUIVALENT CODE AND PRE-REQUISITE - BELG

Students are required to keep record of their obtained grades for a given course as shown in Appendix B (Student Audit Form - BELG) for graduation purpose.

COMPULSORY FOR LOCAL STUDENTS ONLY
* COMPULSORY FOR INTERNATIONAL STUDENTS ONLY
** OPTIONAL

SEMESTER	CODE	COURSE	CATEGORY	CREDIT HOUR	EQUIVALENT CODE	PRE- REQUISITE
SEMESTER 1	BLLW 1XX2	ELECTIVE I (UNIVERSITY)	E	2		
	BKKX 1XX1	CO-CURRICULUM I	W	1		
	BMIG 1313	ENGINEERING MATHEMATICS 1	P	3		
	BITG 1233	COMPUTER PROGRAMMING	P	3		
	BELG 1123	PRINCIPLES OF ELECTRICAL AND ELECTRONICS	P	3		
	BMIG 1213	ENGINEERING MATERIALS	P	3		
	BELU 1131	ENGINEERING PRACTICE I	P	1		
			TOTAL	16		
SEMESTER 2	BLHW 1762	PHILOSOPHY AND CURRENT ISSUES	W	2		
	BLLW 1142	ENGLISH FOR ACADEMIC PURPOSES	W	2		
	BKKX 1XX1	CO-CURRICULUM II	W	1		
	BMKC 1013	DIFFERENTIAL EQUATIONS	P	3		
	BERG 1413	DIGITAL ELECTRONICS	P	3		
	BELG 1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	P	3		
	BELU 1123	ELECTRICAL CIRCUIT I	P	3		
	BELU 1231	ENGINEERING PRACTICE II	P	1		
			TOTAL	18		
SEMESTER 3	BLLW 2152	ACADEMIC WRITING	W	2		BLLW 1142
	BELG 2443	ENGINEERING MATHEMATICS 2	P	3		
	BMKU 1313	ENGINEERING GRAPHIC AND COMPUTER AIDED DESIGN	P	3		
	BELU 2333	ELECTRICAL CIRCUIT II	P	3		
	BELE 2333	ANALOGUE ELECTRONICS	P	3		
	BELC 2433	SIGNALS & SYSTEMS	P	3		
	BELU 2331	ELECTRICAL ENGINEERING LABORATORY I	P	1		
			TOTAL	18		
SEMESTER 4	#BLHW 2772 / *BLHW 2752	#APPRECIATION OF ETHICS AND CIVILISATIONS/ *MALAYSIAN CULTURE	W	2		
	BERN 2143	ENGINEERING STATISTICS	P	3		
	BELG 2433	ELECTRICAL SYSTEMS	P	3		
	BMKU 2432	INTRODUCTION TO MECHANICAL ENGINEERING	P	3		
	BELC 2453	COMMUNICATION SYSTEMS	P	3		
	BELP 2453	ELECTROMAGNETIC THEORY	P	2		
	BELU 2431	ELECTRICAL ENGINEERING LABORATORY II	P	1		
			TOTAL	17		

SEMESTER	CODE	COURSE	CATEGORY	CREDIT HOUR	EQUIVALENT CODE	PRE- REQUISITE
SEMESTER 5	BLLW 3162	ENGLISH FOR PROFESSIONAL INTERACTION	W	2		BLLW 2152
	BELE 3533	ELECTRICAL MACHINES	P	3		
	BELC 3523	CONTROL SYSTEMS ENGINEERING	P	3		
	BELC 3543	MICROPROCESSOR	P	3		
	BELE 3543	POWER ELECTRONICS	P	3		
	BELP 3673	POWER SYSTEMS ANALYSIS	P	3		
			TOTAL	**17**		
SEMESTER 6	BELX XXX3	ELECTIVE I (PROGRAM)	E	3		
	BELE 3653	ELECTRICAL DRIVES	P	3		
	BELC 3663	CONTROL AND INSTRUMENTATION	P	3		
	BELP 3693	HIGH VOLTAGE ENGINEERING	P	3		
	BELG 3673	INTEGRATED DESIGN PROJECT	P	3		
	BELU 3551	ELECTRICAL ENGINEERING LABORATORY III	P	1		
			TOTAL	**16**		
SPECIAL SEMESTER	BELU 3695	INDUSTRIAL TRAINING	P	5		
			TOTAL	**5**		
SEMESTER 7	BMIU 3213	ENGINEERING ECONOMY AND MANAGEMENT	P	3		
	BELU 4861	ENGINEERING SEMINAR	P	1		
	BELU 4792	FINAL YEAR PROJECT I	P	2		
	BELP 4843	RENEWABLE ENERGY	P	3		
	BLHW 2792	INTEGRITY AND ANTICORRUPTION	E	2		
	BELX XXX3	ELECTIVE II (PROGRAM)	E	3		
			TOTAL	**14**		
SEMESTER 8	BTMW4012	TECHNOLOGY ENTREPRENEURSHIP	W	2		
	BERN 3322	ENGINEER AND SOCIETY	P	2		
	BELU 4894	FINAL YEAR PROJECT II	P	4		BELU 4792
	BELP 4853	ENERGY UTILIZATION AND CONSERVATION	P	3		
	BELX XXX3	ELECTIVE III (PROGRAM)	E	3		
			TOTAL	**14**		
MINIMUM TOTAL CREDIT				**135**		

P = Core, E = Elective, W = University Requirements

LIST OF ELECTIVE COURSES FOR BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS PROGRAMME (BELG)

COURSE	ELECTIVE SPECIALIZATION	CODE	COURSE NAME	CREDIT	EQUIVALENT CODE	PRE-REQUISITE
ELECTIVE PROGRAM	INDUSTRIAL POWER	BELP 3683	DISTRIBUTION SYSTEM DESIGN	3		
		BELP 4873	POWER SYSTEM PROTECTION	3		
	CONTROL, INSTRUMENTATION & AUTOMATION	BELC 3673	INDUSTRIAL CONTROL AND AUTOMATION	3		
		BELC 4743	INTELLIGENT CONTROL SYSTEMS	3		
		BELC 4683	DIGITAL CONTROL SYSTEMS	3		
		BELM 4863	INDUSTRIAL ROBOTICS	3		
	POWER ELECTRONICS & DRIVES	BELE 3673	INDUSTRIAL POWER ELECTRONICS	3		
		BELE 4763	MODERN ELECTRICAL DRIVES	3		
		BELE 4873	SPECIAL MACHINES	3		
		BELE 3663	POWER ELECTRONICS SYSTEM	3		
ELECTIVE UNIVERSITY	THIRD LANGUAGE	BLLW 1222	MANDARIN LANGUAGE 1	2		
		BLLW 1242	KOREA LANGUAGE 1	2		
		BLLW 1212	ARABIC LANGUAGE 1	2		
		BLLW 1252	GERMAN LANGUAGE 1	2		
		BLLW 1232	JAPANESE LANGUAGE 1	2		
		*BLLW 1172	COMMUNICATIVE MALAY LANGUAGE 1	2		
	KIAR	BLHW 2792	INTEGRITY AND ANTICORRUPTION	2		

P = Core, E = Elective, W = University Requirements

Selection Guideline of Elective Courses - Refer to Curriculum Structure - BELG

STUDENT LEARNING TIME (SLT) - BELG

Semester	Code	Course	Face-to-Face Learning				Self- Learning Activities	Formal Assessment	Total
			Teacher Centered (TC)	Student Centered Learning (SCL)			Student Direct Learning/ Revision/ Exercise	Continuous Learning + Final Examination	
			Lecture	Tutorial	Practical	PBL/ Other SCL Activities			
1	BLLW 1XX2	ELECTIVE 1 (UNIVERSITY)	22	3		6	45.5	3.5	80
	BKKX 1XX1	CO-CURRICULUM I				16	22	2	40
	BMIG 1313	ENGINEERING MATHEMATICS 1	42	5.5			67.5	5	120
	BITG 1233	COMPUTER PROGRAMMING	28	3.25	20		63.25	5.5	120
	BELG 1123	PRINCIPLES OF ELECTRICAL AND ELECTRONICS	42	5.5			67.5	5	120
	BMIG 1213	ENGINEERING MATERIALS	42	5.5			67.5	5	120
	BELU 1131	ENGINEERING PRACTICE I			20		18	2	40
2	BLHW 1762	PHILOSOPHY AND CURRENT ISSUES	22	3		6	45.5	3.5	80
	BLLW 1142	ENGLISH FOR ACADEMIC PURPOSES	22	3		6	45.5	3.5	80
	BKKX 1XX1	CO-CURRICULUM II				16	22	2	40
	BMKC 1013	DIFFERENTIAL EQUATIONS	42	5.5			67.5	5	120
	BERG 1413	DIGITAL ELECTRONICS	36	5.5		6	67.5	5	120
	BELG 1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	42	5.5			67.5	5	120
	BELU 1123	ELECTRICAL CIRCUIT I	42	5.5			67.5	5	120
	BELU 1231	ENGINEERING PRACTICE II			20		18	2	40
3	BLLW 2152	ACADEMIC WRITING	22	3		6	45.5	3.5	80
	BELG 2443	ENGINEERING MATHEMATICS 2	42	5.5			67.5	5	120
	BMKU 1313	ENGINEERING GRAPHIC AND COMPUTER AIDED DESIGN	28	3.25	20		63.25	5.5	120
	BELU 2333	ELECTRICAL CIRCUIT II	42	5.5			67.5	5	120
	BELE 2333	ANALOGUE ELECTRONICS	36	5.5		6	67.5	5	120
	BELC 2433	SIGNALS & SYSTEMS	42	5.5			67.5	5	120
	BELU 2331	ELECTRICAL ENGINEERING LABORATORY I			20		18	2	40

4	#BLHW 2772 / *BLHW 2752	#APPRECIATION OF ETHICS AND CIVILISATIONS/ *MALAYSIAN CULTURE	22	3		6	45.5	3.5	80
	BERN 2143	ENGINEERING STATISTICS	42	5.5			67.5	5	120
	BELG 2433	ELECTRICAL SYSTEMS	42	5.5			67.5	5	120
	BMKU 2432	INTRODUCTION TO MECHANICAL ENGINEERING	28	3.25			45.25	3.5	80
	BELC 2453	COMMUNICATION SYSTEMS	42	5.5			67.5	5	120
	BELP 2453	ELECTROMAGNETIC THEORY	42	5.5			67.5	5	120
	BELU 2431	ELECTRICAL ENGINEERING LABORATORY II			20		18	2	40
5	BLLW 3162	ENGLISH FOR PROFESSIONAL INTERACTION	22	3		6	45.5	3.5	80
	BELE 3533	ELECTRICAL MACHINES	42	5.5			67.5	5	120
	BELC 3523	CONTROL SYSTEMS ENGINEERING	42	5.5			67.5	5	120
	BELC 3543	MICROPROCESSOR	36	5.5	6		67.5	5	120
	BELE 3543	POWER ELECTRONICS	42	5.5			67.5	5	120
	BELP 3673	POWER SYSTEMS ANALYSIS	42	5.5			67.5	5	120
6	BELX XXX3	ELECTIVE I (PROGRAM)	42	5.5			67.5	5	120
	BELE 3653	ELECTRICAL DRIVES	33	5.5		9	67.5	5	120
	BELC 3663	CONTROL AND INSTRUMENTATION	42	5.5			67.5	5	120
	BELP 3693	HIGH VOLTAGE ENGINEERING	42	5.5			67.5	5	120
	BELG 3673	INTEGRATED DESIGN PROJECT	1			41	73	5	120
	BELU 3551	ELECTRICAL ENGINEERING LABORATORY III			20		18	2	40
Special Semester	BELU 3695	INDUSTRIAL TRAINING					200		200
7	BMIU 3213	ENGINEERING ECONOMY AND MANAGEMENT	42	5.5			67.5	5	120
	BELU 4861	ENGINEERING SEMINAR	14	6			18	2	40
	BELU 4792	FINAL YEAR PROJECT I	3			6.5	67	3.5	80
	BELP 4843	RENEWABLE ENERGY	42	5.5			67.5	5	120
	BLHW 2792	INTEGRITY AND ANTICORRUPTION	22	3		6	45.5	3.5	80
	BELX XXX3	ELECTIVE II (PROGRAM)	42	5.5			67.5	5	120
8	BTMW4012	TECHNOLOGY ENTREPRENEURSHIP	22	3		6	45.5	3.5	80
	BERN 3322	ENGINEER AND SOCIETY	22	3		6	45.5	3.5	80
	BELU 4894	FINAL YEAR PROJECT II	4			7	141.75	7.25	160
	BELP 4853	ENERGY UTILIZATION AND CONSERVATION	42	5.5			67.5	5	120
	BELX XXX3	ELECTIVE III (PROGRAM)	42	5.5			67.5	5	120
		TOTAL HOURS	**1495**	**202**	**146**	**161.5**	**3172.75**	**222.75**	**5400**

COURSE DETAILS FOR BACHELOR PROGRAMME (BELG)

BELU 1131
ENGINEERING PRACTICE I

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Construct and demonstrate the operation of a basic electric circuits using basic electrical components.
2. Perform measurement and troubleshooting of electrical circuit operation using digital oscilloscope.
3. Construct, operate and troubleshoot a typical domestic lighting and ventilation (fan) system based on Malaysian standard installation practice.
4. Demonstrate comprehension of results and observation through a short report.
5. Work in a group during the lab implementation and present the work results.

Synopsis
Electrical Engineering Practice I is designed to provide the student with the knowledge to construct, operate, and troubleshoot simple electrical circuits using basic components, measuring instruments and techniques with proficiency. Some of the components and instruments used are, but not limited to, breadboard, wires, resistors and variable power supply. Students will be exposed to practice the various functions and use of typical electrical engineering tools, such as multimeter and oscilliscope for measurement and troubleshooting of circuit operation and performance. Finally, the students will construct a basic domestic lighting and fan wiring based on the Malaysian standard regulations.

References
1. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory: Pearson New International Edition, 11th Edition, Pearson Education Limited, 2013.
2. Akta Bekalan Elektrik(447 Pindaan 2001).
3. K.A. Charles, N.O. Sadiku, Fundamentals of Electric Circuits, McGraw-Hill Education, 2019.
4. Pethebridge, K., Neeson, I., Lowe, P., Electrical Wiring Practice, 8th Edition, McGraw-Hill, 2018.

BELU 1231
ENGINEERING PRACTICE II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify and describe the basic characteristics and operations of diode, BJT and FET.
2. Investigate the basic characteristics and operation of digital components such as basic gates and it's combinational, adder and flip- flops.
3. Apply the basic microcontroller programming language for dynamic mechanism application.
4. Apply the basic microcontroller programming language for dynamic mechanism application.
5. Apply the basic of design concept of relay control circuit Work in a group during implementation of relay and microcontroller programming and present the work results.

Synopsis
This course will let students to practice with hardware experiment to solve simple engineering problem. Students also will be introduced with analog components, digital components, electrical and electronic circuitry, relay control, and microcontroller programming using Arduino.

References
1. K.A. Charles, N.O. Sadiku, Fundamentals of Electric Circuits, 6th Ed., McGraw Hill, 2016.
2. Robert L. Boylestad and Louis Nasheslsky, Electronic Devices and Circuit Theory, Pearson, 11th Ed., 2014.

3. Proteus reference: https://www.labcenter.com/downloads/
4. Massimo Banzi, Getting Started with Arduino, 2nd Ed., O'reilly, 2011.
5. Arduino microcontroller reference: https:// www.arduino.cc.

BELU 2331
ELECTRICAL ENGINEERING LABORATORY I

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Measure and analyse the electrical characteristics of single-phase series and parallelRLC circuits.
2. Construct and analyse three phase motor starter control circuits. Identify and describe basic characteristics and operation of digital components such basic gates and it's combinational, adder, and flip-flops clearly.
3. Identify and describe basic characteristics and operation of digital components such basic gates and it's combinational, adder, and flip-flops clearly.
4. Identify and describe basic circuit and operation of analogue application circuit such as active filter, amplifier, voltage regulator, and oscillator clearly.
5. Write and present technical report systematically.
6. Work as a team effectively

Synopsis
Students will conduct experiments of single-phase and three-phase circuits with RLC load combinations to measure the electrical quantities such as voltage, current measurement values will be used to calculate the reactive power, apparent power and power factor. The laboratory experiments also consist of practical and simulation which are conducted to enhance student skills and theoretical knowledge in analogue electronics and digital electronics system topics. The experiments include amplifier, power amplifier, oscillator, basic gates, combinational logic circuit, binary adder, and flip-flop. Students will also learn on how to construct the motor control the speed and direction of an ac motor.

References
1. K.A. Charles, N.O. Sadiku, Fundamentals of Electric Circuits, 3rd Ed. 2007, McGraw Hill.
2. James W. Nilsson, Susan Riedel, Electric Circuits, 9th Ed. 2010, Prentice Hall.
3. Allan Robbins, Wilhelm C. Miller, Circuit Analysis: Theory and Practice, 4th Ed. 2006, Thomson Delmar Learning.
4. Tocci, R.J, Digital Systems: Principles and Applications, 10th ed., Prentice Hall, 2009.
5. Thomas L. Floyd, Digital Fundamentals, Prentice Hall, 10th Ed.
6. Boylestad and Nashelsky, Electronic Devices and Circuit Theory, 10th ed., Prentice Hall, 2009.
7. Floyd, T., Electronic Devices, 11th, Edition Prentice Hall, 2009.

BELU 2431
ELECTRICAL ENGINEERING LABORATORY II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the performance characteristics of different configurations of DC motor.
2. Analyse the performance of synchronous and induction machine.
3. Conduct measurement on single-phase transformer and three-phase system with RLC loads.
4. Analyse the performance of the open-loop and closed-loop system according to specifications.
5. Write and present technical report systematically.
6. Demonstrate soft skill such as spirit of teamwork.

Synopsis
The modules involved in this laboratory are designed to horn students practical skills in using common electrical engineering equipment and tools based on

hardware experiment and simulation works. Students are practically exposed to common measurement for single-phase and three-phase system, investigate the characteristics and driving operation of DC, synchronous and induction motors, as well as evaluating the behaviour of open- loop and closed-loop control system. The modules are mapped with courses such as Electrical Systems, Electrical Machines and Control System Engineering taken by students during their 2nd and 3rd year of study.

References

1. M.J. Roberts, Signals and System Analysis Using Transform Methods and MATLAB, 2nd Ed., McGraw Hill, 2012.
2. Hadi Saadat, Power Sytem Analysis, Third Edition, Mc-Graw Hill, 2010.
3. Nise, S. Norman, Control Systems Engineering, 6th Edition, John Wiley & Sons Inc., United State of America, 2011.
4. Muhamad H. Rashid. Power Electronics – circuits, Devices, and Application, 3rd Edition, Prentice Hall, 2005.
5. Stephen J. Chapman, Electric Machinery Fundamentals, 5th ed., McGraw-Hill, 2011.
6. LabVolt user and instruction manuals.

BELU 3551
ELECTRICAL ENGINEERING LABORATORY III

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Demonstrate the use of engineering simulation software, equipment and tools in generation, transmission, distribution and power system fault problems.
2. Investigate the method to improve the output voltage performance of three-phase inverter.
3. Investigate and design PID controller to control the positioning of the motor.
4. Demonstrate ability to write technical reports related to the experimental works being conducted.
5. Function effectively in a team.

Synopsis

In this course students will be exposed to two engineering simulation software; PSCAD and MATLAB/Simulink. The PSCAD will be used in the Power System Module while the MATLAB/Simulink will be used in the Power Electronics and Control System modules. For control system module, there are real application integration between MATLAB/ Simulink with stepper motor where the PID controller will be used to ensure the trajectory of the motor stop at the desired angle. The students will also investigate and analyze the harmonics performance of a three phase inverter in hardware. Besides that, students need to do some practical with hardware for power system delivery. Along the laboratory session students will also be evaluated in term of their ability to function well in team.

References

1. Daniel W. Hart, Introduction to Power Electronics, Prentice Hall, 2006.
2. Muhammad H. Rashid, Power Electronics - Circuits, Devices and Applications, 4th Edition, Prentice Hall, 2013.
3. J. Duncn Glover, Thomas J. Overbye, and Mulukutla S. Sama, Power System Analysis & Design, 6th Edition, CENGAGE Learning.
4. Norman Nise, Control System Engineering, 6th Edition, John Wiley & Sons.

BELG 3673
INTEGRATED DESIGN PROJECT

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Design solutions by synthesizing electrical engineering knowledge that will solve complex electrical engineering problem in accordance to relevant standards and with appropriate consideration for public health and safety, cultural, societal, environmental and sustainability factors.
2. Utilize modern engineering and IT tools in facilitating solution to complex electrical engineering problems with an understanding of the limitations.
3. Evaluate the impact of the designed product, components or processes, in terms of safety, environmental and sustainability factors.
4. Demonstrate effective teamwork skills in completing the electrically integrated design project.
5. Apply project management and financial knowledge effectively in completing the electrically integrated design project.

Synopsis
Integrated design project is a capstone project where student have to design project where students have to design an electrical and electronic 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 electrical and electronic design, students are also required to integrate their knowledge of other engineering such as (but not limited to) circuit design and analysis, including component 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 of electrical engineering knowledge.

References
1. Dieter, G.E. & Schmidt, L.C. (2013). Engineering Design, 5th Edition, McGraw Hill.
2. Ulrich, K.T. & Eppinger, S.D. (2008). Product Design and Development, 4th Edition, McGraw Hill.
3. John P. Bentley, Principles of Measurement Systems, 4th Ed., Prentice Hall, 2005.
4. Cross, Nigel, (2010) Engineering Design Methods, Wiley.
5. W.Bolton, Mechatronics electronic control systems in mechanical and electrical engineering, 4th Ed., Prentice Hall, 2008.
6. Kutz, Myer, Mechanical Engineers Handbook - Manufacturing and Management, 3rd ed., John Wiley 2006.

BELC 2433
SIGNALS AND SYSTEMS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply the basic knowledge of signals and systems for continuous-time and discrete-time signals.
2. Analyze the linear time-invariant (LTI) systems in time-domain and frequency-domain.
3. Analyze the LTI systems using Z-Transform method.

Synopsis
This course will discuss about the introduction to signals and systems; classification of signals and systems; linear time- invariant systems and convolutions; Fourier series and Fourier transform; Fourier analysis

for continuous- time and discrete- time signals; and Z-transforms method.

References

1. Philips, C. L., Parr, J. M., Signals, Systems and Transforms, 5th Ed., Prentice Hall, 2014.
2. Oppenheim, A. V., Willsky, A. S., Signals and Systems, 2nd Ed., Prentice Hall, 2014.
3. M.J. Roberts, Signals and System Analysis Using Transform Methods and MATLAB, 2nd Ed., Mc Graw Hill, 2012.

BELC 2453
COMMUNICATION SYSTEMS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe the basic principles of analogue & digital communication, data and computer network.
2. Analyse the analogue and digital communication techniques that are typically used in communication systems.
3. Explain the concept of computer system network.

Synopsis

Topics covered are: Introduction to Telecommunications, Transmission Modes, Power Measurements, Electromagnetic Frequency Spectrum, Bandwidth and Information Capacity, Amplitude Modulation Transmission & Reception, Single-Sidebands Communications Systems, Angle Modulation Transmission & Reception, FM Stereo, Noise in Telecommunication Systems, Digital Communication, Digital Transmission, PCM, Digital Modulation/ Demodulation, ASK, FSK, PSK, Data Communication & Computer Network. Frequency Division Multiplexing, Time Division Multiplexing, Space Division Multiplexing.

References

1. Anis Niza Ramani, Arfah Syahida Mohd Nor, Ezreen Farina Shair, Sazuan Nazrah Mohd Azam and Musa Yusup Lada, Basic Analog Communication System, First Edition, Penerbit Universiti UTeM, 2013.
2. Ahmad Fairuz Muhammad Amin, Hyreil Anuar Kasdirin, Zulhani Rasin, Wan Mohd Bukhari Wan Daud and Nur Maisarah Sobran, Introduction to Digital Communication System, First Edition, Penerbit Universiti UTeM, 2013.
3. Wayne Tomasi, Electronics Communications Systems Fundamentals Through Advanced, Prentice Hall, Fifth Edition, 2004.
4. Jeffrey S. Beasley, Modern Electronic Communication, Pearson, 9th Edition, 2008.
5. Behrouz A. Forouzan, Data Communication and Networking, 4th Edition, McGraw Hill, 2007.

BELC 3543
MICROPROCESSOR

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe and explain microprocessor based system (Motorola 68000) architecture, its operation interfacing circuitry and its supporting components.
2. Write and apply the 68K Microprocessor instruction set operation in assembly language.
3. Describe and distinguish the concept of the Motorola 68000 microprocessor system and design memory and peripheral device interface.
4. Develop and construct a microprocessor based system in solving any related problems.
5. Demonstrate the ability to work in a team for the microprocessor-based system project.
6. Present in oral and prepare the technical report for the microprocessor-based system project.

Synopsis
This course is about hardware and microprocessor handling, type of microprocessor systems, system handler and timing diagrams. The course covers the concept of MC68000 microprocessor software architecture, programming, assembly language and basic instruction, data transferring instruction, program control and subroutine, arithmetic and logic operations. It touches most on programming techniques, designing a microcomputer system, interfaces with memory and I/O devices. Students will experience PBL approach in this course where a PO- PBL will be introduced to the student.

References
1. Antonakos, J.L., The 68000 Microprocessor: Hardware and Software Principles and Applications, 5th Edition, Prentice Hall, (2004).
2. Spasov, P., Microcontroller Technology: The 68HC11 and 68HC12, 5th Edition, Prentice Hall, (2004).
3. Tocci, R.J., Digital Systems: Principles and Applications, 9th Edition, Prentice Hall, (2004).

BELC 3523
CONTROL SYSTEMS ENGINEERING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the basic features and configuration of control systems and derive the mathematical model of physical system in frequency and time domains.
2. Analyse control system performance and stability of linear control system in time and frequency domains.
3. Employ root locus method and its role in control system design.
4. Analyse the asymptotic approximation Bode plots performances for first order and second order systems.

Synopsis
This course introduces the students to the fundamental ideas and definition of control systems such as block diagrams, plants or processes, open-loop and closed- loop control systems, transfer functions and transient and steady state responses. Students will be taught on how to obtain mathematical models for actual physical systems such as electrical, mechanical, electromechanical and simple fluid flow systems in transfer function and state space equation. Methods of system representation such as block diagram representation and signal flow graphs will be examined. The students will also be exposed to techniques of analysing control systems such as time domain analysis and stability. Besides, the student will be taught on the Root locus method and system performance analyse using Bode diagrams. Finally, an introduction to the design and analysis of control systems using MATLAB will also be given.

References
1. Dorf, R.C., Bishop R.H., Modern Control Systems, 12th Edition, Pearson, 2014.
2. Nise, N.S., Control Systems Engineering, 7th Edition, John Wiley & Sons Inc., United State of America, 2015.
3. Ogata Katsuhiko, Modern Control Engineering, 5th Edition, Prentice Hall, 2010.

BELC 3663
CONTROL AND INSTRUMENTATION

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply and analyze the appropriate instrumentation elements for a data acquisition system.
2. Design compensators and controllers for control systems in time and frequency domain.
3. Design a controller and observer for a state variable feedback system.

Synopsis

This course divides the contents into two parts; Control System and Instrumentation. Control system part introduces students to the controller design of Linear Time Invariant (LTI) Systems by using Root Locus, Ziegler Nichols and state variable feedback systems. In state variable feedback systems, students will study the controllability and observability of LTI systems in state-space form and design a state feedback controller with full-state feedback observer by using pole placement approach. Instrumentations part exposes students to the concepts of data acquisition system (such as sensors & transducers, signal conditioning & processing, A/D and D/A conversion, interfacing standards and data presentation).

References

1. Bishop, Dorf, Modern Control Systems, 11th Edition, Prentice Hall, 2011.
2. Nise, S Norman, Control Systems Engineering, 6th Edition, John Wiley & Sons Inc., United State of America, 2011.
3. Ogata Katsuhiko, Modern Control Engineering, 5th Edition, Prentice Hall, 2010.
4. H.S. Kalsi, Electronic Instrumentation, 3rd Ed., McGraw Hill, 2010.
5. Larry, D. J, Foster A. C, Electronic Instruments and Measurements, 2nd Edition, Prentice Hall, Simon & Schuster (Asia), 1995.

BELC 4743
INTELLIGENT CONTROL SYSTEMS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Utilize the simulation tools for AI applications such as Simulink and MATLAB for appropriate industrial case studies.
2. Design basic fuzzy logic or neural network systems according to the engineering problem.
3. Demonstrate and analyze the performance of fuzzy logic and/or neural network using Simulink/ MATLAB or other specified tools.

Synopsis

Artificial Intelligence (AI) is a field of study concerns on allowing machines to imitate human's thinking or behaviour. By applying AI techniques, machines would be able to solve complex engineering problems such as predicting numbers of defect products in factory, optimizing a water tank system, classifying patients based on symptoms of a disease and etc. In this course students will be focusing on two popular subtopics in Artificial Intelligence area which is Neural Network and Fuzzy Logic. Students will be exposed towards the concept of Neural Network and/or Fuzzy Logic and its implementation methods in controlling engineering system using appropriate tools such as SIMULINK/MATLAB.

References

1. Michael Negnevitsky; Artificial Intelligence A
Guide to Intelligent System, 2nd Edition, 2005.
2. S.N. Sivanandam, S.Sumathi & S.N. Deepa; Introduction to Fuzzy Logic Using MATLAB, 2007.
3. Kevin M. Passino, Stephen Yurkovich; Fuzzy Control; 1998.
4. Timothy J. Ross; Fuzzy Logic with Engineering Applications; McGraw-Hill International Editions; 2010.
5. Simon Haykin; Neural Networks A Comprehensive Foundation; 2nd Edition; Prentice Hall; 2008.
6. Satish Kumar; Neural Networks A Classroom Approach; International Edition; McGraw Hill; 2005.
7. Hung T.Nguyen, Nadipuram R.Prasad, Carol
L. Walker, Ebert A. Walker; A First Course in Fuzzy and Neural Control Chapman and Hall; 2003.

BELC 4683
DIGITAL CONTROL SYSTEMS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Transform continuous-time signals into discrete- time signals and to represent LTI digital control systems in z- domain.
2. Analyze the stability and performance of digital control systems.
3. Design a discrete compensator using root locus technique, analytical technique and frequency response method, as well as to design a discrete state feedback controller and observer using a pole-placement method.

Synopsis
This course consists of discussions about an introduction to digital control systems, the relationship between continuous-time and discrete-time control systems, digital system coding, sampling process, quantization and z-transform, and digital control system representations. The notions of controllability, observability, and stability of digital control systems and analyses in time, frequency, and z domains are also included in this course. The design of digital PID controllers, lead-lag compensators, and state feedback and observer gain via a pole placement are covered in this course. The analyses and design of digital control systems are performed using MATLAB and Simulink. Students are encouraged to gain scientific knowledge of contemporary issues related this course.

References
1. Katsuhiko Ogata, Discrete-time Control System, 2nd Edition, Prentice Hall, 1995.
2. Benjamin C. Kuo, Digital Control Systems, 2nd Edition, Oxford, 1992.
3. C.L. Philips and H.T Nagle, Digital Control System Analysis and Design, 5th Edition, Pearson Education, 2005.

BELE 2333
ANALOGUE ELECTRONICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply the knowledge of electrical principle in BJT/FET amplifier, power amplifier, oscillator, active filter and voltage regulator.
2. Analyze the BJT/FET amplifier, power amplifier, oscillator, active filter and voltage regulator.
3. Design the analogue circuit system for signal amplification.
4. Exhibit technical writing to design the analogue circuit system for signal amplification.

Synopsis
This course is about the basic principle of analog electronic circuits mostly performing the concepts of amplification. The course courses contain the concepts of amplifier, BJT and FET are the devices usually used in amplifiers, small signal amplifier, power amplifiers (class A and class AB), oscillator, active filters and voltage regulators.

References
1. Bolysted, R., Nashelsky, L., Electronic Devices and Circuit Theory, 12th Edition, Prentice Hall, 2014.
2. Floyd, T., Electronic Devices, 10th, Edition Prentice Hall, 2018.
3. Aliminian, A., Kazimierczuk, M. K., Electronic Devices: A Design Approach, 1st Edition, Prentice Hall, 2004.
4. Russell, L. M., Robert, D., Foundations of Electronics Circuits and Devices, 5th Edition, Thomson Delmar Learning, 2007.

BELE 3533
ELECTRICAL MACHINES

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Understanding on basic principle of electromechanical energy conversion and operation of electrical machines.
2. Analyze dynamic parameters and performances of electrical machines in terms of torque density, power efficiency and speed.
3. Design an electrical machine based on given requirements and constraints.

Synopsis
Introduction to selected type of both DC and AC electrical machines which cover physical construction, equivalent electrical circuit diagrams and working principles. The machine performances like torque, speed and efficiency are investigated. The starting and control techniques are also investigated for a better machine selection of appropriate application.

References
1. Stephen J. Chapman, Electric Machinery Fundamentals, 4th ed., McGraw-Hill, 2012.
2. Charles I. Hubert, Electric Machines: Theory, Operation, Applications, Adjustment, and Control, 2nd ed., Prentice Hall, 2006.
3. Fitzgerald, Kingsley, Umans, Electric Machinery, 6th ed., McGraw-Hill, 2014.
4. Theodore Wildi, Electric Machines, Drives & Power System, 5th ed., Prentice Hall, 2005.

BELE 3543
POWER ELECTRONICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Demonstrate the principle, theory and concept of power electronic devices, rectifiers, dc to dc converters and inverters.
2. Develop and design power rectifiers, dc to dc converters and inverters by incorporating the power electronic devices and components for various engineering applications.

Synopsis
This course will discuss the characteristics of power switching devices so that the suitable devices and components can be selected in designing the power electronic converters. Various topologies of power electronic converters such as rectifiers, dc- dc choppers (non-isolated and isolated), dc-ac inverter (single and three phase) and their principle operation will be discussed. The performance parameters of the power converters, i.e. average and rms values, power, efficiency, total harmonic distortion (THD) and etc. will be analyzed through the mathematical calculation and simulation using PSpice and Matlab. In addition, several switching techniques including pulse width modulation (PWM) and their effect on the converter performance will also be covered.

References
1. Daniel W. Hart, Power Electronics, McGraw Hill, International Edition, 2011.
2. Muhammad H. Rashid. Power Electronics – Circuits, Devices, and Applications, 3rd Edition, Prentice Hall, 2013.
3. Issa Batarseh, Power Electronic Circuits, John Wiley & Sons, 2004.
4. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics–Converters, Applications and Design, 3rd Edition, John Wiley and Sons, 2003.

BELE 3673
INDUSTRIAL POWER ELECTRONICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Understand and analyze the application of power electronics in renewable energy, power system, industrial appliances and transportation.
2. Explain the operation, function and interaction between the components and the sub-systems used in power electronic applications.
3. Model, analyze and design the power electronic application system.

Synopsis
This course will discuss the principles of power generation, power application, and power quality improvement by means of power electronic devices. The basic operation and design of power supply and gate driver will be reviewed at glance. Subsequently, students will be given fundamental knowledge on how to design common power electronic systems used in industrial applications. The basic operation and designed of switched mode power supply (SMPS), power electronics in solar applications, high voltage direct current (HVDC), flexible AC Transmission Systems (FACTS), electric/ hybrid vehicles and active filter will be exposed to the students.

References
1. Abraham I.Pressman, Switching and Linear Power Supply, Power Converter Design, Hayden Book Company, Inc., 2004.
2. Ali Emadi, Abdolhosein Nasiri, Stoyan B. Bekiarov, Uninterrruptible Power Supplies And Active Filters, CRC PRESS, 2005.
3. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles. CRC PRESS, 2004.
4. Daniel W. Hart, Introduction to Power Electronics, Prentice Hall, 2006.
5. N.G Hingorani and L. Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems. Piscataway, NJ: IEEE Press, 2000.
6. Muhammad H. Rashid, Power Electronics – Circuits, Devices, and Applications, 4th Edition, Prentice Hall, 2013.
7. Hirofumi Akagi, Edson Hirokazu Watanabe, Mauricio Aredes, Instantaneous Power Theory and Applications to Power Conditioning, Wiley- IEEE Press, 2007.
8. Chris Mi, Abul Masrur, David Gao, Hybrid Electric Vehicles: Principles and Applications with practical, John Wiley & Son, 2011.
9. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics–Converters, Applications and Design, 3rd Edition, John Wiley and Sons, 2003.

BELE 3663
POWER ELECTRONICS SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyse converter output performances for various modulation control strategies.
2. Design control algorithm or modulation technique and control circuit for improving converter output performances.
3. Apply and perform project-based learning using modern engineering tools.

Synopsis
This course will discuss on essential parts in power electronic systems, development of control strategies of power electronic systems (e.g. firing control unit and some modulation techniques for controlled rectifiers, choppers and inverters), design of control algorithms/circuits and analyse the converter outputs performances. Students will perform a project-based learning to improve output converter performances using modern engineering tools.

References

1. Daniel W. Hart, Power Electronics, McGraw Hill, International Edition, 2011. (Text Book).
2. Haitham Abu-Rud, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with Matlab/ Simulink Models.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics–Converters, Applications and Design, 3rd Edition, John Wiley and Sons, 2003.
4. Muhammad H. Rashid, Power Electronics – Circuits, Devices, and Applications, 4th Edition, Prentice Hall, 2013.

BELE 3653
ELECTRICAL DRIVES

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyse the characteristics and dynamic modeling of electrical machine and drives.
2. Analyze the performance parameters of the electrical drives.
3. Design control strategy to drive the machine for optimum performance.
4. Operate as a team member or leader in a team project.
5. Engage in an independent and life long learning.

Synopsis
This course will discuss the electric drives, switch-mode converters, quadrants operation, current-controlled converters, modeling and transfer function of DC motor, converters of DC drive, closed-loop control of DC drives. It also covers the basic operations and dynamic modeling of Induction Motor, including scalar control, vector control and implementation of motor drive using microprocessor.

References

1. R. Krishnan, Electric Motor Drives, Modeling, Analysis and Control, Prentice Hall, 1st Ed., 2001.
2. Austin Hughes, Electric motor and drives: Fundamentals, types and application, Newnes, 4th edition, 2013.
3. Piotr Wach, Dynamics and control of electrical drives, springer 2011.
4. Mukhtar Ahmad, High Performance AC Drives: Modelling Analysis and Control, Springer, 2010.
5. André Veltman, Duco W. J. Pulle, R. W. A. A. De Doncker, Fundamentals of electrical drives, Springer, 2007.
6. Seung-Ki Sul, Control of Electric Machine Drive System, John Wiley & Sons, 2011.

BELE 4763
MODERN ELECTRICAL DRIVES

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain power electronics conversion in AC drives.
2. Analyze the dynamic motor of 3 phase AC machine.
3. Design the controller and evaluate the performance of AC drive systems.

Synopsis
This course will discuss the electric drives components, machine reference frame principle, vector transformation, direct vector control of synchronous motor and induction motor drives, dynamic modeling of AC motors, three-phase PWM Voltage Source Inverter fed AC motor drives and direct torque induction motor drives. Closed-loop speed control, current control and voltage control strategies including hysteresis current control, ramp- comparison and space- vector modulation. Students will experience POPBL approach in this course.

References

1. I. Boldea, Syed A. Nasar and S.A. Nasar, Electric drives, CRC/Taylor & Francis, 2nd edition, 2006.
2. Mukhtar Ahmad, High Performance AC Drives: Modelling Analysis and Control, Springer, 2010.
3. Austin Hughes, Electric motor and drives: Fundamentals, types, and application, Newnes, 3rd edition, 2006.
4. Seung-Ki Sul, Control of Electric Machine Drive System, John Wiley & Sons, 2011.
5. Andre Veltman, Duco W. J. Pulle, R. W. A. A. De Doncker, Fundamentals of electrical drives, Springer, 2007.
6. Piotr Wach, Dynamics and control of electrical drives, Springer 2011.

BELE 4873
SPECIAL MACHINES

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Demonstrate fundamental understanding of the interaction of the electromagnetic and mechanical engineering disciplines related to electrical machine design.
2. Identify of the differences in construction, performance and operation between the main topologies of electrical machines.
3. Select and employ techniques to design an electrical machine and select the appropriate materials for the application at hand.

Synopsis

This module is a continuation of the material covered in electrical machines. The module will cover the machine sizing considering power electronic and mechanical issues, magnetic materials including soft and hard materials and winding design, operating principle and basic design principles of different machine types and topologies including surface and buried permanent magnet radial machines, axial flux and reluctance machines.

References

1. P.C.Sen, Principles of Electric Machines and Power Electronics, Wiley, 2013.
2. Jacek F. Gieras, Electrical Machines, Drives and Power Systems, CRC Press, 2009.
3. J.R. Hendershot & T.J.E. Miller, Design of Brushless Permanent-Magnet Machines, Motor Design Books LLC, 2010.
4. Duane Hanselman, Brushless Motors: Magnetic Design, Performance, and Control of Brushless DC and Permanent Magnet Synchronous Motors, E-Man Press LLC, 2012.

BELG 1123
PRINCIPLES OF ELECTRICAL AND ELECTRONICS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Explain the basic principles of electrical and electronics components, terminologies, configuration, laws and rules.
2. Apply appropriate circuit analysis methods to solve DC (resistive) circuits problems.
3. Analyze circuits containing semiconductor devices.

Synopsis

This course will discuss about the basic principles of electrical and electronics, such as fundamental knowledge on electric element, principles of electricity, units associated with basic electrical quantities, symbol and components. Then the study on how to apply circuit theory to the solution of simple circuits and networks by the application of Ohm's law and Kirchhoff's laws, and the concepts of potential and current dividers in solving DC series and parallel circuit is explained.

Then, the behaviour of semiconductors and the way in which they are employed in diodes will be discussed. The semiconductor theory and devices, the atomic structures, energy band, P-type and N-type and how these materials are employed to form devices such as diode and BJTs are mentioned. Then the application and calculation of diode, DC biasing of Bipolar Junction Transistor (BJT), DC biasing of Field Effect Transistor (FET) and Operational-Amplifier (Op-Amp) circuits are explained.

References

1. Charles K. Alexander and Matthew N. O. Sadiku, Fundamentals of Electric Circuits, McGraw Hill, 5th Ed. (2013).
2. Floyd, T., Electronic Devices, 9th, Edition Prentice Hall, 2014.
3. Robert L. Boylestad and Louis Nasheslsky, Electronic Devices and Circuit Theory, Pearson, 11th Ed. (2014).
4. Allan R. Hambley, Electrical Engineering Principles & Application, Pearson, 6th Ed. (2014).

BELG 1233
PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe the principle, various terms and standards in measurement.
2. Explain the principle of measurement devices.
3. Apply the suitable bridge techniques to measure component values such as resistance, inductance and capacitance.
4. Explain the operation, function and applications of the transducers/sensors.

Synopsis

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

References

1. HS Kalsi, Electronic Instrumentation, 3rd Ed., Tata McGraw Hill, 2010.
2. UA Bakshi, AV Bakshi and KA Bakshi, Electronic Measurements and Instrumentation, Technical Publications Pune, 2009.
3. S. Wolf, Richard F.M Smith, Reference Manual for Electronic Instrumentation Laboratories 2nd Ed., Prentice-Hall, 2004.
4. Donald Calibration Book, Vaisala Oyj, Vaisala 2006.

BELG 2433
ELECTRICAL SYSTEMS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Explain the major components of an electrical power system (generation, transmission, and distribution system).
2. Calculate the AC voltage and current characteristic in AC circuits.
3. Analyze the single and three phase circuits by emphasizing on complex power and power factor correction.
4. Analyze the magnetic, single phase transformer and three phase transformer equivalent circuits.

Synopsis

This course introduces students to topics such as alternating current circuit analysis, phasor representation, RMS value, average power, reactive power, active power, apparent power, power factor and power factor correction for single phase and balance three phase system. In addition, magnetic circuit, construction and operation of transformer will be discussed in this course.

References

1. Glover, Sarma, Power System Analysis and Design, 4th ed., Thomson Learning, 2008.- main reference.
2. Hadi Saadat, Power System Analysis, 2nd ed., Mc- Graw Hill, 2004.
3. William D. Stevenson, Jr., Elements of Power System Analysis, 4th ed., Mc-Graw Hill, 1998.
4. Grainger and Stevenson Jr, Power System Analysis, Mc-Graw Hill, 1994.
5. Arthur R. Bergen, Power System Analysis, 2nd ed., Prentice Hall, 2000.

BELG 2443
ENGINEERING MATHEMATICS 2

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe the fundamental concepts of multivariable functions, multiple integrals and vector calculus.
2. Solve the mathematical problems that involve function of several variable, multiple integrals and vector calculus.
3. 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

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

BELM 4863
INDUSTRIAL ROBOTICS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Identify the solution of complex kinematics and dynamics problem.
2. Design a robotic manipulator work cell for manufacturing purposes.
3. Explain the working principles of robot manipulator drive, flexible manufacturing system and quality control in industrial robotic network.

Synopsis

This course is an introduction to the basic principle of robotic technology in industry. Robotic systems fundamental which includes forward and reverse kinematics of the basic robotic are introduce. Fundamental mathematics, scientific and engineering knowledge will be applied in this course to the solution of complex robotic problems. In developing the solution of integration of robotic components, the robotic actuation and drive systems are introduced, i.e. pneumatic and hydraulic systems, mechanical actuation systems, and electrical actuation systems. Student will be exposed to industrial field topics such as production system and integration of industrial robotic in flexible manufacturing system. The quality production will be analyze using six sigma and DMAIC procedure.

References

1. Craig, J. J., Introduction to Robotics, Mechanics and Control, 3rd Ed., Addison Wesley Longman, 2017.
2. Man Zhihong, Robotics, Prentice Hall, 2nd ed., 2005.
3. Stadler, W., Analytical Robotics and Mechatronics, McGraw Hill, 1995.
4. Fuller, J. L., Robotics: Introduction, Programming and Projects, 2nd Ed., Prentice Hall, 1998.
5. Saeed B. Niku, Introduction to Robotics, Prentice-Hall, 2001.
6. Bolton, W., Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 4th ed., Prentice-Hall, 2008.
7. Groover, W., Industrial Robotics: Technology, Programming and Applications, McGraw Hill, 1986.

BELP 2453
ELECTROMAGNETIC THEORY

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Apply vector analysis in order to solve problems regarding electromagnetic phenomena.
2. Identify the principles of static electric and magnetic fields as well as formulating and analyzing electrostatics and magnetostatic problems.
3. Investigate static and dynamic electromagnetic fields by utilizing the Maxwell's equation.

Synopsis

This course begins by teaching about vector calculus, an essential mathematical tool for gaining a quantitative understanding of the electromagnetic phenomena. It is then followed by the study of electrostatic fields, covering Coulomb's Law, Gauss's Law, conductors, dielectrics, and electric boundary conditions. Next, magnetostatic fields are covered; its sub-topics include Biot-Savart's Law, Ampere's Law, magnetic forces and torque, and magnetic boundary conditions. After that, the course will examine the situations in which electric and magnetic fields are dynamic (i.e. varies with time) using Maxwell's equations.

References

1. Fawwaz T. Ulaby, Fundamental of Applied Electromagnetics 7th edition, Pearson Education, 2015.
2. Matthew N.O. Sadiku, Elements of Electromagnetics, 6th edition, Oxford University Press, 2014.
3. David J. Griffith, Introduction To Electrodynamics, 4th Edition, Pearson Education, 2014.
4. William H. Hayt Jr, John A Buck, Engineering Electromagnetics, 8th Edition, Mcgraw-Hill, 2012.

BELC 3673
INDUSTRIAL CONTROL AND AUTOMATION

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Explain the principles and fundamentals of industrial control systems and automations system.

2. Analyze complex structure of control processes based on pneumatic and hydraulic applications, as well as by using feedback and feedforward control systems.
3. Design automated PLC based systems with consideration for specific needs.

Synopsis
This course will cover sensors, instrumentation and control systems commonly used in the industry. The instrumentation part includes topics such as sensors, signal conditioning and conversion, transducers & actuators, and data acquisition. The industrial control portion covers the evaluation and types of control systems, centralized system, distributed control systems (DCS), fieldbuses, PID controllers and their operations. It will include other common control systems such as feedforward, cascade, ratio, time-delay compensation, sequence control. Besides, it will cover appropriate controllers for process control industries, too.

References
1. Andrew Parr, Industrial Control Handbook, 3rd Edition, Newnes (Elsevier), 2000.
2. W. Bolton, Instrumentation and Control Systems, Newnes (Elsevier), 2004.
3. Seborg, Edgar, Mellichamp, Doyle, Process Dynamics and Control, 3rd Edition, Wiley, 2011.
4. W. Bolton, Mechatronics: Electronic Control System in Mechanical and Electrical Eng., 5th Edition, Pearson, 2012.
5. Chester L. Nachtigal, Instrumentation and Control: Fundamental and Applications, Wiley, 1990.

BELP 3683
DISTRIBUTION SYSTEM DESIGN

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyze and breaking down the information of design parameters into component parts.
2. Create the design of low voltage system by using standard design procedures.
3. Apply the concept and technical specification of low voltage protection system.
4. Apply the Acts, Regulations and Standard related to electrical installation and its safety.

Synopsis
This course presents the principles and design of electrical distribution system. It covers various issues of distribution system which includes regulations and standards related to electrical installation. Characteristics and specifications for circuit breakers, cable size selection, and method of earthing and earthing arrangement are described in detail. The students are also exposed to the use of standard design procedures and the type of testing and troubleshooting required for low voltage systems. The students will also be exposed on the concepts of protection and its devices in low voltage system.

References
1. Teo Cheng Yu, Principle and Design of Low Voltage System, Byte Power Publication, 1995.
2. Ir Md Nazri, Aminudin, Md Hairul Nizam, Engineering Practice: Wiring System & Motor Starter, Modul 2 UTeM, 2007.
3. Brian Scaddan, Inspection, Testing & Certification, Third Edition, Newes, 2001.
4. IEE Wiring Regulation 17th Edition.

BELP 3673
POWER SYSTEM ANALYSIS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Develop the Per-Unit system from one line diagram and analyzed the power flow analysis using Gauss Seidel and Newton Raphson method.
2. Investigate the balanced and unbalanced faults in Power System and the stability of synchronous machine.

Synopsis
The Power System Analysis covers transient/ dynamic nature of power systems such as fault analysis, load flow and stability analysis. The analysis on balanced and unbalanced faults in power systems are discussed. Solutions for unbalanced faults are approached using fundamentals of symmetrical components. The course also covers the fundamental concept of the behavior of synchronous machines after a disturbance, i.e., steady-state and transient.

References
1. Hadi Saadat, Power System Analysis, International 3rd ed. McGraw Hill, 2011
2. Grainger and Stevenson Jr, Power System Analysis, McGraw Hill, 1994.
3. Sarma and Glover, Power System Analysis and Design, 5th ed. Brooks/Cole, 2012.

BELP 4843
RENEWABLE ENERGY

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Interpret the government policy in relation to renewable energy development both technically and economically.
2. Analyse the selected forms of distributed generators and their associated connection impacts to the electrical grid
3. Design the grid-connected solar photovoltaic system and evaluate the system performance accordingly

Synopsis
The course intends to expose the students the most recent renewable energy development both technically and economically. This includes context, drivers and the up-to- update government policy. In addition, this course also introduces the students various form of renewable energy resources and their associated impact to the electricity systems. The students will also be exposed to different types of photovoltaic technology. Finally, this course includes the detail design of grid-connected PV systems and the performance evaluation.

References
1. Gilbert M. Masters, “Renewable and Efficient Electric Power Systems”, Wiley-IEEE Press, July 2004.
2. N. Jenkins, J.B. Ekanayake and G. Strbac, Distributed Generation, Stevenage IET, 2010.
3. Felix A. Farret, M. Godoy Simões, “Integration of Alternative Sources of Energy”, John Wiley & Sons, Jan 17, 2006.
4. S. Shaari, A. Maliki, S. Irwan, N. Zaini, “SEDA Grid-Connected Photovoltaic Systems Design Course”, 2014.

BELP 4853
ENERGY UTILIZATION AND CONSERVATION

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify and analyze energy consumption for different type of electricity tariff, demand side tariff initiative, penalty in electricity bill and correction strategy for different sector.

2. Design and establish a Sustainable Energy Management System (SEMS) strategy for an organization.
3. Conduct and implement procedural energy auditing and interpret data through measurement & verification practices with economic aspect for energy management project.
4. Apply energy policies, regulation, act, energy efficient, green and renewable technologies toward energy utilization and conservation.

Synopsis

This course introduces energy utilization and conservation through the understanding of its energy policies, regulation and act such as electricity supply act 1990 (act 447) and electricity regulation 1994, energy commission act 2001 (act 610) and efficient management of electrical energy regulation (Emeer) 2008 at distribution level. The syllabus covers the important of energy efficient equipment, green and renewable technologies towards utilization and conservation. Furthermore, analysis of different electricity tariff categories and energy auditing procedure will be conducted and implemented. Finally, this course will also cover the evaluation of the economic aspect in energy management project through measurement and verification practices.

References

1. Energy Manager Training Course Material, Malaysia Green Technology Corporation (Mgtc), 2015.
2. Energy Audit Training Course Material, Malaysia Green Technology Corporation (Mgtc), 2015.
3. Management, Measurement and Verification of Performance Contracting, James P. Waltz, 2003.
4. Gilbert M.Masters, Renewable and Efficient Electric Power Systems, Wiley, 2005.
5. Measurement and Verification Course Material, Malaysia Green Technology Corporation (Mgtc), 2016.
6. Energy Efficiency and Conservation Guidelines For Malaysian Industries, Part 1: Electrical Energy-Use Equipment, Suruhanjaya Tenaga (St), Second Edition, 2008.

BELP 4873
POWER SYSTEM PROTECTION

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Apply the basic principles of power system protection.
2. Analyze the use of Current Transformer (CT), Voltage Transformer (VT), fuse and circuit breaker for protection through technical justification.
3. Design the coordination for protection system scheme.
4. Design appropriate protection schemes for electrical equipment such as transformer, generator and motor.

Synopsis

This course introduces the fundamental of power system protection and relaying, protection principle and coordination in power system network. Detail explanation on various type of protection schemes such as overcurrent protection, transformer protection, distance protection and differential protection. In addition, the theory and applications of the main components used in power system protection and device such as protection relay, circuit breaker (CB), CTs, VTs, will be discussed.

References

1. Khim Sang, Wong, Power Distribution and Protection, Second Edition, Prentice Hall 2003.
2. Y.G. Paithankar, Fundamentals of Power System Protection, Prentice Hall of India, 2004.
3. Abdullah Asuhaimi Mohd Zin, Kejuruteraan Sistem Kuasa, UTM, 2003.

4. Glover, Sarma, Power System Analysis and Design, Third Edition, Brooks/Cole 2011.

BELP 3693
HIGH VOLTAGE ENGINEERING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify and analyze the conduction and breakdown theory in gas, solid and liquid dielectrics.
2. Explain the fundamental knowledge of generation and measurement of high voltage AC, DC and impulse.
3. Examine the high voltage testing, insulation coordination and diagnostics on materials and electrical apparatus.
4. Analyze the overvoltage phenomenon in electric power system.

Synopsis
This course is intended to give students deep knowledge about high voltage engineering it focusses on the characteristics of conduction and breakdown in gas, solid and liquid dielectrics. Generation of high voltages AC, DC and impulses, their measurements and testing techniques on materials and electrical apparatus according to standard are also covered. Students are also exposed to overvoltage phenomenon in electric power systems.

References
1. M.S. Naidu & V. Kamaraju, 5th Edition, McGraw Hill, 2013.
2. E. Kuffel, W.S. Zaengl & J. Kuffel, High Voltage Engineering Fundamentals, Newnes, 2nd ed., 2000.
3. Dieter Kind & Kurt Feser, High Voltage Test Techniques, Newnes, 2nd ed., 2001.

BELU 1123
ELECTRICAL CIRCUIT I

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyse electrical circuit using Ohm's Law and Kirchhoff's Laws.
2. Apply Mesh and Nodal methods for DC and AC circuit analysis.
3. Analyze DC an AC circuits using Superposition, Thevenin, Norton and Maximum Power Transfer Theorems.

Synopsis
This course introduces the students to Ohm's Laws, Kirchhoff's Laws and use them to calculate current, voltage and power in electrical circuitries. Students also learn the analytical methods namely mesh and nodal analysis, as well as apply Thevenin theorem, Norton theorem, Superposition, and the Maximum Power Transfer in circuit analysis. The applications of the above tools will cover both dc and ac circuits.

References
1. K.A. Charles, N.O. Sadiku, Fundamentals of Electric Circuits, 5th Ed. McGraw Hill, 2013.
2. Robbins and Miller, Circuit Analysis and Practice, 3rd. Ed., Thomson and Delmar, 2003.
3. Nilsson and Riedel, Electric Circuits, Prentice Hall, Electric Circuits (9th Edition), 2010.

BELU 2333
ELECTRICAL CIRCUIT II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyse the first order and second order technique for RLC circuits transient analysis.
2. Apply Laplace transforms method and its frequency response in electrical circuit analysis.

3. Analyze the frequency response of RLC circuits and the characteristics of RLC filters.
4. Analyze various topology of two-port network in electrical circuit analysis.

Synopsis

This course exposes student to the application of several techniques in analyzing electrical circuits, such as the Laplace transform and two ports network. The students are required to use appropriate tools to analyze transient and frequency response in electrical circuit.

References

1. K.A. Charles,N.O. Sadiku, Fundamentals of Electric Circuits, 6th Ed. McGraw Hill, 2016.
2. Robbins and Miller, Circuit Analysis and Practice, 5th Ed., Thomson and Delmar, 2013.
3. Nilsson and Riedel, Electric Circuits, Prentice Hall, Electric Circuits (11th Edition).
4. Thomas L. Floyd. Electric Circuits Fundamentals. 8th Edition, Pearson, 2009.

BELU 3695
INDUSTRIAL TRAINING

Learning Outcomes

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

1. Apply appropriate techniques and technical knowledge which is relevant for student field of study.
2. Demonstrate the ability to adapt with working environment and practice working efficiently and ethically.
3. Demonstrate soft skill especially communication skill at all level.
4. Work affectively as an individual, team members and as a leader as well.
5. Acquire new knowledge, life-long learning and aware to new technology.

Synopsis

All bachelor degree students are required to undergo industrial training as part of their curriculum to complete their four (4) years course for the Bachelor of Electrical Engineering (BELG) and Bachelor of Mechatronics Engineering (BELM). It is compulsory for all degree program students to undergo the Industrial Training Programme.In general, the aim of industrial training are to give exposure, experience and professional skills to various aspects of engineering discipline, in particular in electrical engineering related industries. The students are also expected to be familiarized with efficient, accountable and ethical conduct as they will be supervised directly under the company's personnel as well as supervisors from the faculty. Apart from that, the assessment will be made by the appointed faculty supervisors & the industry supervisors.

References

1. Dasar Latihan Industri KPT, 2010.
2. Garis Panduan Latihan Industri UTeM, 2017.
3. Dokumen Jawatankuasa Latihan Industri FTKE.

BELU 4792
FINAL YEAR PROJECT 1

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Conduct proper literature survey and identify the problems, objectives and scope of project clearly.
2. Select, plan and execute a proper methodology in problem solving.
3. Present the project proposal in written and in oral format effectively.
4. Work systematically and commit to professional ethics.

Synopsis

This course is the first part of the Final Year Project which requires two semesters to complete. For the first semester as of this course, student(s) and supervisor(s) are expected to have two-way communications which later comes to an agreement of project topic leading to project supervision and project learning process collectively. At the end of the semester, students are required to deliver first year progress report which generally covers abstract, problem statement, objectives, scope of works, literature review, proposed methodology, early results, and general conclusion. Sessions for oral presentation is also held to measure student's level of understanding and capability on carrying specified project.

References
Depend on each student project's references.

BELU 4861
ENGINEERING SEMINAR

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify the professional engineering knowledge, practices and responsibilities.
2. Collect and sort relevant information with regards to the given technical talk.
3. Discuss current engineering issues and practices that impacting engineering professionals.

Synopsis
The main purpose of this course is to instill the recognition of the need for and the ability to engage in life-long learning among students. Through presentation by invited speakers from the industry and academia, students will be exposed to topics such as professional engineering bodies and knowledge of in contemporary issues in related engineering fields. Presentation by successful alumni describing how their careers developed after obtaining their undergraduate degrees will also be included.

BELU 4894
FINAL YEAR PROJECT II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify, formulate, research literature and analyze problem.
2. Conduct investigation using research-based knowledge and methods.
3. Apply ethical principles in project implementation.
4. Present the results in written and in oral format effectively.
5. Identify basic entrepreneurship skills in project management.
6. Apply reasoning informed by contextual knowledge.
7. Engage in independent and lifelong learning.

Synopsis
This course is the second part of Final Year Project I, in second semester. Students will continue their project from FINAL YEAR PROJECT I (BELU 4792) during the second semester, and they should accomplish the projects completely either in hardware, software or both. Students needs to write-up a good final report (in thesis format), as a part of the course's assessment.

References
Depend on each student project's references.

BERG 1413
DIGITAL ELECTRONICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the number system, basic concept and terminology of digital circuits that form complex electronic systems.
2. Analyze the basic circuits based on combinational and sequential components.

Synopsis

The outcome of this course is to deliver knowledge, understanding and application of the digital electronics. The course begin with the introductory concepts of digital technology, number systems and codes. Then, logic gates and Boolean algebra will be explored. Apart from that, combinational logic circuits and functions of combinational logic will be introduced. Students will also be enlightened with latches and flip-flops. Finally, this course will also introduce integrated circuit technology where students also will be explored to semiconductor technology for the project assignment. This course will also expose the students to current application in the digital electronics industry.

References

1. Thomas L. Floyd. Digital Fundamentals. Eleventh Edition, Prentice Hall, 2014.
2. Ronald J. Tocci, N. Widmer, G. Moss. Digital Systems, Principles and Applications. 11th Edition, Prentice Hall, 2011.
3. Roger I. Tokheim. Digital Electronics, Principles and Applications. McGraw-Hill, 2013.

BERN 2143
ENGINEERING STATISTICS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Apply the concepts of data description and probability, normal and sampling distributions, estimation and hypothesis testing, ANOVA, regression and non- parametric tests to solve mathematical problems.
2. Analyze engineering data using descriptive statistics.
3. Deduce statistical inference for engineering problems by using the techniques of estimation, hypothesis testing and regression.

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 using statistical software application which are widely used in the industry.

References

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

BERN 3322
ENGINEER AND SOCIETY

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Apply ethical principles and commitment, to professional ethics, responsibilities and norms of engineering practice.

2. Apply reasoning informed by contextual knowledge to assess health, safety and legal issues and its subsequent responsibilities, relevant to professional practice.
3. Understand the needs for sustainable development and the impact of engineering solutions on society and environment.

Synopsis
This course will discuss about:
Ethics and professionalism, engineers and society, professional ethics, code of ethics, ethics dealing with human relations, BEM, IEM, regulations on professional conduct, route to professional status, engineers as an employee or employer, decision making, competence of practicing engineering, accountability, liability, engineer's legal liability specified in contract law, engineers and the environment, sustainability, etc.

References
1. The Institution of Engineer, "Engineering Professionalism and Ethics" 4th Ed, 1995.
2. Charles B. Fleddermann, Engineering Ethics, 3rd Ed, Prentice Hall, 2008.
3. Mike W Martin, Roland Schinzinger, Ethics in Engineering, 4th Ed, McGraw-Hill, 2005.
4. Charles E Harris JR, Michael S Pritchard, Michael J Rabin, "Engineering Ethics" 2nd Ed, Thomson and Wadsworth, 2003.

SERVICE COURSES (FTMK)
BITG 1233
COMPUTER PROGRAMMING

Learning Outcomes
In the end of the course, student will be able to:
1. Identify the fundamental principles of problem solving, programming techniques and structures in program development.
2. Explain the principles of problem solving and programming techniques to solve given problems.
3. 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
1. Gaddis, T., (2015), "Starting Out with C++ Brief Version: From Control Structures Through Objects 8th. Edition", Pearson Education.
2. Abdullah, N. et. al, (2018), "Lab Module Computer Programming (edition 2018), FTMK, UTeM.
3. Friedman, Koffman (2011), "Problem Solving, Abstraction and Design using C++", 6th Edition, Pearson Education.
4. Etter, D.M., Ingber, J.A., (2012), "Engineering Problem Solving with C++", 3rd Edition, Pearson Education.
5. Hanly, J.R, (2002), "Essential C++ for Engineers and Scientists", 2nd Addison Wesley.

SERVICE COURSES (FKM)
BMKC 1013
DIFFERENTIAL EQUATIONS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the basic concept of first and second order differential equations, Laplace Transform and Fourier series.
2. Select an appropriate technique to solve problems involving differential equations.
3. Apply the concept of differential equations in solving engineering problems.

Synopsis

This course provides an introductory knowledge to differential equations and its applications. The students are introduced to the first order differential equations and solve using analytical methods of separable variable and linear equations and also using numerical methods such as Euler's method and second order Runge-Kutta method. 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, Fourier series and partial differential equations and solving using numerical methods which is finite difference method (Parabolic, Hyperbolic).

References

1. Rahifa R., Irmawani J., & Nurilyana A. A. (2019). Differential Equations for Engineering Students. Penerbit UTeM.
2. Khoo, C.F. (2021). Numerical Methods Using Scilab. Penerbit UTeM.
3. Zill D.G. & Wright S.W. (2018). Differential Equationswith Boundary-Value Problems, 9th Edition. Brooks/Cole
4. Edwards C. H., Penny D.E. & Calvis D. (2016). Differentialequations and Boundary Value Problems, Fifth Edition. Pearson Education Inc.
5. Rai B., Choudhury D.P. And Freedman H.I.(2013). A Course In Ordinary Differential Equations. Oxford Alpha Science International.

BMKU 1313
ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Explain the engineering graphics fundamentals.
2. Construct technical drawing using manual sketching and computer aided design.
3. Communicate by using engineering drawings.

Synopsis

The course concentrates on manual drafting and Computer Aided Drafting (CAD) software. For manual drafting, students will be exposed to the basic drafting tools, techniques and the application in producing various types of engineering drawing. For computer aided design, CAD engineering drawing software is exercised to produce engineering drawing. The students will be exposed to CAD interface, editing commands, coordinate system, template preparation and layer to produce various types of engineering drawing.

References

1. Omura, G & Benton, B., 2015, Mastering Autocad 2016 And Autocad Lite 2016, John Wiley & Sons Inc., Indiana, USA.
2. Er. R. K. Dhawan, 2010, Engineering Graphics (In First Angle Projection), 1st Ed., S. Chand Technical, India.
3. Mohd Rizal Alkahari et. al., 2009, Modul Lukisan Berbantu Komputer, Penerbit Universiti Teknikal Malaysia Melaka, Melaka.
4. Giesecke, F.E., Mitchell, A., Spencer, H.C., Hill, I.L., Dygdon, J.T., and Novak, J.E., 2008, Technical Drawing, 13th Ed., Prentice Hall, New York.
5. Khairul Anuar Hanafiah, 1999, Lukisan Berbantu Komputer, Penerbit Universiti Teknologi Malaysia, Skudai.

BMKU 2432
INTRODUCTION TO MECHANICAL ENGINEERING

Learning Outcomes
Upon completion of this course, the student should be able to:

1. Describe basic concepts and fundamental principles of mechanical engineering mechanics.
2. Apply basic concepts and fundamental principles to solve mechanical engineering problems.
3. Analyze basic problems in mechanical engineering.

Synopsis
This course consists of basic principles of:
Static: General principle, Force vector and Equilibrium of Particle.
Dynamics: Apply Newton's 2nd Law in Kinematics and Kinetics of Particle.
Mechanics: Principle of Stress & Strain and Torsion. Thermodynamics: Property table of pure substance, Closed and open system with respect to first law of thermodynamics and refrigeration cycles.

References

1. Hibbeler, R.C, Engineering Mechanics: Statics, 12th Editions, Prentice Hall. (2010).
2. Beer, F. P., Vector Mechanics for Engineers, Dynamics SI Units, 9th Edition, McGraw-Hill, (2010).
3. Hibbeler, R.C, Engineering Mechanics, Dynamics, 12th Editions, Prentice Hall. (2010).
4. Beer, F.P., Johnston E.R, DeWolf J.T and Mazurek D.F, 2009, Mechanics of Materials 5th Editions in SI Units,McGraw- Hill.
5. Cengel, Y. A. and Boles, M. A., 2011, Thermodynamics: An Engineering Approach, 7th Edition, McGraw Hill.
6. Sonntag, R. E., 2009, Borgnakke, C., and Van Wylen, G. J., Fundamentals of Thermodynamics, 7th Edition, John Wiley & Sons Inc.
7. Wark, K., 1999, Thermodynamics, 6th Edition, McGraw-Hill.
8. Gupta, S.C., 2008, Thermodynamics, Pearson

BMIG 1313
ENGINEERING MATHEMATICS 1

Learning Outcomes
Upon completion of this course, the student should be able to:

1. Describe the fundamental concepts of matrices, eigenvalues and eigenvector, complex numbers, interpolation, differentiation, integration and vector- valued functions.
2. Solve the mathematical problems that involve matrices, eigenvalues and eigenvector, complex numbers, interpolation, differentiation, integration and vector-valued functions by using an appropriate technique.
3. Apply the knowledge of engineering mathematics to deal with the engineering problems.

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

1. James, G., Modern Engineering Mathematics, 5th edition, Pearson, 2015.
2. Khoo, C.F., Sharifah Sakinah, S.A., Zuraini, O. and LOk, Y.Y., Numerical Methods, 3rd edition, Pearson Prentice Hall, 2009.
3. Muzalna M.J., Irma Wani J. Rahifa R. and Norazlina A.R., Engineering Mathematics, 2nd edition, Prentice Hall, 2009.

4. Kreyszig, E., Advance Engineering Mathematics, 10th edition, John Wiley, 2010.
5. Guo W., Advance Mathematics for Engineering and Applied Sciences, Pearson, 2015.

BMIG 1213
ENGINEERING MATERIALS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain the basic concepts of engineering materials in terms of interatomic bonding and crystal structure.
2. Analyze the properties of engineering materials based on its structure.
3. Describe the processing methods for engineering materials.

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. Introduction to the binary phase diagrams are also provided. Explanation on different types of engineering material (i.e. metal, ceramic, polymer, composites and functional), its mechanical properties, basic processing and applications are also included.

References
1. Callister, W.D. Jr. and Rethwisch, D.G. (2020) Materials Science and Engineering - An Introduction, 10th Edition. John Wiley & Sons Inc
2. Askeland, D.R., Fulay, P.P. and Wright, W.J., (2012), The Science and Engineering of Materials, 6th Edition. Thomson.
3. Smith, W.F. (2010) Principle of Materials Science & Engineering, 5th Edition, Mc. Graw Hill.
4. Shackelford, J.F. (2009) Introduction to Materials Science for Engineering, 7th Edition, Prentice Hall.

BMIU 3213
ENGINEERING ECONOMY AND MANAGEMENT

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain the principles and terminology of engineering economy, concepts of time value of money, and risk planning.
2. Apply the concepts, principle and techniques in project management and engineering economy.
3. Analyze complex problems and scenario using engineering economy factors (F/P, P/F, P/A, A/P, F/A, A/F, P/G, A/G factors).
4. Evaluate and select between alternatives using suitable methods such as Present Worth, Future Worth, Annual Worth Analysis; Rate of Return and Breakeven & Payback Analysis.
5. Evaluate the project risk in engineering project.

Synopsis
The course covers engineering economy and managing project & risk. Engineering economy discusses about the time value of money and interest relationship; engineering economy factors; nominal and effective interest rates; worth analysis; breakeven and payback analysis; which are useful to define certain project criteria that are utilized by engineers and project managers to select the best economic choice among several alternative. Management of risk incorporates the concepts of probability and statistics in the evaluation of alternatives. This allows management to determine the probability of success of failure of the project.

References
1. Blank, L and Tarquin, A., 2012, Engineering Economy, 7thEdition, McGraw Hill.
2. Whitman D. and Terry R., 2012, Fundamentals of Engineering Economics and Decision Analysis, Morgan& Claypool Publishers.

3. Sullivan W.G, Wicks E.M, Koelling C.P., 2012, Engineering Economy, 15th Edition, Prentice Hall international.
4. Park C.S., 2011, Contemporary Engineering Economics, 5th Edition, Pearson.

SERVICE COURSES
(FPTT, PPB, IPTK & CO-CURRICULUM UNIT)
BTMW 4012
TECHNOLOGY ENTREPRENEURSHIP

Learning Outcomes
In the end of the course, student will be able to:
1. Recognize the importance of entrepreneurship, the role of entrepreneurship in today's society, and the technical knowledge of the entrepreneurial process.
2. Explain the basic concepts of interdisciplinary competences in management and create technology- based businesses.
3. 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
1. Barringer, B.R, and Ireland, R.D. (2012). Entrepreneurship 4th Edition. Pearson.
2. Scarborough, N.M. (2011). Essentials of Entrepreneurship and Small Business Management 6th.Edition. Pearson.
3. UiTM Entrepreneurship Study Group. Revised Edition (2010). Fundamentals of Entrepreneurship. Pearson.

BLLW 1172
COMMUNICATIVE MALAY LANGUAGE I

Hasil Pembelajaran
Pada akhir kursus ini, pelajar akan dapat:
1. Memberikan respon terhadap perbualan biasa dan situasi-situasi lain.
2. Mengaitkan bunyi-bunyi atau ucapan dalam Bahasa Melayu dari segi nahu, fonologi dan kemahiran lisan tentang diri sendiri, keluarga, rakan-rakan and aktiviti harian.
3. Membincangkan secara mudah tentang sesuatu topik semasa.
4. Membina ayat dan bertutur dalam bahasa Melayu dengan gramatis.

Sinopsis
Kursus ini memperkenalkan susuk tatabahasa bahasa Melayu. Pelajar didedahkan dengan aspek-aspek nahu, klausa, terminologi, binaan ayat, penjodoh bilangan dan unsur sastera. Diharapkan pelajar dapat menguasai pertuturan atau berkomunikasi dengan baik dan mudah berdasarkan kemampuan pelajar asing.

Rujukan
1. Amy Buttner. (2013). Aktivitas, permainan dan strategi penilaian untuk kelas bahasa asing. PT InDELs, Jakarta, Indonesia.
2. Yong ChynChye, Rohaidah Mashudi dan Maarof Abd Rahman. (2012). Bahasa Kebangsaan untuk pelajar luar negara (Malay Language for International Students). Kuala Lumpur: Pearson Malaysia Sdn. Bhd.

3. Zarina Othman, Roosfa Hashim dan Rusdi Abdullah (Peny.). (2012). Modul Komunikasi Melayu Antarabangsa. Bangi, Selangor: Penerbit Universiti Kebangsaan Malaysia.

BLLW 1212
ARABIC LANGUAGE 1

Learning Outcomes
In the end of the course, student will be able to:
1. Use the basic Arabic grammar correctly and apply the information from the text
2. Construct sentences and apply selected vocabulary in a report.
3. Demonstrate communication skills.

Synopsis
This basic Arabic course adopts the communicate approach and introduces the phonology, grammar, vocabulary and writing system. Students will be exposed to basic reading materials in the languages.

References
1. Abdul Rahim (2004). Pembelajaran Bahasa Arab bagi golongan yang bukan Arab, (Bil.1) Kuliah Bahasa Arab Universiti Islam Madinah, Saudi Arabia.
2. Yaakob, M., Mohd Salleh, A.H & Mahpol, S. (2003). Al- ibtikar, (Bil.1) Sepang, Selangor: Penerbitan Salafi.
3. Abdul Masih, G.M. (2001). Mu'jam Kawaid Al-Lugatul Arobiah Fi Jadawal Walauhat. Maktabah Lubnan.
4. Yaakob, A.B. (2000). Mausuah An-Nahwu Wassorp Wali'raf. Beirut, Lubnan: Darul Ilmi Lilmalayin.
5. Mohd. Rejab I. (2000). Kursus Bahasa Arab. Yayasan Dakwah Islamiah Malaysia (YADIM).
6. Arifin Jami'an, M. (1994). Bahasa Arab, Kursus mudah dan cepat. Dinie Publisher.

BLLW 1232
JAPANESE LANGUAGE 1

Learning Outcomes
In the end of the course, student will be able to:
1. Use grammar and classify the features of Japanese phonology correctly.
2. Demonstrate correct pronunciation.
3. Construct sentences and demonstrate writing skills.

Synopsis
This course 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 course 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
1. Minna no Nihongo 1, 3A Corporation, 2002.
2. Minna no Nihongo 1, Translation & Grammatical Notes, 3A Corporation, Tokyo, 2002.
3. Shin Nihongo No Kiso 1-Grammatical Notes In English, 2001, Association for Japanese-Language Teaching.
4. Shin Nihongo No Kiso 1-English Translation Asian Edition, 2000, Association for Japanese
-Language Teaching.
5. The Association for Overseas Technical Scholarship (AOTS), 2000, Shin Nihongo No Kiso 1-English Translation, Asia Edition.
6. Japanese For Young People 1 Kana Workbook, 2000, Association for Japanese-Language Teaching.

BLLW 1222
MANDARIN LANGUAGE 1

Learning Outcomes
In the end of the course, student will be able to:
1. Demonstrate the ability to converse in Mandarin with correct and accurate pronunciation and intonation.
2. Use the rules of Chinese writing and the theory of word and sentence formation.
3. Interpret the information in the simple text.

Synopsis
This course is designed for students who do not have any background in Mandarin. It provides students with the knowledge to enable them to understand and communicate in the oral and written forms. This course encompasses the listening, speaking, reading and writing components. This course aims to help students to obtain enough exposure of the Mandarin phonetics (Han yu pin yin). The grammar introduced is related to the language used daily by Chinese. Particular care is also taken to ensure that the complexity of the dialogues is gradually developed using simple to complex sentences.

References
1. Ang Lay Hoon, Ooi Bee Lee (2008) Basic Chinese For Everyone. Selangor: Pelanduk Publications.

BLHW 2752
MALAYSIAN CULTURE

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Discuss issues related to Malaysian culture.
2. Present issues related to Malaysian culture.
3. Reflect the scenario of cultural diversity in Malaysia.
4. 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 to assist international students in developing their understanding and appreciation of Malaysian culture.

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

BLHW 1762
PHILOSOPHY AND CURRENT ISSUES

Learning Outcome
In the end of this course, the students are able to;
1. Explain the current issues related to philosophy, National Education Philosophy and National Ideology.
2. Analyze the current issues based on main scholarly thought and various philosophical theories.
3. Examine the current issues according to philosophical comparative studies between dialogue and culture.

Synopsis
This course will discuss on the concept of knowledge, ethics and civilization which emphasize on comparative available systems, social development and multi-cross cultural activities in Malaysia. Besides, this course is stressing on current and contemporary issues

discussion related to economy, politic, social, culture and environment based on ethical and civilizational approach. This course will cover the comparative system, developmental phase, social development and cross cultural activities in order to produce a man with positive values.

References

1. Dzulkifli A. R. dan Rosnani H. (Eds). (2019). Pentafsiran Baharu Falsafah Pendidikan Kebangsaan dan Pelaksanaannya Pasca 2020. Kuala Lumpur: IIUM.
2. Osman Bakar (2019). Classification of Knowledge in Islam: A Study in Islamic Schools of Epistemology. Kuala Lumpur: IBT.
3. Osman Bakar (2016). Qur'anic Pictures of the Universe: The Scriptural Foundation of Islamic Cosmology. Kuala Lumpur: UBD dan IBT.
4. Osman Bakar (2008). Tawhid and Science: Islamic Perspectives on Religion and Science, (2nd Ed.). Shah Alam: Arah Publications.
5. Shaharir Mohamad Zain (2012), Berakhir Sudahkah Ilmu Dalam Acuan Sendiri?, Pusat Dialog Peradaban UM.
6. Shaharir Mohamad Zain (2018), Falsafah Ilmu Daripada Karya-Karya Besar Sains dan Matematik Islam Malayonesia, Akademi Kajian Ketamadunan.
7. Tajul Ariffin Noordin. (1993). Perspektif Falsafah dan Pendidikan di Malaysia. Kuala Lumpur: DBPMaszlee Malik.(Dr). (2017).
8. Foundation of Islamic Governance : A Southeast Asian Perspective (1st Ed). London & New York : A Routledge.

BLHW 2772
APPRECIATION OF ETHICS AND CIVILISATIONS

Hasil Pembelajaran

Pada akhir kursus ini, pelajar akan dapat:

1. Menjelaskan konsep etika daripada perspektif peradaban yang berbeza.
2. Membandingkan sistem, tahap perkembangan, kemajuan sosial dan kebudayaan merentas bangsa.
3. Membincangkan isu kontemporari berkaitan ekonomi, politik, sosial, budaya dan alam sekitar daripada perspektif etika dan peradaban.

Sinopsis

Kursus ini menerangkan tentang konsep etika daripada perspektif peradaban yang berbeza. Ia bertujuan bagi mengenal pasti sistem, tahap perkembangan, kemajuan dan kebudayaan sesuatu bangsa dalam mengukuhkan kesepaduan sosial. Selain itu, perbincangan berkaitan isu-isu kontemporari dalam aspek ekonomi, politik, sosial, budaya dan alam sekitar daripada perspektif etika dan peradaban dapat melahirkan pelajar yang bermoral dan profesional. Penerapan amalan pendidikan berimpak tinggi (HIEPs) yang bersesuaian digunakan dalam penyampaian kursus ini. Di hujung kursus ini pelajar akan dapat menghubungkaitkan etika dan kewarganegaraan berminda sivik.

Rujukan

1. Shamsul Amri Baharuddin (2012). Modul Hubungan Etnik. Selangor: Institut Kajian Etnik Universiti Kebangsaan Malaysia.
2. Harari Y. N. (2017). Homo Deus : A Brief History of Tomorrow. Australia : Harper Collins.
3. MacKinnon, B. (2015). Ethics: Theory and Contemporary Issues (8th) ed). Stamford CT : Cengage Learning.

BKXX XXX1
CO-CURRICULUM I &II

Please refer to the Pusat Pembelajaran Bahasa (PPB) and Institut Pengurusan Teknologi dan Keusahawanan (IPTK) handbook for further information on the offered courses.

BLLW 1142
ENGLISH FOR ACADEMIC PURPOSES

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Demonstrate effective reading skills in academic reading texts.
2. Comply with correct grammar rules according to academic genres.

Sinopsis
This subject aims to develop students' reading and grammar skills. 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. Both grammar and reading skills are benchmarked against the Common European Framework of Reference for Languages (CEFR) level B2

Rujukan
1. Council of Europe. (2018). Common European Framework Of Reference For Languages: Learning, Teaching, Assessment Companion Volume With New Descriptors. Strasbourg. Retrieved from https://rm.coe.int/cefr-companion-volume-with-new-descriptors- 2018/1680787989

BKXX XXX1
CO-CURRICULUM I &II
Please refer to the Pusat Pembelajaran Bahasa (PPB) and Institut Pengurusan Teknologi dan Keusahawanan (IPTK) handbook for further information on the offered courses.

BACHELOR PROGRAMME
BACHELOR OF MECHATRONICS ENGINEERING WITH HONOURS (BELM)

BACHELOR OF MECHATRONICS ENGINEERING WITH HONOURS - BELM

The Bachelor of Mechatronics Engineering with Honours (BELM) is a synergistic combination of several engineering disciplines; namely electrical & electronic, mechanical, control, and computer systems design. This program aims to produce graduates who are competent in creating, designing and producing mechatronics products that consist of mechanical and electronic systems which require control of the computer system.

PROGRAMME IMPLEMENTATION - BELM

This programme would take four (4) years minimum and consist of at least 135 credit hours. The programme emphasise on Mechatronics Engineering with the composition of the credits are as follows:

COMPONENTS		CREDIT HOURS	PERCENTAGE
Compulsory University Course (W)		12	8.89%
Co-Curriculum (W)		2	1.50%
Core Course (P)	Programme	99	73.33%
	Engineering Seminar	1	0.74%
	Industrial Training	5	3.70%
	Final Year Project	6	4.44%
Elective (E)	University	4	2.96%
	Programme	6	4.44%
Total		**135**	**100%**

This programme emphasizes on theoretical and tutorials, computer-aided learning, and problem-based learning (PBL). It also encourages active and cooperative learning activities other than carrying out assignments, job workshops, industrial training and final year project.

CURRICULUM STRUCTURE - BELM

Students are required to keep record of their obtained grades for a given course as shown in Appendix C (Student Audit Form - BELM) for graduation purpose.

COMPULSORY FOR LOCAL STUDENTS ONLY
* COMPULSORY FOR INTERNATIONAL STUDENTS ONLY
** OPTIONAL

TYPE COURSE	YEAR 1				YEAR 2			
	SEMESTER 1		SEMESTER 2		SEMESTER 3		SEMESTER 4	
COMMON CORE & PROGRAM CORE (P)	BMIG 1313 ENGINEERING MATHEMATICS 1	SEMESTER BREAK	BMKC 1013 DIFFERENTIAL EQUATIONS	LONG SEMESTER BREAK	BELG 2443 ENGINEERING MATHEMATICS 2	SEMESTER BREAK	BERN 2143 ENGINEERING STATISTICS	LONG SEMESTER BREAK
	BELG 1123 PRINCIPLES OF ELECTRIC AND ELECTRONICS		BERG 1413 DIGITAL ELECTRONICS		BITG 1233 COMPUTER PROGRAMMING		BELE 2422 ANALOGUE ELECTRONICS APPLICATIONS	
	BMIG 1213 ENGINEERING MATERIALS		BMKU 1313 ENGINEERING GRAPHICS AND CAD		BELU 2333 ELECTRICAL CIRCUIT II		BELC 3533 INTRODUCTION TO CONTROL SYSTEM	
	BMKU 1123 STATICS & MECHANICS OF MATERIAL		BELU 1123 ELECTRICAL CIRCUIT I		BELG 1233 PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT		BELC 3543 MICROPROCESSOR	
	BELU 1131 ENGINEERING PRACTICE I		BMKU 1253 DYNAMICS & MECHANISM		BELM 2342 INTRODUCTION TO MECHATRONICS SYSTEM		BELC 2433 SIGNAL & SYSTEMS	
			BELU 1231 ENGINEERING PRACTICE II		BMKU 2372 FLUID MECHANICS		BELM 2321 MECHANICAL ENGINEERING LABORATORY	
					BELB 1231 ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY			
CREDIT HOUR SEMESTER	13		16		17		15	
ELECTIVE (E)								
CREDIT HOUR SEMESTER								
UNIVERSITY REQUIREMENTS (W)	BLLW 1142 ENGLISH FOR ACADEMIC PURPOSES		BKKX XXX1 CO-CURRICULUM II				BLLW 2152 ACADEMIC WRITING	
	BKKX XXX1 CO-CURRICULUM I						** BKKX XXX1 CO-CURRICULUM (SUKSIS)	
CREDIT HOUR SEMESTER	3		1				2	
TOTAL CREDIT HOUR SEMESTER	16		17		17		17	

TYPE COURSE	YEAR 3				YEAR 4			
	SEMESTER 5	SEMESTER BREAK	SEMESTER 6	SPECIAL SEMESTER	SEMESTER 7	SEMESTER BREAK	SEMESTER 8	
COMMON CORE & PROGRAM CORE (P)	BELM 3453 MICROCONTROLLER TECHNOLOGY		BELM 3653 INTEGRATED DESIGN PROJECT	BELU 3695 INDUSTRIAL TRAINNING	BELU 4861 ENGINEERING SEMINAR		BERN 3322 ENGINEER AND SOCIETY	
	BELM 3543 ELECTROMECHANICAL SYSTEMS		BELC 4753 PLC & AUTOMATION		BELU 4792 FINAL YEAR PROJECT I		BELU 4894 FINAL YEAR PROJECT II	
	BELC 3643 CONTROL SYSTEM ENGINEERING		BMKU 3643 HYDRAULIC & PNEUMATIC SYSTEMS		BELM 4763 ROBOTICS			
	BELG 2433 ELECTRICAL SYSTEMS		BMKU 3653 THERMODYNAMICS & HEAT TRANSFER		BELC 2453 COMMUNICATION SYSTEMS			
	BMIU 3213 ENGINEERING ECONOMY AND MANAGEMENT							
	BELC 2421 CONTROL SYSTEMS LABORATORY		BELM 3641 MECHATRONICS ENGINEERING LABORATORY I		BELM 4751 MECHATRONICS ENGINEERING LABORATORY II			
CREDIT HOUR SEMESTER	16		13	5	10		6	111
ELECTIVE (E)					BLLW 1XX2 ELECTIVE I (UNIVERSITY) BELX 4XX3 ELECTIVE I (PROGRAM)		BXXX XXX2 ELECTIVE II (UNIVERSITY) BELX 4XX3 ELECTIVE II (PROGRAM)	
CREDIT HOUR SEMESTER					5		5	10
UNIVERSITY REQUIREMENTS (W)	BLLW 3162 ENGLISH FOR PROFESSIONAL INTERACTION		#BLHW 1762 PHILOSOPHY AND CURRENT ISSUES				BTMW 4012 TECHNOLOGY ENTREPRENEURSHIP	
			*BLHW 1742 MALAYSIAN STUDIES					
							#BLHW 2772 APPRECIATION OF ETHICS AND CIVILISATIONS *BLHW 2752 MALAYSIAN CULTURE	
CREDIT HOUR SEMESTER	2		2				4	14
TOTAL CREDIT HOUR	18		15	5	15		15	135

CHOOSE ONE (1) COURSE FROM ANY OF ELECTIVE PROGRAM I; AND CHOOSE ONE (1) COURSE FROM ANY OF ELECTIVE PROGRAM II; AND CHOOSE ONE (1) COURSE FROM ANY OF ELECTIVE UNIVERSITY I (THIRD LANGUAGE); AND CHOOSE ONE (1) COURSE FROM ANY OF ELECTIVE UNIVERSITY II (GENERAL)					
ELECTIVE PROGRAM	**I**	BELM 4783 MACHINE VISION	BELC 4873 ARTIFICIAL INTELLIGENCE		
	II	BELC 4683 DIGITAL CONTROL SYSTEM	BELC 4883 ADVANCED MANUFACTURING SYSTEMS	BELM 4823 DATA COMMUNICA-TIONS & COMPUTER NETWORKING	
	THIRD LANGUAGE	BLLW 1222 MANDARIN LANGUAGE 1	BLLW 1242 KOREAN LANGUAGE 1	BLLW 1212 ARABIC LANGUAGE 1	BLLW1252 GERMAN LANGUAGE 1
		BLLW 1232 JAPANESE LANGUAGE 1	* BLLW 1172 MALAY COMMUNICA-TION 1		

*BLLW 1172 BAHASA MELAYU KOMUNIKASI 1 is compulsory for international student.

International student MUST PASS Third Language (Bahasa Melayu) and General Elective University courses before enroll another elective university course.

CREDIT HOUR AND PRE-REQUISITE - BELM

Students are required to keep record of their obtained grades for a given course as shown in Appendix C (Student Audit Form - BELM) for graduation purpose.

COMPULSORY FOR LOCAL STUDENTS ONLY
* COMPULSORY FOR INTERNATIONAL STUDENTS ONLY
** OPTIONAL

SEMESTER	CODE	COURSE	CATEGOR Y	CREDIT	PRE- REQUISITE
SEMESTER 1	BLLW 1142	ENGLISH FOR ACADEMIC PURPOSE	W	2	
	BKKX XXX1	CO-CURRICULUM I	W	1	
	BMIG 1313	ENGINEERING MATHEMATICS 1	P	3	
	BELG 1123	PRINCIPLES OF ELECTRIC AND ELECTRONICS	P	3	
	BMIG 1213	ENGINEERING MATERIALS	P	3	
	BMKU 1123	STATICS & MECHANICS OF MATERIAL	P	3	
	BELU 1131	ENGINEERING PRACTICE I	P	1	
			TOTAL	16	
SEMESTER 2	BKKX XXX1	CO-CURRICULUM II	W	1	
	BMKC 1013	DIFFERENTIAL EQUATIONS	P	3	
	BERG 1413	DIGITAL ELECTRONICS	P	3	
	BMKU 1313	ENGINEERING GRAPHICS AND CAD	P	3	
	BELU 1123	ELECTRICAL CIRCUIT I	P	3	
	BMKU 1253	DYNAMICS & MECHANISM	P	3	
	BELU 1231	ENGINEERING PRACTICE II	P	1	
			TOTAL	17	
SEMESTER 3	BELG 2443	ENGINEERING MATHEMATICS 2	P	3	
	BITG 1233	COMPUTER PROGRAMMING	P	3	
	BELU 2333	ELECTRICAL CIRCUIT II	P	3	
	BELG 1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	P	3	
	BELM 2342	INTRODUCTION TO MECHATRONICS SYSTEM	P	2	
	BMKU 2372	FLUID MECHANICS	P	2	
	BELB 1231	ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY	P	1	
	**BKKX XXX1	CO-CURICULUM (SUKSIS)	W		
			TOTAL	17	

SEMESTER	CODE	COURSE	CATEGOR Y	CREDIT	PRE- REQUISITE
SEMESTER 4	BLLW 2152	ACADEMIC WRITING	W	2	BLLW 1442
	BERN 2143	ENGINEERING STATISTICS	P	3	
	BELC 2433	SIGNAL & SYSTEMS	P	3	
	BELE 2422	ANALOGUE ELECTRONICS APPLICATIONS	P	2	
	BELC 3533	INTRODUCTION TO CONTROL SYSTEM	P	3	
	BELC 3543	MICROPROCESSOR	P	3	
	BELM 2321	MECHANICAL ENGINEERING LABORATORY	P	1	
			TOTAL	17	
SEMESTER 5	BLLW 3162	ENGLISH FOR PROFESSIONAL INTERACTION	W	2	BLLW 2152
	BMIU 3213	ENGINEERING ECONOMY AND MANAGEMENT	P	3	
	BELG 2433	ELECTRICAL SYSTEMS	P	3	
	BELM 3453	MICROCONTROLLER TECHNOLOGY	P	3	
	BELM 3543	ELECTROMECHANICAL SYSTEMS	P	3	
	BELC 3643	CONTROL SYSTEM ENGINEERING	P	3	
	BELC 2421	CONTROL SYSTEMS LABORATORY	P	1	
			TOTAL	18	
SEMESTER 6	#BLHW 1762 *BLHW 1742	PHILOSOPHY AND CURRENT ISSUES MALAYSIAN STUDIES	W	2	
	BELM 3653	INTEGRATED DESIGN PROJECT	P	3	
	BELC 4753	PLC & AUTOMATION	P	3	
	BMKU 3643	HYDRAULIC & PNEUMATIC SYSTEMS	P	3	
	BMKU 3653	THERMODYNAMICS & HEAT TRANSFER	P	3	
	BELM 3641	MECHATRONICS ENGINEERING LABORATORY I	P	1	
			TOTAL	15	
SPECIAL SEMESTER	BELU 3695	INDUSTRIAL TRAINING	P	5	
			TOTAL	5	
SEMESTER 7	BELU 4861	ENGINEERING SEMINAR	P	1	
	BELU 4792	FINAL YEAR PROJECT I	P	2	
	BELM 4763	ROBOTICS	P	3	
	BELC 2453	COMMUNICATION SYSTEMS	P	3	
	BELM 4751	MECHATRONICS ENGINEERING LABORATORY II	P	1	
	BLLW 1XX2	ELECTIVE I (UNIVERSITY)	W	2	
	BELC 4683 BLLC 4873	**ELECTIVE PROGRAM I** DIGITAL CONTROL SYSTEM ARTIFICIAL INTELLIGENCE	E	3	
			TOTAL	15	

	BTMW 4012	TECHNOLOGY ENTREPRENEURSHIP	W	2	
	#BLHW 2772	APPRECIATION OF ETHICS AND CIVILISATIONS	W	2	
	*BLHW 2752	MALAYSIAN CULTURE			
	BERN 3322	ENGINEER AND SOCIETY	P	2	
	BELU 4894	FINAL YEAR PROJECT II	P	4	BELU 4792
SEMESTER 8	BLHW 2792	INTEGRITY AND ANTICORRUPTION	W	2	
		ELECTIVE PROGRAM II			
	BELC 4683	DIGITAL CONTROL SYSTEMS	E	3	
	BELC 4883	ADVANCED MANUFACTURING SYSTEMS			
	BELM 4823	DATA COMMUNICATIONS & COMPUTER NETWORKING			
TOTAL				**15**	
MINIMUM TOTAL CREDIT				**135**	

P = Core, E = Elective, W = University Requirements

STUDENT LEARNING TIME (SLT) - BELM

Semester	Code	Course	Face-to-Face Learning				Self Learning Activities	Formal Assessment	Total
			Teacher Centered (TC)	Student Centered Learning (SCL)			Student Direct Learning / Revision / Exercise	Continuous Learning + Final Examination	
			Lecture	Tutorial	Practical	PBL/ Other SCL Activities			
1	BLLW 1142	ENGLISH FOR ACADEMIC PURPOSES	22	3		6	45.5	3.5	80
	BKKX XXX1	CO-CURRICULUM I				16	22	2	40
	BMIG 1313	ENGINEERING MATHEMATICS 1	42	5.5			67.5	5	120
	BELG 1123	PRINCIPLES OF ELECTRIC AND ELECTRONICS	42	5.5			67.5	5	120
	BMIG 1213	ENGINEERING MATERIALS	42	5.5			67.5	5	120
	BMKU 1123	STATICS & MECHANICS OF MATERIAL	42	5.5			67.5	5	120
	BELU 1131	ENGINEERING PRACTICE I			20		18	2	40
2	BKKX XXX1	CO-CURRICULUM II				16	22	2	40
	BMKC 1013	DIFFERENTIAL EQUATIONS	42	5.5			67.5	5	120
	BERG 1413	DIGITAL ELECTRONICS	36	5.5		6	67.5	5	120
	BMKU 1313	ENGINEERING GRAPHICS AND CAD	28		28		59	5	120
	BELU 1123	ELECTRICAL CIRCUIT I	42	5.5			67.5	5	120
	BMKU 1253	DYNAMICS & MECHANISM	42	5.5			67.5	5	120
	BELU 1231	ENGINEERING PRACTICE II			20		18	2	40
3	BELG 2443	ENGINEERING MATHEMATICS 2	42	5.5			67.5	5	120
	BITG 1233	COMPUTER PROGRAMMING	28		28		59	5	120
	BELU 2333	ELECTRICAL CIRCUIT II	42	5.5			67.5	5	120
	BELG 1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	42	5.5			67.5	5	120
	BELM 2342	INTRODUCTION TO MECHATRONICS SYSTEM	28	3.25			45.25	3.5	80
	BMKU 2372	FLUID MECHANICS	28	3.25			45.25	3.5	80
	BELB 1231	ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY			20		18	2	40
4	BLLW 2152	ACADEMIC WRITING	22	3		6	45.5	3.5	80
	BERN 2143	ENGINEERING STATISTICS	42	5.5			67.5	5	120
	BELC 2433	SIGNAL & SYSTEMS	42	5.5			67.5	5	120
	BELE 2422	ANALOGUE ELECTRONICS APPLICATIONS	28	3.25			45.25	3.5	80
	BELC 3533	INTRODUCTION TO CONTROL SYSTEM	42	5.5			67.5	5	120
	BELC 3543	MICROPROCESSOR	36	5.5	6		67.5	5	120
	BELM 2321	MECHANICAL ENGINEERING LABORATORY			20		18	2	40

5	BLLW 3162	ENGLISH FOR PROFESSIONAL INTERACTION	22	3		6	45.5	3.5	80
	BMIU 3213	ENGINEERING ECONOMY AND MANAGEMENT	42	5.5			67.5	5	120
	BELG 2433	ELECTRICAL SYSTEMS	42	5.5			67.5	5	120
	BELM 3453	MICROCONTROLLER TECHNOLOGY	36	5.5	6		67.5	5	120
	BELM 3543	ELECTROMECHANICAL SYSTEMS	42	5.5			67.5	5	120
	BELC 3643	CONTROL SYSTEM ENGINEERING	42	5.5			67.5	5	120
	BELC 2421	CONTROL SYSTEMS LABORATORY			20		18	2	40
6	#BLHW 1762 *BLHW 1742	PHILOSOPHY AND CURRENT ISSUES MALAYSIAN STUDIES	22	3		6	45.5	3.5	80
	BELM 3653	INTEGRATED DESIGN PROJECT	39		27	20	29	5	120
	BELC 4753	PLC & AUTOMATION	36	5.5		6	67.5	5	120
	BMKU 3643	HYDRAULIC & PNEUMATIC SYSTEMS	36	5.5	6		67.5	5	120
	BMKU 3653	THERMODYNAMICS & HEAT TRANSFER	42	5.5			67.5	5	120
	BELM 3641	MECHATRONICS ENGINEERING LABORATORY I	42	5.5			67.5	5	120
Special Semester	BELU 3995	INDUSTRIAL TRAINING					200		200
7	BELU 4861	ENGINEERING SEMINAR	14	6			18	2	40
	BELU 4792	FINAL YEAR PROJECT I	3			6.5	67	3.5	80
	BELM 4763	ROBOTICS	42	5.5			67.5	5	120
	BELC 2453	COMMUNICATION SYSTEMS	42	5.5			67.5	5	120
	BELM 4751	MECHATRONICS ENGINEERING LABORATORY II			20		18	2	40
	BLLW 1XX2	ELECTIVE I (UNIVERSITY)	22	3		6	45.5	3.5	80
	BELC 4683	DIGITAL CONTROL SYSTEM	42	5.5			67.5	5	120
	BELC 4873	ARTIFICIAL INTELLIGENCE							
8	BTMW 4012	TECHNOLOGY ENTREPRENEURSHIP	22	3		6	45.5	3.5	80
	#BLHW 2772 #BLHW 2752	APPRECIATION OF ETHICS AND CIVILISATIONS MALAYSIAN CULTURE	22	3		6	45.5	3.5	80
	BERN 3322	ENGINEER AND SOCIETY	22	3		6	45.5	3.5	80
	BELU 4894	FINAL YEAR PROJECT II	4			7	141.75	7.25	160
	BLLW 1XX2	ELECTIVE II (UNIVERSITY)	22	3		6	45.5	3.5	80
	BELM 4783	MACHINE VISION	42	5.5			67.5	5	120
	BELC 4883	ADVANCED MANUFACTURING SYSTEMS							
	BELM 4823	DATA COMMUNICATIONS & COMPUTER NETWORKING							
		TOTAL HOURS	**1484**	**196.75**	**186**	**146.5**	**3164**	**222.75**	**5400**

COURSE DETAILS FOR BACHELOR PROGRAMME (BELM)

BELU 1131
ENGINEERING PRACTICE I

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Construct and demonstrate the operation of a basic electric circuits using basic electrical components.
2. Perform measurement and troubleshooting of electrical circuit operation using digital oscilloscope.
3. Construct, operate and troubleshoot a typical domestic lighting and ventilation (fan) system based on Malaysian standard installation practice.
4. Produce lab reports that confirm to standard engineering technical report.
5. Work in a group during the lab implementation and present the work results.

Synopsis
The Electrical Engineering Practice I is designed to provide the student with the knowledge to construct, operate, and troubleshoot simple electrical circuits using basic components, measuring instruments and techniques with proficiency. Some of the components and instruments used are, but not limited to, breadboard, wires, resistors and variable power supply. Students will be exposed to practice the various functions and use of typical electrical engineering tools, such as multimeter and oscilliscope for measurement and troubleshooting of circuit operation and performance. Finally, the students will construct a basic domestic lighting and fan wiring based on the Malaysian standard regulations.

References
1. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory: Pearson New International Edition, 11th Edition, Pearson Education Limited, 2013.
2. Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of Electric Circuits, McGraw-Hill Education, 2019.
3. Pethebridge, K., Neeson, I., Lowe, P., Electrical Wiring Practice, 8th Edition, McGraw-Hill, 2018.

BELU 1231
ENGINEERING PRACTICE II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply the basic microcontroller programming language for dynamic mechanism application.
2. Construct and demonstrate relay control circuits.
3. Identify and describe basic characteristics and operation of digital components such as basic gates and it's combinational, adder and flip- flops clearly.
4. Investigate the basic characteristics and operations of diode, BJT and FET.
5. Exhibit soft skills such as communication skills and teamwork.

Synopsis
This course exposes students to practice with Arduino programming to solve simple engineering problem. Students also will be introduced to basic relay control circuit which covers on timer and hold circuits, digital electronics and electronics devices applications.

References
1. Massimo Banzi and Michael Shiloh, Getting Started with Arduino: The Open Source Electronics Prototyping Platform, 3rd Ed., Maker Media, Inc., 2014.
2. Diane Lobsiger, Electrical Control for Machines, 7th Ed., Cengage Learning, 2015.
3. Ronald J. Tocci, Neal Widmer, and Greg Moss, Digital Systems: Principles and Applications, 11th Ed., Pearson Education Limited, 2014.

4. Thomas L. Floyd, Digital Fundamentals, 11th Ed., Pearson Education Limited, 2015.
5. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Ed., Pearson Education Limited, 2013.

BELC 2421
CONTROL SYSTEM ENGINEERING LABORATORY

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Design experiments according to the requirement of Control and Instrumentation System Engineering experiments. (PO4)
2. Analyze and interpret data and synthesize information related to Control and Instrumentation System Engineering experiments. (PO4)
3. Demonstrate practical competence in using Control and Instrumentation System Engineering software and apparatus. (PO5)
4. Report the findings in a way that is appropriate to the targeted audience. (PO9)

Synopsis
This laboratory provides students with practical activities related to signal and system as well as control and instrumentation theories. Students will carry out experiments regarding AC and DC bridges using oscilloscope, as well as modelling of open and closed loop system by using Lab-Volt Temperature Process Control Trainer. The simulation part covers practical application involving Real-time implementation based on problem-based learning design using MATLAB, SIMULINK, and Control System Toolbox, as well as simulation of Discrete- Time & Continuous-Time Signal and Fourier series using Symbolic Toolbox. Student will be exposed to methods to conduct and report investigation work including design of experiment, analysis of data, synthesis of information and evaluation of findings.

References
1. Course File BELM 2433 (Signal & System), FKE, UTeM, (2012).
2. Course File BELC 3533 (Introduction to Control System), FKE, UTeM, (2012).
3. Course File BELM 2453 (Instrumentation Systems), FKE, UTeM, (2012).

BELC 2433
SIGNALS & SYSTEMS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply the basic knowledge of signals and systems for continuous-time and discrete-time signals.
2. Analyze the linear time-invariant (LTI) systems in time-domain and frequency-domain.
3. Analyze the LTI systems using Z-Transform method.

Synopsis
This course will discuss about the introduction to signals and systems; classification of signals and systems; linear time- invariant systems and convolutions; Fourier series and Fourier transform; Fourier analysis for continuous-time and discrete- time signals; and Z-transforms method.

References
1. Philips, C. L., Parr, J. M., Signals, Systems and Transforms, 5th Ed., Prentice Hall, 2014.
2. Oppenheim, A. V., Willsky, A. S., Signals and Systems, 2nd Ed., Prentice Hall, 2014.
3. M.J., Roberts, Signals and System Analysis Using Transform Methods and MATLAB, 2nd Edition, McGraw-Hill, (2012).

BELC 2453
COMMUNICATION SYSTEMS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the basic principles of analogue & digital communication, data and computer network.
2. Analyse the analogue and digital communication techniques that are typically used in communication systems.
3. Explain the concept of computer system network.

Synopsis
Topics covered are: Introduction to Telecommunications, Transmission Modes, Power Measurements, Electromagnetic Frequency Spectrum, Bandwidth and Information Capacity, Amplitude Modulation Transmission & Reception, Single-Sidebands Communications Systems, Angle Modulation Transmission & Reception, FM Stereo, Noise in Telecommunication Systems, Digital Communication, Digital Transmission, PCM, Digital Modulation/ Demodulation, ASK, FSK, PSK, Data Communication & Computer Network. Frequency Division Multiplexing, Time Division Multiplexing, Space Division Multiplexing.

References
1. Anis Niza Ramani, Arfah Syahida Mohd Nor, Ezreen Farina Shair, Sazuan Nazrah Mohd Azam and Musa Yusup Lada, Basic Analog Communication System, First Edition, Penerbit Universiti UTeM, 2013.
2. Ahmad Fairuz Muhammad Amin, Hyreil Anuar Kasdirin, Zulhani Rasin, Wan Mohd Bukhari Wan Daud and Nur Maisarah Sobran, Introduction to Digital Communication System, First Edition, Penerbit Universiti UTeM, 2013.
3. Wayne Tomasi, Electronics Communications Systems Fundamentals Through Advanced, Prentice Hall, Fifth Edition, 2004.
4. Jeffrey S. Beasley, Modern Electronic Communication, Pearson, 9th Edition, 2008.
5. Behrouz A. Forouzan, Data Communication and Networking, 4th Edition, McGraw Hill, 2007.

BELC 3533
INTRODUCTION TO CONTROL SYSTEMS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the basic features and configuration of control systems and derive the mathematical model of physical system in frequency and in time domain.
2. Analyze control system performance and stability of linear control system in time and frequency domain.
3. Able to employ root locus method and its role in control system design.
4. Analyze the asymptotic approximation bode plots performances for first order and second order systems.

Synopsis
This course will introduces the students to the fundamental ideas and definition of control systems such as block diagrams, plants or processes, open-loop and close loop control systems, transfer functions, and transient and steady state responses. Students will be taught how to obtain mathematical models for actual physical systems such as electrical, mechanical, electromechanical and simple fluid flow systems in transfer function and state space equation. Methods of system representation such as block diagram representation and signal flow graphs will be examined. The students will also be exposed to techniques of analysing control systems such as time domain analysis and stability. Besides, the student will be taught on the design techniques such as Root locus and Bode plot. Finally, an introduction to the design and analysis of control systems using MATLAB will also be given.

References

1. Bishop, Dorf, Modern Control Systems, 12th Edition, Prentice Hall, 2010.
2. Gene F. Franklin, J.David Powell, Abbas Emami-Naeini, Feedback Control of Dynamic Systems, 6th Edition, Pearson, 2010.
3. Ogata Katsuhiko, Modern Control Engineering, 5th Edition, Prentice Hall, 2010.
4. Gopal, Control Systems: Principles & Design, 3rd Edition, Tata McGraw Hill, 2008.
5. Nise, S Norman, Control Systems Engineering, 6th Edition, John Wiley & Sons Inc., 2011.
6. Graham C. Goodwin, Stefan F. Graebe, Mario E. Salqado, Control System Design, Prentice Hall, 2001.

BELC 3543
MICROPROCESSOR

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe and explain microprocessor (Motorola 68000) architecture and its operation. Able to illustrate the interfacing circuitry of microprocessor-based systems and its supporting components.
2. Write and apply the 68k Microprocessor instruction set operation in assembly language.
3. Describe and distinguish the concept of the Motorola 68000 microprocessor system with memory and peripheral device interface.
4. Develop and construct a microprocessor-based system and solve the problem related and prepare the technical report.

Synopsis

This course is about hardware and microprocessor handling, type of microprocessor systems, system handler and timing diagrams. The course covers the concept of MC68000 microprocessor software architecture, programming, assembly language and basic instruction, data transferring instruction, program control and subroutine, arithmetic and logic operations. It touches most on programming techniques, designing a microcomputer system, interfaces with memory and I/O devices. Students will experience PBL approach in this course where a PO- PBL will be introduced to the student.

References

1. Antonakos, J.L., The 68000 Microprocessor: Hardware and Software Principles and Applications, 5th Edition, Prentice Hall, (2004).
2. Spasov, P., Microcontroller Technology: The 68HC11 and 68HC12, 5th Edition, Prentice Hall, (2004).
3. Tocci, R.J., Digital Systems: Principles and Applications, 9th Edition, Prentice Hall, (2004).

BELC 3643
CONTROL SYSTEM ENGINEERING

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Understand and interpret control systems characteristics and specifications.
2. Analyze the problems of a system and point out the proposed solution.
3. Design and construct the compensators in time domain, frequency domain and state variable fedback systems.

Synopsis

This subject addresses compensator design in control systems engineering. In particular, the design of active and passive compensators via root locus technique; passive compensator via frequency response technique; state feedback controller design using pole placement technique; integral control and observer design via pole placement technique. The compensator design concentrates on systems that can be modeled by Ordinary Differential Equations

(ODEs), and that satisfy certain linearity and time-invariance conditions. Student must have sufficient knowledge in differential equations, basic concepts of control systems and signals & systems.

References

1. Nise, N.S., Control Systems Engineering, 7th Edition, John Wiley & Sons Inc., United State of America, 2015.
2. Dorf, R.C., Bishop R.H., Modern Control Systems, 12th Edition, Pearson, 2014.
3. Ogata, K., Modern Control Engineering, 5th Edition, Pearson, 2010.

BELC 4753
PLC & AUTOMATION

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Explain the principles and fundamentals of programmable logic controllers (PLCs) and elements of automations system.
2. Use tools and equipments for PLC programming that related to industrial applications.
3. Design a basic automated PLC based system with consideration for specific needs.
4. Demonstrate communication skill through team work activities effectively.

Synopsis

This course will expose students with knowledge and skills of PLC including its principles and fundamental, main hard components, PLC programming languages, interfacing PLC with computers, integrating PLC hardware and software to design an automation system, introduction to automation system in manufacturing process, computer-integrated manufacturing (CIM) and industrial communication networking.

References

1. D. Petruzella, Frank Programmable Logic Controller, 4th Ed., McGraw Hill, 2011.
2. Mikell P. Groover, Automation, Production Systems & Computer-Integrated Manufacturing, 3rd Ed., 2008.
3. Hugh Jack, Automating Manufacturing Systems, Version 5.0, 2007.
4. L. A. Bryan & E. A. Bryan, Programmable Controller: Theory and Implementation, 2nd Ed., Industrial Text, 2007.

BELC 4683
DIGITAL CONTROL SYSTEMS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Transform continuous-time signals into discrete-time signals and to represent LTI digital control systems in z- domain.
2. Analyze the stability and performance of digital control systems in time, frequency, and z domains.
3. Analyze the digital control systems represented in state space model.
4. Design a digital PID controller and digital lead-lag compensators using root locus and frequency response methods, and state feedback using a pole-placement method.

Synopsis

This subject consists of discussions about an introduction to digital control systems, the relationship between continuous- time and discrete –time control systems, digital system coding, sampling process, quantization and z-transform, and digital control system representations. The notions of controllability, observability, and stability of digital control systems and analyses in time, frequency, and z domains are also included in this subject. The design of digital PID controllers, lead-lag compensators, and state feedback and observer gain via a pole placement are covered in this subject. The analyses and design of digital control systems are performed using MATLAB and Simulink. Students are encouraged to gain scientific knowledge of contemporary issues related this subject.

References

1. Katsuhiko Ogata, Dicrete-time Control System, 2nd Edition, Prentice Hall, 1995.
2. Benjamin C. Kuo, Digital Control Systems, 2nd Edition, Oxford, 1992.
3. C.L. Philips and H.T Nagle, Digital Control System Analysis and Design, 5th Edition, Pearson Education, 2005.

BELC 4873
ARTIFICIAL INTELLIGENCE

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Utilize the simulation tools for AI applications such as Simulink and MATLAB for appropriate industrial case studies.
2. Design basic fuzzy logic or neural network systems according to the engineering problem.
3. Demonstrate and analyze the performance of fuzzy logic and/or neural network using Simulink/ MATLAB or other specified tools.

Synopsis

Artificial Intelligence (AI) is a field of study concerns on allowing machines to imitate human's thinking or behaviour. By applying AI techniques, machines would be able to solve complex engineering problems such as predicting numbers of defect products in factory, optimizing a water tank system, classifying patients based on symptomps of a disease and etc. In this course students will be focusing on two popular sub topics in Artificial Intelligence area which is Neural Network and Fuzzy Logic. Students will be exposed towards the concept of Neural Network and/ or Fuzzy Logic and its implementation methods in controlling engineering system using appropriate tools such as SIMULINK/MATLAB.

References

1. KazuoTanaka; Introduction to Fuzzy Theory towards Application, Russel Books, 1991.
2. Kenji Sugawara; Artificial Intelligence; Morikita; 1997.
3. Satish Kumar; Neural Networks A Classroom Approach; International Edition; McGraw Hill; 2005.
4. Simon Haykin; Neural Networks A Comprehensive Foundation; 2nd Edition; Prentice Hall; 1999.
5. George F. Luger; Artificial Intelligence, Structures and Strategies for Complex Problem Solving; 6th Edition; Addison Wesley; 2005.
6. Timothy J. Ross; Fuzzy Logic With Engineering Applications; McGraw-Hill International Editions; 1997.

BELC 4883
ADVANCED MANUFACTURING SYSTEM

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Explain the principles of manufacturing operation in advanced manufacturing system.
2. Investigate the operation of manufacturing system in advanced manufacturing industries.
3. Design an assembly line for production system using manufacturing system approach.

Synopsis

This subject is introduction to industrial field topics such as production system, manufacturing system, manufacturing operation, manufacturing models and metrics besides exposure to manual assembly lines and automated assembly lines which applicable in industry. The analysis of quality control and quantitative analysis in FMS bottleneck models in this and product design using CAD/CAM in production system.

References

1. Groover, M. P., “Automation, Production Systems, and Computer-Integrated Manufacturing”, 3rd Ed., Prentice Hall, 2008.
2. Groover, M. P., “Fundamentals of Modern Manufacturing: Materials, Processes, and Systems”, John Wiley & Sons Inc, 2007.
3. Kalpakjian, S. & Schmid, S., “Manufacturing, Engineering, and Technology”, 5th Ed., Addison-Wesley, 2005.

BELE 2422
ANALOGUE ELECTRONICS APPLICATION

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe the operation of small signal analysis and power amplification for electronics analogue devices.
2. Analyze the BJT, power amplifier, active filter, oscillator and voltage regulator.
3. Design active filter circuit, oscillator and voltage regulator in solving electrical engineering problem.

Synopsis

This course contains the application of electronic analogue devices in solving electrical engineering problems; focuses on small signal analysis (BJT), power amplification, active filter, oscillator and voltage regulator. In power amplification, three classes of the power amplifier are introduced which are power amplifier class A, class B and class AB. The active filter covers the usage of transistor or op-amps with RC circuit in producing the low-pass filter, high-pass filter, band- pass filter and band- stop filter. The wave generation using op-amp and timer 555 is applied in the oscillator part. Finally, the concept of voltage regulator based on transistor for linear shunt and series regulator as well as the integrated circuit voltage regulator is covered.

References

1. Floyd, T., Electronic Devices, 10th, Edition Prentice Hall, 2018.
2. Bolysted, R., Nashelsky, L., Electronic Devices and Circuit Theory, 11th Edition, Prentice Hall, 2014.
3. Aliminian, A., Kazimierczuk, M. K., Electronic Devices: A Design Approach, 1st Edition, Prentice Hall, 2004.
4. Russell, L. M., Robert, D., Foundations of Electronics Circuits and Devices, 5th Edition, Thomson Delmar Learning, 2007.

BELG 1123
PRINCIPLES OF ELECTRIC AND ELECTRONICS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Explain the basic electrical and electronics principles, circuit schematics and components.
2. Solve basic electric DC circuits using electrical and electronics principles.
3. Explain the operating principles of semiconductor devices for Diode, BJT, FET and Op Amp.
4. Analyze the operating principles of semiconductor devices and electrical and electronics to solve the Diode, BJT, FET and Op- Amp circuits.

Synopsis

This course will discuss about the basic principles of electrical and electronics; such as fundamental knowledge on electric element, principles of electricity, units associated with basic electrical quantities, symbol and components. Then the study on how to apply circuit theory to the solution of simple circuits and networks by the application of Ohm's law and Kirchhoff's laws, and the concepts of potential and current dividers in solving DC series and parallel circuit is explained. Then, the behaviour of semiconductors and the way in which they are employed in diodes will be discussed. The semiconductor theory and devices covers the atomic structures, energy band, P-type and N-type and how these materials are employed to form devices such as diode and BJTs. Then the application and calculation of diode, DC biasing of Bipolar Junction Transistor (BJT),DC biasing of Field Effect Transistor (FET) and Operational-Amplifier (Op-Amp) circuits is explained.

References

1. Charles K. Alexander and Matthew N. O. Sadiku, Fundamentals of Electric Circuits, McGraw Hill, 5th Ed. (2013).
2. Floyd, T., Electronic Devices, 9th, Edition Prentice Hall, 2014.
3. Robert L. Boylestad and Louis Nasheslsky, Electronic Devices and Circuit Theory, Pearson, 11th Ed. (2014).
4. Allan R. Hambley, Electrical Engineering Principles & Application, Pearson, 6th Ed. (2014).

BELG 1233
PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the principle, various terms and standards in measurement.
2. Explain the principle of measurement devices
3. Apply the suitable bridge techniques to measure component values such as resistance, inductance and capacitance.
4. Explain the operation, function and applications of the transducers/sensors.

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

References

1. HS Kalsi, Electronic Instrumentation, 3rd Ed., Tata McGraw Hill, 2010.
2. UA Bakshi, AV Bakshi and KA Bakshi, Electronic Measurements and Instrumentation, Technical Publications Pune, 2009.
3. Donald Calibration Book, Vaisala Oyj, Vaisala 2006.
4. S Wolf, Richard F.M Smith, Reference Manual for Electronic Instrumentation Laboratories, 2nd Ed., Prentice-Hall, 2004.

BELG 2433
ELECTRICAL SYSTEMS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain the major components of an electrical power system (generation, transmission, and distribution system).
2. Calculate the AC voltage and current characteristic in AC circuits.
3. Analyze the single and three phase circuits by emphizing on complex power and power factor correction.
4. Analyze the magnetic, single phase transformer and three phase transformer equivalent circuits.

Synopsis
This subject introduces students to topics such as alternating current circuit analysis, phasor

representation, RMS value, average power, reactive power, active power, apparent power, power factor and power factor correction for single phase and balance three phase system. In addition, magnetic circuit, construction and operation of transformer will be discussed in this subject.

References

1. Glover, Sarma, Power System Analysis and Design, 4th ed., Thomson Learning, 2008.- main reference.
2. Hadi Saadat, Power System Analysis, 2nd ed., Mc-Graw Hill, 2004.
3. William D. Stevenson, Jr., Elements of Power System Analysis, 4th ed., Mc-Graw Hill, 1998.
4. Grainger and Stevenson Jr, Power System Analysis, Mc- Graw Hill, 1994.
5. Arthur R. Bergen, Power System Analysis, 2nd ed., Prentice Hall, 2000.

BELG 2443
ENGINEERING MATHEMATICS 2

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Describe the fundamental concepts of multivariable functions, multiple integrals and vector calculus.
2. Solve the mathematical problems that involve function of several variable, multiple integrals and vector calculus.
3. 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'stheorem, Curl and Divergence, Parametric surfaces and their Areas, Surface integrals, Stoke's theorem and Divergence theorem.

References

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

BELM 2321
MECHANICAL ENGINEERING LABORATORY

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Conduct investigation on the experiments which includes statics and mechanics of material, dynamics and mechanisms, and fluid mechanics correctly using mechanical resources.
2. Analyze data gathered during experiments using software tools.
3. Communicate effectively through technical report writing.

Synopsis

This mechanical laboratory experiments will cover three courses, Statics and Mechanics of Material, Dynamics and Mechanisms and Fluid Mechanics. Axially loaded test, shear and torsion tests will cover the Statics and Mechanics of Material course. Laboratory experiments for Dynamics and Mechanisms consists of accelerated rotational movement, belt drives and gear efficiency and Fluid Mechanics will cover Bernoulli theorem and Reynolds number.

References

1. Beer, F.P., Vector Mechanics for Engineers, Dynamics SI Units, 8th Edition, McGraw-Hill, (2007).
2. Yuan, C.S., Fluid Mechanics I, Pearson Prentice Hall, Malaysia, (2006).
3. Equipments user manual.

BELM 2342
INTRODUCTION TO MECHATRONICS SYSTEM

Learning Outcomes

Upon completing this course, the student should be able to:

1. Explain basic concept of mechatronics systems.
2. Explain the working principles of mechatronics systems.
3. Analyze selection and integration of mechatronics components.
4. Identify and analyse basic mechatronics system.

Synopsis

This course introduces the concept of mechatronics system and its element and integration. Topics that are covered includes the following: Introduction to sensors and transducers, performance terminology, static and dynamic characteristics. Example of relevant sensors, selection of sensors. Inputting data by switches. Introduction to signal conditioning, operational amplifier, protection, filtering, wheatstone bridge, digital signal, multiplexers, data acquisition, digital signal processing, pulse modulation. Displays, data presentation elements, magnetic recording, displays, data acquisition systems, testing and calibration. Introduction to actuation systems, introduction to pneumatic and hydraulic systems, directional control valves, pressure control valves, cylinders, process control valves, rotary actuators. Introduction to mechanical systems, types of motion, kinematic chain, cams, gear trains, ratchet and pawl, belt and chain drives, bearings, mechanical aspects of motor selection. Introduction to electrical systems, mechanical switches, solid-state switches, solenoids, D.C. motors, A.C. motors, stepper motors. Mathematical models, mechanical system building blocks, electrical system building blocks, fluid system building blocks, thermal system building blocks. System model of engineering systems, rotational- translational systems, electromechanical systems and hydraulic-mechanical systems. Brief description of mechatronics system related topics: system transfer function, frequency response, closed loop controller, digital logic, microprocessor, assembly language, C language, input/output systems or interfacing, programmable logic controllers, communication systems, fault finding.

References

1. Bolton, W., Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 4th Edition. Prentice-Hall, (2008).
2. Medriam, J.L., Engineering Mechanics: Static, 5th Edition, John Wiley & Sons, (2003).
3. Saeed B. Niku, Introduction to Robotics, Prentice-Hall, (2001).
4. Devdas, S., Richard, A.K., Mechatronics System Designs, PWS, (1997).
5. Robert L. Norton, Machine Design An Integrated Approach 3rd Edition, Pearson Prentice Hall, (2006).

BELM 3453
MICROCONTROLLER TECHNOLOGY

Learning Outcomes
Upon completion of this course, the student should be able to:

1. Apply the knowledge of microcontroller's architecture, operations of peripherals and subsystems.
2. Analyze control Direct Current (DC), servo and stepper motors using microcontroller and relevant driver circuits.
3. Design the application of Analog to Digital Converter with LCD display/Keypad/RS232/EEPROM modules.
4. Utilize the microcontroller based system application software or hardware for Problem Based Learning.
5. Exhibit technical writing and explain to design of the Problem Based Learning amplification.

Synopsis
Basic concept of microcontroller in terms of the architecture, usage and the differences between microcontroller and microprocessor. Exploring the available PIC Modules such as Timers, Analog to Digital Converter, Pulse Width Modulation, EEPROM, USART and interrupt capabilities for external or internal peripheral and hardware controlling. Students will practically implement the knowledge to apply in the project oriented Problem Based Learning.

References

1. Microcontroller Technology Theory & Code examples Zamani Md Sani, Aminurrashid Noordin, Anuar Mohamed Kassim, Ahmad Zaki Shukor.
2. Peatman, J.B., Design with PIC microcontrollers, 8th ed., Prentice Hall, 1998.
3. Milan Verle., PIC Microcontroller, Mikroelektronika, 2008.
4. Iovine, J.,PIC Microcontroller Project Book, McGraw-Hill, USA 2000.
5. Mazidi, A. M., McKinlay, R. D. and Causey, D., PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18, Pearson Education, 2008.

BELM 3543
ELECTROMECHANICAL SYSTEM

Learning Outcomes
Upon completion of this course, the student should be able to:

1. Comprehend the basic principle of electromechanical energy conversion and operation of electrical machines.
2. Investigate and analyze the torque speed characteristics of electric motors and their corresponding drive requirements.
3. Design the drive for electrical motors according to application requirements and appropriate mechanical model.

Synopsis
This course focuses on the applications of electrical machines as primary mover for mechanical systems. Students are introduced to the basic principle of electromagnetics and the constructions of electrical machines. Then, an emphasis is put on electric motors and how to control them. Finally, students are exposed to general steps required in analyzing a drive system for mechanisms, modelling the mechanism's dynamics and selecting appropriate motor and its drive for the application.

References

1. Wildi T., 'Electrical Machines, Drives and Power systems', Prentice Hall, 2002.
2. Crowder, R. 'Electric Drives and Electromechanical Systems', Newnes, 2006.
3. Chapman, Stephen J. Electric Machinery Fundamentals', 5th Ed. McGrawHill, 2002.
4. Tobin, Stephen M. 'DC Servos: Application and Design with MATLAB', CRC Press, 2010.

BELM 3641
MECHATRONICS ENGINEERING LABORATORY I

Learning Outcomes
Upon completion of this laboratory course, the student should be able to:
1. Design and analyze a controller for mechatronics system by using PLC.
2. Design and demonstrate the appropriate solution to actuate a mechatronics system by using pneumatic and hydraulic circuits.
3. Analyze and evaluate the accuracy of the integrated PLC and electropneumatic system performance by using statistical method.
4. Exhibit technical writing to solve complex problem.

Synopsis
In this lab session, students are exposed to the lab works of major fluid power technologies; pneumatics and hydraulics as well as the lab works in automation using Programmable Logic Controller (PLC). In fluid power technology, students will learn the operation of a single acting and double acting cylinder, the application of electro-pneumatic and electro- hydraulic control technology, the application of pressure relief valve and flow control valve as well as the logic “AND” and “OR” operation. In automation, the students will be enlightened to draw the ladder diagram, perform console programming and mnemonic code using PLC as well as designing and executing timer and counter application. Finally, students will carry out the pneumatic and hydraulic control programming using PLC.

References
1. Craig, J.J., Introduction to Robotics Mechanics and Control, 3rd Ed, Addison Wesley Longman, 2005.
2. Petruzella F. D., Programmable Logic Controller, McGraw Hill, 2005.
3. Course Files of BELC 4753 and BMKU 3643, FKE, UTeM.
4. Equipments user manual.

BELM 3653
INTEGRATED DESIGN PROJECT

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Design solutions by synthesizing electrical engineering knowledge that will solve complex electrical engineering problem in accordance to relevant standards and with appropriate consideration for public health and safety, cultural, societal, environmental and sustainability factors.
2. Utilize modern engineering and IT tools in facilitating solution to complex electrical engineering problems with an understanding of the limitations.
3. Evaluate the impact of the designed product, components or processes, in terms of safety, environmental and sustainability factors.
4. Demonstrate effective teamwork skills in completing the electrically integrated design project.
5. Apply project management and financial knowledge effectively in completing the electrically integrated design project.

Synopsis
Electrical engineering project is integrated design project where student have to design project where students have to design an electrical and electronic 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

electrical and electronic design, students are also required to integrate their knowledge of other engineering such as (but not limited to) circuit design and analysis, including component 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 of electrical engineering knowledge.

References

1. Dieter, G.E. & Schmidt, L.C. (2013). Engineering Design, 5th Edition, McGraw Hill.
2. Ulrich, K.T. & Eppinger, S.D. (2008). Product Design and Development, 4th Edition, McGraw Hill.
3. John P. Bentley, Principles of Measurement Systems, 4th Ed., Prentice Hall, 2005.
4. Cross, Nigel, (2010) Engineering Design Methods, Wiley.
5. W.Bolton, Mechatronics electronic control systems in mechanical and electrical engineering, 4th Ed., Prentice Hall, 2008.
6. Kutz, Myer, Mechanical Engineers Handbook - Manufacturing and Management, 3rd ed., John Wiley 2006.

BELM 4751
MECHATRONICS ENGINEERING LABORATORY II

Learning Outcomes

Upon completion of this laboratory course, the student should be able to:

1. Identify and describe robot specification and workspace properly.
2. Design procedures to manipulate robot movement by using teach pendant/console and RoboTalkTM programming software.
3. Design procedure to develop a robotic gripper and test it using Rhino robot.
4. Analyze and evaluate the accuracy, repeatability and reliability of the robot performances by using statistical method.

Synopsis

In this course, students are exposed to the lab works related to the development and application of mechatronics/robotic system. Firstly, student will learn the robotic system specification. After that, students will design procedures to develop a robotic gripper and program the robot to a specific task. In the design process, students will be exposed to the engineering tools such as Solid Work, teach pendant/console programming and RoboTalkTM software. Student design should take into account the appropriate sensor, controller and actuator for their design for safety purpose. At the end of the lab work, students will analyze and evaluate the accuracy, repeatibility and reliability of the robot performances by using statistical method.

References

1. Craig, J.J., Introduction to Robotics Mechanics and Control, 3rd Ed, Addison Wesley Longman, 2005.
2. Rhino Robotics Ltd., Mark III - 8 Axis Controller Owners Manual for Windows, Version 2.00.00, 2000.
3. Rhino Robotics Ltd., Owners Manual XR-3, XR-4 and SCARA, Version 2.00.01, 1995.
4. Rhino Robotics Ltd., RobotTalkTM for Windows User's Manual for Mark III Controller, Version 2.00.0.
5. Richard, G., Sandra, D., Understanding and Using Scientific Evidence: How to Critically Evaluate Data, 1st Edition, SAGE Publications, 2003.

BELM 4763
ROBOTICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply knowledge in physics and mathematics to the solution of complex kinematics and dynamics.
2. Analyze the effects of controller gains on the motion of a robotics system.
3. Design robot trajectories based on safety and environmental needs.

Synopsis
This subject introduces robotic fundamentals including kinematics (forward, reverse, jacobian, and singularity), dynamics and trajectory generation of robots. Fundamental mathematics, scientific and mechatronics engineering knowledge will be applied in this subject to the solution of complex robotic problems. In developing the solution of the robotics problem, student will be exposed to influential factors that might affect the design of the solution including safety and environmental factors. Throughout the semester, student will be exposed to robotics simulation software to enhance their understanding of robotics knowledge.

References

1. Craig, J. J., Introduction to Robotics, Mechanics and Control, 3rd Ed., Addison Wesley Longman, 2014.
2. Stadler, W., Analytical Robotics and Mechatronics, McGraw Hill, 1995.
3. Man Zhihong, Robotics, Prentice Hall, 2nd ed., 2005.

BELM 4783
MACHINE VISION

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify the application areas, restrictions, structure of machine vision systems and operation of digital images.
2. Design the solution related to the basics of machine learning and approaches to decision making.
3. Implement an algorithms using an image processing and image understanding tools.

Synopsis
This course is to introduce the theory, applications and techniques of machine vision to students, and to provide students with an understanding of the problems involved in the development of machine vision systems. The course begins with low level processing and works its way up to the beginnings of image interpretation. This approach is taken because image understanding originates from a common database of information. The learner will be required to apply their understating of the concepts involved through the process of building applications that manipulate bi-level and grey scale images through the use of suitable packages (e.g. Matlab or OpenCV).

References

1. Rafael C.Gonzalez, Richard E.Woods, Digital Image Processing, Prentice Hall, (2002).
2. Jain, R. J., R. Kasturi and B. G. Schunck., Machine Vision. New York: McGraw-Hill, Inc, (1995).
3. Davis, E. R., Machine Vision. 2nd Ed. San Diego, California: Academic Press, (1997).

BELM 4823
DATA COMMUNICATIONS & COMPUTER NETWORKING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain and apply the schemes and methods used for tasks in data communication of computer network.
2. Describe and analyze the coding schemes, transmission modes, transmission methods, communication modes, error detection methods, flow control, and error control in a network.
3. Classify the OSI model, IEEE 802.x model, transmission media, network services, repeater, bridges, router and gateways.
4. Describe and analyze the network operation and technology of LAN, wireless Lan, Wan and routing.
5. Design a basic network configuration for local area network (LAN).

Synopsis
Topics covered are: Introduction to Computer Network, Data Communications, Network Structure, Local Area Network, Wide Area Network, Interconnection, Internetworking. That include the network models / topology / type and technology and its application. Characteristics of analog signals, digital signals, coding schemess, transmission modes, transmission methods, communication modes, bandwidth and signal transmission, digital signal encoding, error detection method, error and flow control, datalink control, multiplexing, synchronous & asynchronous transmission. Standard organization and OSI model, LAN topology, wired & wireless LAN, circuit switching, packet switching and comparison. Interconnection issues and architecture. Repeater, bridge, router & gateway. Structure of network layer. Internet Protocol, TCP/IP ans ISO Internet Protocol.

References
1. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill, 4th Edition 2007.
2. W.Stalling, Data and Data Communications, Prentice Hall, 8th Edition, 2007.
3. S.Tanenbaum, Computer Networks, Prentice Hall, 4th Edition, 2003.
4. F.Halsall, Data Communications, Computer Networks and Open Systems, 4th Edition, Addison Wesley, 5th Edition, 1997.

BELU 1123
ELECTRIC CIRCUIT 1

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyse electrical circuit using Ohm's Law and Kirchhoff's Laws.
2. Apply Mesh and Nodal methods for DC and AC circuit analysis.
3. Analyze DC an AC circuits using Superposition, Thevenin, Norton and Maximum Power Transfer Theorems.

Synopsis
This course introduces the students to Ohm's Laws, Kircchoff's Laws and use them to calculate current, voltage and power in electrical circuitries. Students also learn the analytical methods namely mesh and nodal analysis, as well as apply Thevenin theorem, Norton theorem, Superposition and the Maximum Power Transfer in circuit analysis. The applications of the above tools will cover both dc and ac circuits.

References
1. K.A. Charles,N.O. Sadiku, Fundamentals of Electric Circuits, 5th Ed. McGraw Hill, 2013.
2. Robbins and Miller, Circuit Analysis and Practice, 3rd. Ed., Thomson and Delmar, 2003.
3. Nilsson and Riedel, Electric Circuits, Prentice Hall, Electric Circuits (9th Edition), 2010.

BELB 1231
ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Measure the electrical characteristics of single-phase and three-phase ac circuit precisely.
2. Construct the combination of logic circuit and ICs using suitable and appropriate components.
3. Perform simulations of RLC circuits in order to study their characteristics.
4. Exhibit good communication skills through technical writing.

Synopsis
This course will expose students to perform experiments to support the theory such as to observe the capacitor charge and discharge process, build and analyze the second order circuit using pspice. The experiments also include the single phase and three phase circuits with resistive and inductive loads and measurement of voltage, current, power, power factor and single phase transformer. Lastly student will conduct experiments with logic circuit integration, ics and flip- flops circuit.

References
1. Charles K. Alexander and Matthew N. O. Sadiku, Fundamentals of Electric Circuits, Mcgraw Hill, 5th Ed., 2013.
2. Robbins and Miller, Circuit Analysis and Practice, 5th Ed., 2012.
3. Thomson and Delmar. Nilsson and Riedel, Electric Circuits, 9th Ed., 2010.
4. Addison-Wesley, Prentice Hall. Hughes, Electrical Technology, 10th Ed. Prentice Hall.

BELU 2333
ELECTRICAL CIRCUIT II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Analyze first order and second order circuit for transient and steady state response.
2. Apply Laplace transforms method to analyze circuit response in frequency domain.
3. Analyze the frequency response of RLC circuits and the characteristics of RLC filters.
4. Analyze various topology of two-port network in electrical circuit analysis.

Synopsis
This course exposes student to the application of several techniques in analyzing electrical circuits, such as the Laplace transform and two ports network. The students are required to use appropriate tools to analyze transient and frequency response in electrical circuit.

References
1. K.A. Charles,N.O. Sadiku, Fundamentals of Electric Circuits, 6th Ed. McGraw Hill, 2016.
2. Robbins and Miller, Circuit Analysis and Practice, 5th Ed., Thomson and Delmar, 2013.
3. Nilsson and Riedel, Electric Circuits, Prentice Hall, Electric Circuits (11th Edition).
4. Thomas L. Floyd. Electric Circuits Fundamentals. 8th Edition, Pearson, 2009.

BELU 3695
INDUSTRIAL TRAINING

Learning Outcomes
Upon completion of this course, the students should be able to:
1. Apply appropriate techniques and technical knowledge which is relevant for student field of study.

2. Demonstrate the ability to adapt with working environment and practice working efficiently and ethically.
3. Demonstrate soft skill especially communication skill at all level.
4. Work affectively as an individual, team members and as a leader as well.
5. Acquire new knowledge, life-long learning and aware to new technology.

Synopsis

All bachelor degree students are required to undergo industrial training as part of their curriculum to complete their four (4) years course for the Bachelor of Electrical Engineering (BELG) and Bachelor of Mechatronics Engineering (BELM). It is compulsory for all degree program students to undergo the Industrial Training Programme.In general, the aim of industrial training are to give exposure, experience and professional skills to various aspects of engineering discipline, in particular in electrical engineering related industries. The students are also expected to be familiarized with efficient, accountable and ethical conduct as they will be supervised directly under the company's personnel as well as supervisors from the faculty. Apart from that, the assessment will be made by the appointed faculty supervisors & the industry supervisors.

References

1. Dasar Latihan Industri KPT, 2010.
2. Garis Panduan Latihan Industri UTeM, 2017.
3. Dokumen Jawatankuasa Latihan Industri FKE.

BELU 4861
ENGINEERING SEMINAR

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Identify the professional engineering knowledge, practices and responsibilities.
2. Collect and sort relevant information with regards to the given technical talk.
3. Discuss current engineering issues and practices that impacting engineering professionals.

Synopsis

The main purpose of this course is to instill the recognition of the need for and the ability to engage in life-long learning among students. Through presentation by invited speakers from the industry and academia, students will be exposed to topics such as professional engineering bodies and knowledge of in contemporary issues in related engineering fields. Presentation by successful alumni describing how their careers developed after obtaining their undergraduate degrees will also be included.

BELU 4792
FINAL YEAR PROJECT 1

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Conduct proper literature survey and identify the problems, objectives and scope of project clearly.
2. Select, plan and execute a proper methodology in problem solving.
3. Present the project proposal in written and in oral format effectively.
4. Work systematically and commit to professional ethics.

Synopsis

This course is the first part of the Final Year Project which requires two semesters to complete. For the first semester as of this subject, student(s) and supervisor(s) are expected to have two way communications which later comes to an agreement of project topic leading to project supervision and project learning process collectively. At the end of the semester, students are required to deliver first year progress report which generally covers abstract, problem statement, objectives, scope of works, literature review, proposed methodology, early results and general conclusion. Sessions for oral presentation is also held to measure student's level of understanding and capability on carrying specified project.

References
Depend on each student project's references.

BELU 4894
FINAL YEAR PROJECT II

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify, formulate, research literature and analyze problem.
2. Conduct investigation using research based knowledge and methods.
3. Apply ethical principles in project implementation.
4. Present the results in written and in oral format effectively.
5. Identify basic entrepreneurship skills in project management.
6. Apply reasoning informed by contextual knowledge.
7. Engage in independent and lifelong learning.

Synopsis
This course is the second part of Final Year Project I, in second semester. Students will continue their project from FINAL YEAR PROJECT I (BELU 4792) during the second semester, and they should accomplish the projects completely either in hardware, software or both of them. Students needs to write-up a good final report (in thesis format), as a part of the course's assessment.

References
Depend on each student project's references.

<u>SERVICE COURSES (FKEKK)</u>
BERG 1413
DIGITAL ELECTRONICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the number system, basic concept and terminology of digital circuits that form complex electronic systems.
2. Analyze the basic digital circuits based on combinational and sequential components.
3. Communicate effectively through effective report writing or oral presentation.

Synopsis
The outcome of this course is to deliver knowledge, understanding and application of the digital electronics. The course begin with the introductory concepts of digital technology, number systems and codes. Then, logic gates and Boolean algebra will be explored. Apart from that, combinational logic circuits and functions of combinational logic will be introduced. Students will also be enlightened with latches and flip-flops. Finally, this course will also introduce integrated circuit technology where students also will be explored to semiconductor technology for the project assignment. This course will also expose the students to current application in the digital electronics industry.

References
1. Thomas L. Floyd. Digital Fundamentals. 11th Edition, Prentice Hall, 2014.
2. Ronald J. Tocci, N. Widmer, G. Moss. Digital Systems, Principles and Applications. 11th Edition, Prentice Hall, 2011.
3. Roger I. Tokheim. Digital Electronics, Principles and Applications. 8th Edition, McGraw-Hill, 2013.

BERN 2143
ENGINEERING STATISTICS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Apply the concepts of data description, normal and sampling distributions, estimation and hypothesis testing, ANOVA, regression and non-parametric tests to solve mathematical problems.
2. Analyze engineering data using descriptive statistics.
3. Deduce statistical inference for engineering problems by using the techniques of estimation, hypothesis testing and regression.

Synopsis

Topics covered: Data description and probability, Normal and Sampling Distributions, Estimation and Hypothesis Testing for one and two populations, ANOVA, Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Non-parametric Statistics and Software application (SPSS).

References

1. Farah Shahnaz Feroz, Nortazi Sanusi, Hanissah Mohamad, A Student's Guide to Engineering Statistics, Peneribit UTeM, 2019.
2. Prem S.Mann, Introductory Statistics Using Technology, 9th Edition, John Wiley, 2016.
3. Douglas C. Montgomery, George C.Runger, Applied Statistics and Probability for Engineers, 6th Edition, John Wiley, 2013.
4. Richard Johnson, John Freund, Irwin Miller, Miller and Freund's, Probability and Statistics for Engineers, 9th Edition, Pearson – Prentice Hall, 2017.
5. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 9th Edition, Thomsons– Duxbury, 2015.
6. Sharifah Sara, Hanissah, Fauziah, Nortazi, Farah Shahnaz, Introduction to Statistics & Probability A Study Guide, Pearson-Prentice Hall, 2008.

BERN 3322
ENGINEER AND SOCIETY

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Apply ethical principles and commitment, to professional ethics, responsibilities and norms of engineering practice.
2. Apply reasoning informed by contextual knowledge to assess health, safety and legal issues and its subsequent responsibilities, relevant to professional practice.
3. Understand the needs for sustainable development and the impact of engineering solutions on society and environment.

Synopsis

This course will discuss about:

Ethics and professionalism, engineers and society, professional ethics, code of ethics, ethics dealing with human relations, BEM, IEM, regulations on professional conduct, route to professional status, engineers as an employee or employer, decision making, competence of practicing engineering, accountability, liability, engineer's legal liability specified in contract law, engineers and the environment, sustainability, etc.

References

1. The Institution Of Engineer, "Engineering Professionalism and Ethics" 4th Ed, 1995.
2. Charles B. Fleddermann, Engineering Ethics, 3rd Ed, Prentice Hall, 2008.
5. Mike W Martin, Roland Schinzinger, Ethics in Engineering, 4th Ed, McGraw-Hill, 2005.
6. Charles E Harris JR, Michael S Pritchard, Michael J Rabin, "Engineering Ethics" 2nd Ed, Thomson and Wadsworth, 2003.

SERVICE COURSES (FTMK)
BITG 1233
COMPUTER PROGRAMMING

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Identify the fundamental principles of problem solving, programming techniques and structures in program development.
2. Explain the principles of problem solving and programming techniques to solve given problems.
3. 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
1. Gaddis, T., (2015), "Starting Out with C++ Brief Version: From Control Structures Through Objects 8th. Edition", Pearson Education.
2. Abdullah, N. et. al, (2018), "Lab Module Computer Programming (edition 2018), FTMK, UTeM.
3. Friedman, Koffman (2011), "Problem Solving, Abstraction and Design using C++", 6th Edition, Pearson Education.
4. Etter, D.M., Ingber, J.A., (2012), "Engineering Problem Solving with C++", 3rd Edition, Pearson Education.
5. Hanly, J.R, (2002), "Essential C++ for Engineers and Scientists", 2nd Addison Wesley.

SERVICE COURSES (FKM)
BMKC 1013
DIFFERENTIAL EQUATIONS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the basic concept of first and second order differential equations, Laplace Transform and Fourier series.
2. Select an appropriate technique to solve problems involving differential equations.
3. Apply the concept of differential equations in solving engineering problems.

Synopsis
This course provides an introductory knowledge to differential equations and its applications. The students are introduced to the first order differential equations and solve using analytical methods of separable variable and linear equations and also using numerical methods such as Euler's method and second order Runge-Kutta method. 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, Fourier series and partial differential equations and solving using numerical methods which is finite difference method (Parabolic, Hyperbolic).

References
1. Muzalna M. J., Irmawani J., Rahifa R., Nurilyana A. A. (2018). Module 2: Differential Equations, Penerbit UTeM.
2. Khoo, C.F., Syed Ahmad, S.S., Othman, Z. & Lok, Y.Y. (2009). Numerical Methods Third Edition. Pearson Prentice Hall.

BMKU 1123
STATICS & MECHANICS OF MATERIAL

Learning Outcomes
Upon completion of this course, the student should be able to:
1. State the basic concept of force and material mechanics.
2. Identify the force and stress on a mechanical system.
3. Analyze the force and stress on a mechanical system.

Synopsis
Statics
Introduction to basic concepts in statics and mechanics as a study of physical sciences, system of units, scalars and vectors, free body diagram, forces system resultants and moments, equilibrium of a particle, equilibrium of a rigid body, structural analysis, center of gravity and centroid.

Material Mechanics
Introduction to various type of structures, type of supports, concepts and definition of stress, strains, torsion, shear force and bending moment, theory on axial loading, torsion, pure bending and beam deflection, and combination of loads.

References
1. Hibbeler R. C., 2004, Static and Mechanics of Materials, SI Edition, Pearson Prentice Hall, New York.
2. Morrow H.W. and Kokernak R.P., 2007, Statics and Strength of Materials, Pearson Prentice Hall, New York.
3. Limbrunner G. F. and Spiegel L., 2009, Applied Statics and Strength of materials, Pearson Prentice Hall, New York.
4. Riley W. F., Sturges L.D. and Morris D. H., 2002, Static and Mechanics of Materials: An integrated Approach, 2nd Edition, John Wiley & Sons, New York.

BMKU 1253
DYNAMICS & MECHANISM

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Apply and analyze the principle of kinematics of a particle.
2. Apply and analyze the principle of kinematics of a rigid body.
3. Understand and apply the concept of belt amd gear system.
4. Analyze gyroscopic effect and fundamental vibration problem of a system.

Synopsis
This course consist of two parts, Dynamics and Mechanics of Machines. A Dynamics topic introduces the basis principle of mechanics of particles and rigid bodies, kinetics for systems of particles, kinematics of rigid bodies. For Mechanics of Machine, the course will cover of Friction- based power transmission system, balancing system including gyroscope and vibration. It will introduce to students the principles and simple applications.

References
1. Fadilah, et. all, Dynamics and Mechanism: Part 1, Penerbit UTeM, 2013.
2. Fadilah, et. all, Dynamics and Mechanism: Part 1, Penerbit UTeM, 2013.
3. Hibbeler, R. C., Engineering Mechanics, Dynamics, 13th Edition, Prentice Hall. (2012).
4. Beer, F. P., Vector Mechanics for Engineers, Dynamics SI Units, 10th Edition, McGraw-Hill, (2012).
5. Roslan Abdul Rahman, Che Abas Che Ismail dan Mohd Yunus Abdullah, Mekanik Mesin, Penerbit UTM, Johor. (2013).

BMKU 1313
ENGINEERING GRAPHICS AND CAD

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain the engineering graphics fundamentals.
2. Construct technical drawing using manual sketching and computer aided design.
3. Communicate by using engineering drawings.

Synopsis
The course concentrates on manual drafting and Computer Aided Drafting (CAD) software. For manual drafting, students will be exposed to the basic drafting tools, techniques and the application in producing various types of engineering drawing. For computer aided design, CAD engineering drawing software is exercised to produce engineering drawing. The students will be exposed to CAD interface, editing commands, coordinate system, template preparation and layer in order to produce various types of engineering drawing.

References
1. Omura, G & Benton, B., 2015, Mastering Autocad 2016 And Autocad Lite 2016, John Wiley & Sons Inc., Indiana, USA.
2. Er. R. K. Dhawan, 2010, Engineering Graphics (In First Angle Projection), 1st Ed., S. Chand Technical, India.
3. Mohd Rizal Alkahari et. al., 2009, Modul Lukisan Berbantu Komputer, Penerbit Universiti Teknikal Malaysia Melaka, Melaka.
4. Giesecke, F.E., Mitchell, A., Spencer, H.C., Hill, I.L., Dygdon, J.T., and Novak, J.E., 2008, Technical Drawing, 13th Ed., Prentice Hall, New York.
5. Khairul Anuar Hanafiah, 1999, Lukisan Berbantu Komputer, Penerbit Universiti Teknologi Malaysia, Skudai.

BMIU 3213
ENGINEERING ECONOMY AND MANAGEMENT

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Explain the principles and terminology of engineering economy, concepts of time value of money, and risk planning.
2. Apply the concepts, principle and techniques in project management and engineering economy.
3. Analyze complex problems and scenarios using engineering economy factors (F/P, P/F, P/A, A/P,F/A, A/F, P/G, A/G factors).
4. Evaluate and select between alternatives usingWorth, Annual Worth Analysis; Rate of Return and Breakeven & Payback Analysis.
5. Evaluate the project risk in engineering.

Synopsis
The course covers engineering economy and managing project & risk. Engineering economy discusses about the time value of money and interest relationship; engineering economy factors; nominal and effective interest rates; worth analysis; breakeven and payback analysis; which are useful to define certain project criteria that are utilized by engineers and project managers to select the best economic choice among several alternative. Management of risk incorporates the concepts of probability and statistics in the evaluation of alternatives. This allows management to determine the probability of success of failure of the project.

References
1. Blank, L and Tarquin, A., 2012, Engineering Economy, 7thEdition, McGraw Hill.
2. Whitman D. and Terry R., 2012, Fundamentalsof Engineering Economics and Decision Analysis, Morgan& Claypool Publishers.

3. Sullivan W.G, Wicks E.M, Koelling C.P., 2012, Engineering Economy, 15th Edition, Prentice Hall international.
4. Park C.S., 2011, Contemporary Engineering Economics, 5th Edition, Pearson.

BMKU 2372
FLUID MECHANICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Define basic concept in fluid mechanics.
2. Apply fluid mechanics equations in solving problems related to fluid mechanics.
3. Analyze problems related to fluid mechanics and solve them in a systematic manner.

Synopsis
This course introduces students the basic physical properties of fluid and the definition of pressure and head. Then, the derivation of hydrostatic equation and its application in pressure measurement, static forces analysis on immersed surface and buoyancy analysis are presented. For fluid dynamics, the introduction to fluid dynamics and fluid flow analysis followed by the 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 are discussed. In the final chapter, the knowledge of dimensional analysis and its application are instilled.

References
1. Yuan, C.S., Fluid Mechanics I, Pearson Prentice Hall, Malaysia, (2006).
2. Cengel, Y.A. and Cimbala, J.M., Fluid Mechanics: Fundamentals and Applications, International Edition, McGraw-Hill, Singapore, (2006).
3. Munson, B. R., Young D. F. and Okiishi, T. H., Fundamentals of Fluid Mechanics, 5th Edition, John Wiley & Sons, Inc, Asia, (2006).
4. Som, S. K. and Biswas, G., Introduction to Fluid Mechanics and Fluid Machines, 2nd Edition, Tata McGraw-Hill, New Delhi, (2004).
5. Douglas, J. F., Gasiorek J. M. and Swaffield, J. A., Fluid Mechanics, 4th Edition, Prentice Hall, Spain, (2001).

BMKU 3643
HYDRAULIC & PNEUMATIC SYSTEMS

Learning Outcome
Upon completion of this course, the student should be able to:
1. Explain the common hydraulic and pneumatic components, their use, symbols, and their applications in industry.
2. Analyze mathematical models of hydraulic and pneumatic circuits to study the performance of the system.
3. Design hydraulic and pneumatic system manually and using related computer software.
4. Simulate and troubleshoot the circuit of the hydraulic and pneumatic system.

Synopsis
This course covers the introduction of hydraulic and pneumatic systems, types of pump, compressor, working principles, types of valve, actuator, and performance of the fluid power system. The understanding enhanced to the fluid power system ancillaries, sensors, fluid power circuit design, and electrical control. The computer software is used to design and simulate the fluid power circuit. The programmable logic controller has been utilized one step ahead to control the pneumatic robotic and mobile hydraulics.

References
1. Esposito A. 2013. Fluid Power with Applications. 7th Ed. Prentice Hall. New Jersey.

2. Ilango S. 2007. Introduction to Hydraulics and Pneumatics. Prentice Hall-India. New Delhi.
3. Johnson, J.L. 2002. Introduction to Fluid Power. Delmar. New York.
4. Majumdar SR. 2002. Oil Hydarulic System Principles and Maintenance. Tata-McGraw Hill. New York.
5. Hehn A.H. 2000. Fluid Power Handbook.Vol 1. Gulf Publishing Company. Texas.

BMKU 3653
THERMODYNAMICS & HEAT TRANSFER

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe basic terms of thermodynamics and use property tables to define the state of the systems.
2. Apply the concept of First Law of Thermodynamics in Closed Systems and Control Volumes.
3. Apply the concept of Second Law of Thremodynamics to determine the performance of heat engines, refrigerators and heat pumps.
4. Implement the concept of heat transfer such as conduction, convection and radiation through plates, cylinders and spheres including electronics system such as transistor and electric wire.

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 Ts diagrams), First Law of Thermodynamics and Second Law of thermodynamics. It also will cover the different modes of heat transfer, definition of conduction, convection, radiation, thermal conductivity, Fourier's law of conduction, heat transfer coefficients, Newtons's law of cooling, Steffan- Boltzman constant, emissivity of black bodies, heat transfer through plates, cylinders and spheres.

Reference
1. Cengel, Y. A. and Boles, M. A., 2014. Thermodynamics: An Engineering Approach, 8th Ed, McGraw Hill.Singapore.
2. Sonntag, R.E. and Borgnakke, C. 2012. Fundamentals of Thermodynamics, 8th Ed, John Wiley & Sons, Inc.New York.
3. S.C.Gupta, 2009. Thermodynamics, 2nd Ed, Pearson Education (Singapore) Pte. Ltd.
4. Morad, N.A., Mulop, N. and Darus, A. N. 2011. Introduction to Thermodynamics for Engineering Students, 1st Ed, Pearson Malaysia Sdn Bhd.

SERVICE COURSES (FKP)
BMIG 1313
ENGINEERING MATHEMATICS

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Describe the fundamental concepts of matrices, eigenvalues and eigenvector, complex numbers, interpolation, differentiation, integration and vector- valued functions.
2. Solve the mathematical problems that involve matrices, eigenvalues and eigenvector, complex numbers, interpolation, differentiation, integration and vector- valued functions by using an appropriate technique.
3. Apply the knowledge of engineering mathematics to deal with the engineering problems.

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

1. James, G., Modern Engineering Mathematics, 5th edition, Pearson, 2015.
2. Khoo, C.F., Sharifah Sakinah, S.A., Zuraini, O. and LOk, Y.Y., Numerical Methods, 3rd edition, Pearson Prentice Hall, 2009.
3. Muzalna M.J., Irma Wani J. Rahifa R. and Norazlina A.R., Engineering Mathematics, 2nd edition, Prentice Hall, 2009.
4. Kreyszig, E., Advance Engineering Mathematics, 10th edition, John Wiley, 2010.
5. Guo W., Advance Mathematics for Engineering and Applied Sciences, Pearson, 2015.

BMIG 1213
ENGINEERING MATERIALS

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Explain the basic concepts of engineering materials in terms of interatomic bonding and crystal structure.
2. Analyze the properties of engineering materials based on its structure.
3. Describe the processing methods for engineering materials.

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. Introduction to the binary phase diagrams are also provided. Explanation on different types of engineering material (i.e. metal, ceramic, polymer, composites and functional), its mechanical properties, basic processing and applications are also included.

References

1. Callister, W.D. Jr. (2014) Materials Science and Engineering - An Introduction, 9th Edition. John Wiley & Sons Inc.
2. Askeland, D.R., Fulay, P.P. and Wright, W.J., (2012), The Science and Engineering of Materials, 6th Edition. Thomson.
3. Smith, W.F. (2010) Principle of Materials Science & Engineering, 5th Edition, Mc. Graw Hill.
4. Shackelford, J.F. (2009) Introduction to Materials Science for Engineering, 7th Edition, Prentice Hall.

SERVICE COURSES (FPTT, PPB, IPTK & CO-CURRICULUM UNIT)

BMIU 3213
ENTERPRENEURSHIP TECHNOLOGY

Learning Outcomes

Upon completion of this course, the student should be able to:

1. Recognize the importance of entrepreneurship, the role of entrepreneurship in today's society, and the technical knowledge of the entrepreneurial process.
2. Explain the basic concepts of interdisciplinary competences in management and create technology- based businesses.
3. 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
1. Barringer, B.R, and Ireland, R.D. (2012). Entrepreneurship 4th Edition. Pearson.
2. Scarborough, N.M. (2011). Essentials of Entrepreneurship and Small Business Management 6th Edition. Pearson.
3. UiTM Entrepreneurship Study Group. Revised Edition (2010). Fundamentals of Entrepreneurship. Pearson.

BLLW 1172
MALAY COMMUNICATION I

Hasil Pembelajaran
Pada akhir kursus ini, pelajar akan dapat:
1. Memberikan respon terhadap perbualan biasa dan situasi-situasi lain.
2. Mengaitkan bunyi-bunyi atau ucapan dalam Bahasa Melayu dari segi nahu, fonologi dan kemahiran lisan tentang diri sendiri, keluarga, rakan-rakan and aktiviti harian.
3. Membincangkan secara mudah tentang sesuatu topik semasa.
4. Membina ayat dan bertutur dalam bahasa Melayu dengan gramatis.

Sinopsis
Kursus ini memperkenalkan susuk tatabahasa bahasa Melayu. Pelajar didedahkan dengan aspek-aspek nahu, klausa, terminologi, binaan ayat, penjodoh bilangan dan unsur sastera. Diharapkan pelajar dapat menguasai pertuturan atau berkomunikasi dengan baik dan mudah berdasarkan kemampuan pelajar asing.

Rujukan
1. Amy Buttner. (2013). Aktivitas, permainan dan strategi penilaian untuk kelas bahasa asing. PT InDELs, Jakarta, Indonesia.
2. Yong ChynChye, Rohaidah Mashudi dan Maarof Abd Rahman. (2012). Bahasa Kebangsaan untuk pelajar luar negara (Malay Language for International Students). Kuala Lumpur: Pearson Malaysia Sdn Bhd.
3. Zarina Othman, Roosfa Hashim dan Rusdi Abdullah (Peny.). (2012). Modul Komunikasi Melayu Antarabangsa. Bangi, Selangor: Penerbit Universiti Kebangsaan Malaysia.

BLLW 1212
ARABIC

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Use the basic Arabic grammar correctly and apply the information from the text.
2. Construct sentences and apply selected vocabulary in a report.
3. Demonstrate communication skills.

Synopsis
This basic Arabic course adopts the communicate approach and introduces the phonology, grammar, vocabulary and writing system. Students will be exposed to basic reading materials in the languages.

References
1. Abdul Rahim (2004). Pembelajaran Bahasa Arab bagi golongan yang bukan Arab, (Bil.1) Kuliah Bahasa Arab Universiti Islam Madinah, Saudi Arabia.
2. Yaakob, M., Mohd Salleh, A.H & Mahpol, S. (2003). Al- ibtikar, (Bil.1) Sepang, Selangor: Penerbitan Salafi.
3. Abdul Masih, G.M. (2001). Mu’jam Kawaid Al-Lugatul Arobiah Fi Jadawal Walauhat. Maktabah Lubnan.
4. Yaakob, A.B. (2000). Mausuah An-Nahwu Wassorp Wali’raf. Beirut, Lubnan: Darul Ilmi Lilmalayin.
5. Mohd. Rejab I. (2000). Kursus Bahasa Arab. Yayasan Dakwah Islamiah Malaysia (YADIM).
6. Arifin Jami’an, M. (1994). Bahasa Arab, Kursus mudah dan cepat. Dinie Publisher.

BLLW 1232
JAPANESE

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Use grammar and classify the features of Japanese phonology correctly.
2. Demonstrate correct pronunciation.
3. Construct sentences and demonstrate writing skills.

Synopsis
This course 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 course 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
1. Minna no Nihongo 1, 3A Corporation, 2002.
2. Minna no Nihongo 1, Translation & Grammatical Notes, 3A Corporation, Tokyo, 2002.
3. Shin Nihongo No Kiso 1-Grammatical Notes In English, 2001, Association for Japanese-Language Teaching.
4. Shin Nihongo No Kiso 1-English Translation Asian Edition, 2000, Association for Japanese-Language Teaching.
5. The Association for Overseas Technical Scholarship (AOTS), 2000, Shin Nihongo No Kiso 1-English Translation, Asia Edition.
6. Japanese For Young People 1 Kana Workbook, 2000, Association for Japanese-Language Teaching.

BLLW 1222
MANDARIN

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Demonstrate the ability to converse in Mandarin with correct and accurate pronunciation and intonation.
2. Use the rules of Chinese writing and the theory of word and sentence formation.
3. Interpret the information in the simple text.

Synopsis
This course is designed for students who do not have any background in Mandarin. It provides students with the knowledge to enable them to understand and communicate in the oral and written forms. This course encompasses the listening, speaking, reading and writing components. This course aims to help students to obtain enough exposure of the Mandarin phonetics (Han yu pin yin). The grammar introduced is related to the language used daily by Chinese. Particular care is also taken to ensure that the complexity of the dialogues is gradually developed using simple to complex sentences.

References
1. Ang Lay Hoon, Ooi Bee Lee (2008) Basic Chinese For Everyone. Selangor: Pelanduk Publications.

BLHW 2752
MALAYSIAN CULTURE

Learning Outcomes
Upon completion of this course, the student should be able to:
1. Discuss issues related to Malaysian culture.
2. Present issues related to Malaysian culture.
3. Reflect the scenario of cultural diversity in Malaysia.
4. Describe an element in Malaysian culture.

Synopsis

This course exposes international students to the sociocultural 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 to assist international students in developing their understanding and appreciation of Malaysian culture.

References

1. Heidi Munan. (2010). Cultural Shock. A Guide to Customs and Etiquette. Kuala Lumpur: The NewStraits Times Press.
2. Heidi Munan. (2010). Malaysian Culture Group. Kuala Lumpur: Book Group.
3. Guan Yeoh Seng. (2011). Media, Culture and Society in Malaysia. Kuala Lumpur: Routledge.

BLHW 1762
PHILOSOPHY AND CURRENT ISSUES

Learning Outcome

Upon completion of this course, the student should be able to:

1. Explain the current issues related to philosophy, National Education Philosophy and National Ideology.
2. Analyze the current issues based on main scholarly thought and various philosophical theories.
3. Examine the current issues according to philosophical comparative studies between dialogue and culture.

Synopsis

This course will discuss on the concept of knowledge, ethics and civilization which emphasize on comparative available systems, social development and multi-cross cultural activities in Malaysia. Besides, this course is stressing on current and contemporary issues discussion related to economy, politic, social, culture and environment based on ethical and civilizational approach. This course will cover the comparative system, developmental phase, social development and cross cultural activities in order to produce a man with positive values.

References

1. Dzulkifli A. R. dan Rosnani H. (Eds). (2019). Pentafsiran Baharu Falsafah Pendidikan Kebangsaan dan Pelaksanaannya Pasca 2020. Kuala Lumpur: IIUM.
2. Osman Bakar (2019). Classification of Knowledge in Islam: A Study in Islamic Schools of Epistemology. Kuala Lumpur: IBT.
3. Osman Bakar (2016). Qur'anic Pictures of the Universe: The Scriptural Foundation of Islamic Cosmology. Kuala Lumpur: UBD dan IBT.
4. Osman Bakar (2008). Tawhid and Science: Islamic Perspectives on Religion and Science, (2nd Ed.). Shah Alam: Arah Publications.
5. Shaharir Mohamad Zain (2012), Berakhir Sudahkah Ilmu Dalam Acuan Sendiri?, Pusat Dialog Peradaban UM.
6. Shaharir Mohamad Zain (2018), Falsafah Ilmu Daripada Karya-Karya Besar Sains dan Matematik Islam Malayonesia, Akademi Kajian Ketamadunan.
7. Tajul Ariffin Noordin. (1993). Perspektif Falsafah dan Pendidikan di Malaysia. Kuala Lumpur: DBP
8. Maszlee Malik. (Dr). (2017). Foundation of Islamic Governance : A Southeast Asian Perspective (1st Ed). London & New York : A Routledge.

BLHW 2772
APPRECIATION OF ETHICS AND CIVILISATIONS

Hasil Pembelajaran

Pada akhir kursus ini, pelajar akan dapat:

1. Menjelaskan konsep etika daripada perspektif peradaban yang berbeza.

2. Membandingkan sistem, tahap perkembangan, kemajuan sosial dan kebudayaan merentas bangsa.
3. Membincangkan isu kontemporari berkaitan ekonomi, politik, sosial, budaya dan alam sekitar daripada perspektif etika dan peradaban.

Sinopsis
Kursus ini menerangkan tentang konsep etika daripada perspektif peradaban yang berbeza. Ia bertujuan bagi mengenal pasti sistem, tahap perkembangan, kemajuan dan kebudayaan sesuatu bangsa dalam mengukuhkan kesepaduan sosial. Selain itu, perbincangan berkaitan isu-isu kontemporari dalam aspek ekonomi, politik, sosial, budaya dan alam sekitar daripada perspektif etika dan peradaban dapat melahirkan pelajar yang bermoral dan profesional. Penerapan amalan pendidikan berimpak tinggi (HIEPs) yang bersesuaian digunakan dalam penyampaian kursus ini. Di hujung kursus ini pelajar akan dapat menghubungkaitkan etika dan kewarganegaraan berminda sivik.

Rujukan
1. Shamsul Amri Baharuddin (2012). Modul Hubungan Etnik. Selangor: Institut Kajian Etnik Universiti Kebangsaan Malaysia.
2. Harari Y. N. (2017). Homo Deus : A Brief History of Tomorrow. Australia : Harper Collins.
3. MacKinnon, B. (2015). Ethics: Theory and Contemporary Issues (8th) ed). Stamford CT : Cengage Learning.

BKXX XXX1
CO-CURRICULUM I &II
Please refer to the Pusat Pembelajaran Bahasa (PPB) and Institut Pengurusan Teknologi dan Keusahawanan (IPTK) handbook for further information on the offered courses.

BACHELOR PROGRAMME OF ELECTRICAL ENGINEERING TECHNOLOGY

PROGRAMME LEARNING OUTCOMES (PLO)

PLO1	Ability to apply knowledge of mathematics, science, engineering fundamentals and engineering specialization principles to defined and applied engineering procedures, processes, systems or methodologies in the field of electrical engineering technology (industrial automation & robotics / industrial power).
PLO2	Ability to solve broadly-defined engineering problems systematically to reach substantiated conclusions, using tools and techniques appropriate to electrical engineering technology (industrial automation & robotics / industrial power).
PLO3	Ability to design solutions for broadly-defined engineering technology problems, and to design systems, components or processes to meet specified needs with appropriate consideration for public health and safety, as well as cultural, societal, environmental and sustainability concerns.
PLO4	Ability to plan and conduct experimental investigations of broadly-defined problems, using data from relevant sources.
PLO5	Ability to select and apply appropriate techniques, resources and modern engineering tools, with an understanding of their limitations.
PLO6	Ability to demonstrate an awareness of and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities.
PLO7	Ability to demonstrate an understanding of the impact of engineering technology practices, taking into account the need for sustainable development.
PLO8	Ability to demonstrate an understanding of professional ethics, responsibilities and norms of engineering technology practices.
PLO9	Ability to function effectively as individuals, and as members or leaders in diverse technical teams.
PLO10	Ability to communicate effectively with the engineering community and society at large.
PLO11	Ability to demonstrate an awareness of project management, business practices and entrepreneurship.
PO12	Ability to recognise the need for professional development and to engage in independent and lifelong learning.

BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY (INDUSTRIAL POWER) WITH HONOURS (BELK)

CURRICULUM STRUCTURE BELK

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 1	BELG 1013	Matematik Teknikal Technical Mathematics	P	3	
	BELT 1303	Sistem Pengukuran & Instrumentasi Measurement & Instrumentation Systems	K	3	
	BELR 1313	Rekabentuk Terbantu Komputer Computer Aided Design	K	3	
	BELR 1304	Elektronik & Sistem Digital Digital Electronics & Systems	K	4	
	BELK 1303	Pengenalan Litar Elektrik Electrical Circuit Fundamental	K	3	
	BLHW 1762	Falsafah dan Isu Semasa Philosophy and Current Issue	W	2	
	BKKX XXX1	Kokurikulum I Cocurriculum I	W	1	
TOTAL CREDITS THIS SEMESTER				**19**	
SEMESTER 2	BMIG 1023	Kalkulus untuk Teknologi Calculus for Technology	P	3	
	BELK 1311	Bengkel Elektrik I Electrical Workshop I	K	1	
	BELK 1323	Elektrik & Kemagnetan Electrical & Magnetism	K	3	
	**BELK 1333	Litar Elektrik Lanjutan Advanced Electrical Circuits	K	3	BELK 1303
	BELR 1343	Pengaturcaraan Komputer Computer Programming	K	3	
	BELK 1453	Prinsip Elektronik Electronic Principle	K	3	
	BLLW 1142	Bahasa Inggeris untuk Akademik English for Academic Purposes	W	2	
	BLLW 1172	Bahasa Melayu Komunikasi (untuk pelajar antarabangsa) Malay Language for Communication (for international students)	W	2	
TOTAL CREDITS THIS SEMESTER					
LOCAL STUDENT				**18**	
INTERNATIONAL STUDENT				**20**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 3	BMKG 2033	Kalkulus Gunaan Applied Calculus	P	3	
	BELR 2061	Seminar Kejuruteraan I Engineering Seminar I	P	1	
	**BELK 2342	Bengkel Elektrik II Electrical Workshop II	K	2	BELK 1311
	BELK 2373	Mesin Elektrik Electrical Machines	K	3	
	BELK 2364	Teknologi Elektrik Electrical Technology	K	4	
	BELR 2383	Pengenalan Sistem Kawalan Control System Fundamental	K	3	
	BKKX XXX1	Kokurikulum II Cocurriculum II	W	1	
	BLLW 1XX2	Bahasa Ketiga Third Language	W	2	
TOTAL CREDITS THIS SEMESTER				**19**	
SEMESTER 4	BERG 2043	Kaedah Statistik Statistical Methods	P	3	
	BELR 2373	Sistem Terbenam Embedded Systems	K	3	
	BELK 2463	Termodinamik & Pemindahan Haba Thermodynamic & Heat Transfer	K	3	
	BELK 2383	Teknologi Sistem Kuasa Power System Technology	K	3	
	BELK 3413	Elektronik Kuasa Power Electronics	K	3	
	BLLW 2152	Penulisan Akademik Academic Writing	W	2	
	***BLHX	Elektif Umum General Elective	E	2	
TOTAL CREDITS THIS SEMESTER				**19**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 5	**BELK 3393	Sistem Kuasa Lanjutan Advanced Power System	K	3	BELK 2383
	BELK 3423	Penggerak & Pemacu Actuators & Drives	K	3	
	BELR 3413	PLC & Aplikasi PLC & Applications	K	3	
	BELK 3473	Sistem Kuasa Penjanaan & Penghantaran Power System Genaration & Transmission	K	3	
	BLHW 2772 BLHW 2752	Penghayatan Etika dan Peradaban (untuk pelajar tempatan) Appreciation of Ethics and Civilisation (for local students) Kebudayaan Malaysia (untuk pelajar antarabangsa) (Malaysian Culture) (for international students)	W	2	
	BELK 3403	Sistem Pengagihan Kuasa Power Distribution System	K	3	
TOTAL CREDITS THIS SEMESTER				**17**	
SEMESTER 6	BELK 3061	Seminar Kejuruteraan II Engineering Seminar II	P	1	
	BELU 4053	Etika Kejuruteraan & KPPP Engineering Ethics & OSHE	P	3	
	BELU 3764	Projek Sarjana Muda I Bachelor Degree Project I	K	4	
	BELK 4823	Teknologi Voltan Tinggi High Voltage Technology	K	3	
	BELK 4833	Perlindungan Sistem Kuasa Power Systems Protection	K	3	
	BLLW 3162	Bahasa Inggeris untuk Interaksi Profesional English for Professional Interaction	W	2	
	BELU 3803	Rekabentuk Projek Bersepadu Integrated Design Project	K	3	
TOTAL CREDITS THIS SEMESTER				**19**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 7	**BELU 4774	Projek Sarjana Muda II Bachelor Degree Project II	K	4	BELU 3764
	BLHC 4032	Pemikiran Kritis dan Kreatif (untuk pelajar tempatan) Critical and Creative Thinking (for local students)	W	2	
	BTMW 4012	Keusahawanan Teknologi Technology Enterpreneurship	W	2	
	*BELX XXXX	Elektif I Elective I	E	3	
	*BELX XXXX	Elektif II Elective II	E	3	
	*BELX XXXX	Elektif III Elective III	E	3	
TOTAL CREDITS THIS SEMESTER					
LOCAL STUDENT				**17**	
INTERNATIONAL STUDENT				**15**	
SEMESTER 8	BELU 48812	Latihan Industri Industrial Training	K	12	
TOTAL CREDITS THIS SEMESTER				**19**	
TOTAL CREDITS				**140**	

For Elective I, II & III students may choose any THREE (3) subject from the list below:

No.	CODE	SUBJECT
1	BELK 4803	Operasi & Automasi Sistem Kuasa Power Systems Operation & Automation
2	BELT 3803	Sistem Tenaga Lestari Renewable Energy System
3	BELK 4863	Kualiti Kuasa Power Quality
4	BELT 4413	Kecekapan Tenaga Energy Efficiency
5	BELK 4843	Keserasian Elektromagnet Sistem Kuasa Power Systems Electromagnetic Compatibility
6	BELR 4813	Kawalan Proses Industri Industrial Process Control
7	BELK 4853	Ekonomi Sistem dan Pasaran Elektrik Electricity Market and System Economics
8	BELR 4863	Kepintaran Buatan Artificial Intelligence
9	BELR 4873	Teknologi Penyelenggaraan & Pengurusan Aset Maintenance Technology & Asset Management

*** For General elective, students may choose any ONE (1) subject from the list below:

CODE	SUBJECT NAME
BLHW 1722	Falsafah Sains dan Teknologi Philosophy of Science and Technology
BLHC 4012	Komunikasi Organisasi Organizational Communication
BLHH 1032	Psikologi Industri dan Organisasi Industrial Psycology and Organization
BLHC 4022	Kemahiran Perundingan Negotiation Skills
BLHW 2782	Sosiologi Industri Industrial Sociology

BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY (INDUSTRIAL AUTOMATION & ROBOTIC) WITH HONOURS (BELR)

CURRICULUM STRUCTURE BELR

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 1	BELG 1013	Matematik Teknikal Technical Mathematics	P	3	
	BELR 1304	Elektronik & Sistem Digital Digital Electronics & Systems	K	4	
	BELT 1303	Pengukuran dan Instrumentasi Measurement and Instrumentation	K	3	
	BELR 1313	Rekabentuk Terbantu Komputer Computer Aided Design	K	3	
	BELK 1303	Pengenalan Litar Elektrik Electrical Circuit Fundamental	K	3	
	BLHW 1762	Falsafah dan Isu Semasa Philosophy and Current Issue	W	2	
	BKKX XXX1	Kokurikulum I Cocurriculum I	W	1	
TOTAL CREDITS THIS SEMESTER				**19**	
SEMESTER 2	BMIG 1023	Kalkulus untuk Teknologi Calculus for Technology	P	3	
	BELK 1311	Bengkel Elektrik I Electrical Workshop I	K	1	
	BELK 1323	Elektrik & Kemagnetan Electrical & Magnetism	K	3	
	BELK 1453	Prinsip Elektronik Electronics Principle	K	3	BELK 1303
	**BELK 1333	Litar Elektrik Lanjutan Advanced Electrical Circuits	K	3	
	BELR 1343	Pengaturcaraan Komputer Computer Programming	K	3	
	BLLW 1142	Bahasa Inggeris untuk Akademik English for Academic Purposes	W	2	
	BLLW 1172	Bahasa Melayu Komunikasi (untuk pelajar antarabangsa) Malay Language for Communication (for international students)	W	2	
TOTAL CREDITS THIS SEMESTER					
LOCAL STUDENT				**18**	
INTERNATIONAL STUDENT				**20**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 3	BMKG 2033	Kalkulus Gunaan Applied Calculus	P	3	
	BELR 2061	Seminar Kejuruteraan I Engineering Seminar I	P	1	
	**BELK 2342	Bengkel Elektrik II Electrical Workshop II	K	2	BELK 1311
	BELR 2363	Statik & Mekanik Static & Mechanics	K	3	
	BELK 2364	Teknologi Elektrik Electrical Technology	K	4	
	BELK 2373	Mesin Elektrik Electrical Machine	K	3	
	BLLW 1XX2	Bahasa Ketiga Third Language	W	2	
	BKKX XXX1	Kokurikulum II Cocurriculum II	W	1	
TOTAL CREDITS THIS SEMESTER				**19**	
SEMESTER 4	BERG 2043	Kaedah Statistik Statistical Methods	P	3	
	BELR 2373	Sistem Terbenam Embedded Systems	K	3	
	BELK 3413	Elektronik Kuasa Power Electronics	K	3	
	BMKC 2323	Mekanik Bendalir Fluids Mechanics	K	3	
	BELR 2383	Pengenalan Sistem Kawalan Control System Fundamental	K	3	
	BLLW 2152	Penulisan Akademik Academic Writing	W	2	
	***BLHXXXX2	Elektif Umum General Elective	E	2	
TOTAL CREDITS THIS SEMESTER				**19**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 5	BELK 2383	Sistem Kuasa Lanjutan Advanced Power System	K	3	
	BELR 3463	Data Komunikasi Industri Industrial Data Communication	K	3	
	**BELR 3393	Kejuruteraan Sistem Kawalan Control System Engineering	K	3	BELR 2383
	BELR 3453	Sistem Kawalan Peggerak Motion Control System	K	3	
	BELR 3473	PLC & Automasi PLC & Automation	K	3	
	BLHW 2772 BLHW 2752	Penghayatan Etika dan Peradaban (untuk pelajar tempatan) Aprreciation of Ethics and Civilisation (for local students) OR Kebudayaan Malaysia (untuk pelajar antarabangsa) Malaysian Culture (for international students)	W	2	
TOTAL CREDITS THIS SEMESTER				**17**	
SEMESTER 6	BELK 3061	Seminar Kejuruteraan II Engineering Seminar II	P	1	
	BELU 4053	Etika Kejuruteraan & KPPP Engineering Ethics & OSHE	P	3	
	BELU 3764	Projek Sarjana Muda I Bachelor Degree Project I	K	4	
	BELR 3443	Pneumatik & Hidraulik Pneumatic & Hydraulic	K	3	
	BELU 3803	Rekabentuk Projek Bersepadu Integrated Design Project	K	3	
	BLLW 3162	Bahasa Inggeris untuk Interaksi Profesional English for Professional Interaction	W	2	
TOTAL CREDITS THIS SEMESTER				**16**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 7	**BELU 4774	Projek Sarjana Muda II Bachelor Degree Project II	K	4	BELU 3764
	BLHC 4032	Pemikiran Kritis dan Kreatif (untuk pelajar tempatan) Critical and Creative Thinking (for local students)	W	2	
	BTMW 4012	Keusahawanan Teknologi Technology Enterpreneurship	W	2	
	*BELR 48X3	Elektif I Elective I	E	3	
	*BELR 48X3	Elektif II Elective II	E	3	
	*BELR 48X3	Elektif III Elective III	E	3	
TOTAL CREDITS THIS SEMESTER					
LOCAL STUDENT				**17**	
INTERNATIONAL STUDENT				**15**	
SEMESTER 8	BELU 48812	Latihan Industri Industrial Training	K	12	
TOTAL CREDITS THIS SEMESTER				**12**	
TOTAL CREDITS				**140**	

For Elective I, II & III students may choose any THREE (3) subject from the list below:

No.	CODE	SUBJECT
1	BELR 4803	Sistem Pembuatan Teranjal Flexible Manufacturing System
2	BELR 4813	Kawalan Proses Industri Industrial Process Control
3	BELR 4823	Penglihatan Mesin Machine Vision
4	BELR 4833	Sistem Kawalan Teragih Distributed Control System
5	BELR 4843	Sistem Pembuatan Manufacturing System
6	BELR 4853	Sistem Kawalan Lanjutan Advanced Control System
7	BELR 4863	Kepintaran Buatan Artificial Intelligence
8	BELR 4873	Teknologi Penyelenggaraan & Pengurusan Aset Maintenance Technology & Asset Management

*** For General elective, students may choose any ONE (1) subject from the list below:

CODE	SUBJECT NAME
BLHW 1722	Falsafah Sains dan Teknologi Philosophy of Science and Technology
BLHC 4012	Komunikasi Organisasi Organizational Communication
BLHH 1032	Psikologi Industri dan Organisasi Industrial Psycology and Organization
BLHC 4022	Kemahiran Perundingan Negotiation Skills
BLHW 2782	Sosiologi Industri Industrial Sociology
BLHW 2792	Integriti dan Anti-Rasuah Integrity and Anti-Corruption

Besides the aforementioned curriculum, the Programme offers professional certificate courses as an added value for the students to increase their employability. Students may choose any ONE (1) subject from the following list.

CODE	CERTIFICATE NAME
BITS 2610	Cisco Certified Network Associate Routing & Switching (Preparation)
BERC 2210	IoT Fundamentals: Connecting Things Professional Certification
BERC 2220	IoT Fundamentals: Big Data & Analytics Professional Certification
BERE 3210	Programmable Logic Controller (PLC) Level 1 and Level 2
BEER 4210	SMCT MT1 – Practical Mechatronics 1

Number of credit hours regarding to course category is represented in the table below.

W = university compulsory subjects
P = program core subjects
K = course core subjects
E = elective subjects

Programme P	P	17
Course K	K	82
University Compulsory	W	18
Industrial Training	K	12
Elective	E	11
		140

BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY WITH HONOURS (BELT)

CURRICULUM STRUCTURE BELT

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 1	BELU 1013	Matematik Teknikal Technical Mathematics	P	3	
	BELE 1013	Fizik Teknikal Technical Physics	P	3	
	BELT 1303	Pengukuran dan Sistem Instrumentasi Measurement and Instrumentation System	K	3	
	BELR 1313	Rekabentuk Terbantu Komputer Computer Aided Design	K	3	
	BELK 1303	Pengenalan Litar Elektrik Electrical Circuit Fundamental	K	3	
	BLHW 1762	Falsafah dan Isu Semasa Philosophy and Current Issue	W	2	
	BKKX XXX1	Kokurikulum I Cocurriculum I	W	1	
TOTAL CREDITS THIS SEMESTER				**18**	
SEMESTER 2	BELU 1023	Kalkulus untuk Teknologi Calculus for Technology	P	3	
	BELT 1313	Bengkel Elektronik Electronics Workshop	K	3	
	BELK 1323	Elektrik & Kemagnetan Electrical & Magnetism	K	3	
	BELT 1323	Elektronik & Sistem Digital Digital Electronics & System	K	3	
	**BELK 1333	Litar Elektrik Lanjutan Advanced Electrical Circuits	K	3	BELK 1303
	BKKX XXX1	Kokurikulum II Cocurriculum II	W	1	
	BLLW 1442	Bahasa Inggeris untuk Akademik English for Academic Purposes	W	2	
	BLLW 1172	Bahasa Melayu Komunikasi I (untuk pelajar antarabangsa) Malay Language for Communication I (for international students)	W	2	
TOTAL CREDITS THIS SEMESTER					
LOCAL STUDENT				**18**	
INTERNATIONAL STUDENT				**20**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 3	BELU 2053	Kalkulus Gunaan Applied Calculus	P	3	
	BELT 2333	Pemasangan Elektrik I Electrical Installation I	K	3	
	BELT 2343	Peranti Elektronik Electronic Devices	K	3	
	BELT 2353	Teknologi Elektrik Electrical Technology	K	3	
	BELR 1343	Pengaturcaraan Komputer Computer Programming	K	3	
	BELT 2361	Kerjaya Teknologi Kejuruteraan Elektrik Electrical Engineering Technology Career	K	1	
	BLLW 1XX2	Bahasa Ketiga Third Language	W	2	
TOTAL CREDITS THIS SEMESTER				18	
SEMESTER 4	BELU 2043	Kaedah Statistik Statistical Methods	P	3	
	BELR 2373	Sistem Terbenam Embedded Systems	K	3	
	BELT 2373	Pemasangan Elektrik II Electrical Installation II	K	3	
	BELR 2383	Pengenalan Sistem Kawalan Control System Fundamental	K	3	
	BELR 2353	Elektronik Analog Analog Electronics	K	3	
	BLLW 2152	Penulisan Akademik Academic Writing	W	2	
	***BLHX XXX2	Elektif Umum General Elective	E	2	
TOTAL CREDITS THIS SEMESTER				19	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 5	BELK 2373	Mesin Elektrik Electrical Machines	K	3	
	BELT 3383	Peranti Elektronik Kuasa Power Electronics Devices	K	3	
	BELK 2383	Teknologi Sistem Kuasa Power System Technology	K	3	
	BELT 3403	Automasi Industri Industrial Automation	K	3	
	BLHW 2772	Penghayatan Etika dan Peradaban (untuk pelajar tempatan) Aprreciation of Ethics and Civilisation (for local students) OR	W	2	
	BLHW 2752	Kebudayaan Malaysia (untuk pelajar antarabangsa) Malaysian Culture (for international students)	W	2	
	*BELT 38X3	Elektif I Elective I	E	3	
	*BELT 38X3	Elektif II Elective II	E	3	
TOTAL CREDITS THIS SEMESTER				**20**	
SEMESTER 6	BELU 3764	Projek Sarjana Muda I Bachelor Degree Project I	K	4	
	BELT 4393	Sistem Elektronik Kuasa Power Electronics Systems	K	3	
	BELU 3803	Rekabentuk Projek Berintegrasi Integrated Design Project	K	3	
	BLHC 4032	Pemikiran Kritis dan Kreatif (untuk pelajar tempatan) Critical and Creative Thinking (for local students)	W	2	
	BLLW 3162	Bahasa Inggeris untuk Interaksi Profesional English for Professional Interaction	W	2	
	*BELT 38X3	Elektif III Elective III	E	3	
TOTAL CREDITS THIS SEMESTER				**17**	
LOCAL STUDENTS				**17**	
INTERNATIONAL STUDENTS				**15**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 7	BELU 4053	Etika Kejuruteraan & KKPP Engineering Ethics & OSHE	P	3	
	**BELU 4774	Projek Sarjana Muda II Bachelor Degree Project II	K	4	BELU 3764
	BELT 4413	Kecekapan Tenaga Energy Efficiency	K	3	
	BELK 3403	Sistem Pengagihan Kuasa Power Distribution System	K	3	
	BTMW 4012	Keusahawanan Teknologi Technology Enterpreneurship	W	2	
	*BEEX XXX3	Elektif IV Elective IV	E	3	
TOTAL CREDITS THIS SEMESTER				**18**	
SEMESTER 8	BELU 48812	Latihan Industri Industrial Training	K	12	
TOTAL CREDITS THIS SEMESTER				**12**	
TOTAL CREDITS				**140**	

** Pre-requisite subject

* For Elective I, Elective II, Elective III and Elective IV students may choose strictly from either of the TWO (2) tracks below:

Track 1: Renewable Energy

CODE	SUBJECT NAME
BELT 3803	Sistem Tenaga Diperbaharui Renewable Energy System
BELT 3823	Teknologi Penyimpanan Tenaga Energy Storage Technology
BELT 3843	Rekabentuk Sistem PV PV System Design
BELT 3853	Aplikasi Elektronik Kuasa Power Electronics Application
BELK 4843	Keserasian Elektromagnetik Sistem Kuasa Power System Electromagnetic Compatibility
BELK 4853	Ekonomi Sistem dan Pasaran Elektrik Electricity Market and System Economics
BELK 4863	Kualiti Kuasa Power Quality
BELR 4863	Kepintaran Buatan Artificial Intelligence

Track 2: Electrical Transportation

CODE	SUBJECT NAME
BELT 3813	Pengenalan kepada Sistem Pengangkutan Elektrik Introduction To Electric Transportation System
BELT 3823	Teknologi Penyimpanan Tenaga Energy Storage Technology
BELT 3853	Aplikasi Elektronik Kuasa Power Electronics Application
BELT 3863	Pemacu Motor dan Sistem Tarikan Motor Drive and Traction System
BELK 4843	Keserasian Elektromagnetik Sistem Kuasa Power System Electromagnetic Compatibility
BELR 4863	Kepintaran Buatan Artificial Intelligence
BELT 4903	Sistem Pemacu Moden Modern Drive System
BELT 4913	Kenderaan Elektrik Hibrid Hybrid Electric Vehicle

*** For General elective, students may choose any ONE (1) subject from the list below:

CODE	SUBJECT NAME
BLHW 1722	Falsafah Sains Dan Teknologi Philosophy of Science and Technology
BLHC 4012	Komunikasi Organisasi Organizational Communication
BLHH 1032	Psikologi Industri dan Organisasi Industrial Psychology and Organisation
BLHC 4022	Kemahiran Perundingan Negotiation Skills
BLHW 2782	Sosiologi Industri Industrial Sociology
BLHW 2792	Integriti dan Anti-Rasuah Integrity and Anti-Corruption

Besides the aforementioned curriculum, the Programme offers professional certificate courses as an added value for the students to increase their employability. Students may choose any ONE (1) subject from the following list.

CODE	CERTIFICATE NAME
BELR 3100	Certified LabView Associate Developer (CLAD)
BEEE 3100	Programmable Logic Controller (PLC) Level 1 and Level 2
BEEZ 3100	SMCT MT1 – Practical Mechatronics 1

Number of credit hours regarding to course category is represented in the table below.

W = university compulsory subjects
P = program core subjects
K = course core subjects
E = elective subjects

Programme P	P	18
Course K	K	78
University Compulsory	W	18
Industrial Training	K	12
Elective	E	14
		140

UNIVERSITY COMPULSORY COURSES (W)

BKKX XXX1 COCURRICULUM I & COCURRICULUM II / KOKURIKULUM I & KOKURIKULUM II

LEARNING OUTCOMES

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

1. Apply skills in relevant fields.
2. Demonstrate teamwork abilities in related subjects.

SYNOPSIS

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

BLLW 1XX2 THIRD LANGUAGE / BAHASA KETIGA

Bahasa Arab Tahap 1
Bahasa Arab Tahap 2
Bahasa Mandarin Tahap 1
Bahasa Mandarin Tahap 2
Bahasa Jepun Tahap 1
Bahasa Jepun Tahap 2
Bahasa Jerman Tahap 1
Bahasa Jerman Tahap 2
Bahasa Perancis Tahap 1
Bahasa Perancis Tahap 2

BLLW 1442 ENGLISH FOR ACADEMIC PURPOSES / BAHASA INGGERIS UNTUK AKADEMIK

LEARNING OUTCOMES

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

1. Apply correct grammar rules according to context.
2. 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

1. De Chazal, E., & Rogers, L. (2013). Oxford EAP: A course in English for Academic Purposes. Oxford: Oxford University Press.
2. McDonald, A. & Hancock, M. (2010). English result. Oxford: Oxford University Press.
3. Paterson, K. & Wedge, R. (2013). Oxford grammar for EAP. Oxford: Oxford University Press.

BLLW 1172 BAHASA MELAYU KOMUNIKASI / MALAY LANGUAGE FOR COMMUNICATION

LEARNING OUTCOMES

1. Membaca dan menjelaskan maksud ayat serta petikan mudah.
2. Bertutur dalam situasi tertentu dengan menggunakan ayat mudah.
3. Menyusun idea dalam penulisan karangan pendek.

SYNOPSIS

Kursus ini memperkenalkan susuk tatabahasa Bahasa Melayu. Pelajar didedahkan dengan aspek-aspek nahu, klausa, terminologi, binaan ayat, penjodoh bilangan dan unsur sastera. Diharapkan pelajar dapat menguasai pertuturan atau berkomunikasi dengan baik dan mudah berdasarkan kemampuan pelajar asing.

REFERENCES

1. Daftar Ejaan Rumi Bahasa Malaysia. (2006). Kuala Lumpur: Dewan Bahasa dan Pustaka.
2. Daftar Istilah Majlis Bahasa Indonesia-Malaysia. (2005). Kuala Lumpur: Dewan Bahasa dan Pustaka.
3. 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.

BLLW 2152
ACADEMIC WRITING / PENULISAN AKADEMIK

LEARNING OUTCOMES

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

1. Prepare clear and detailed descriptions of a product related to fields of interest.
2. Express arguments systematically in a composition.
3. 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

1. Blass, L & Vargo, M (2018). Pathways: Reading, Writing, and Critical Thinking 3. Mason:Cengage Learning, Inc.
2. Chazal, E.d. & Rogers, L. (2012). Oxford EAP: A course in English for Academic Purposes. New York: Oxford University Press.
3. Paterson, K. & Wedge, R. (2013). Oxford Grammar for EAP. UK: Oxford University Press.

BLLW 3162
ENGLISH FOR PROFESSIONAL INTERACTION / BAHASA INGGERIS UNTUK INTERAKSI PROFESIONAL

LEARNING OUTCOMES

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

1. Listen and infer based on situations in context.
2. Respond to standard spoken language using communication strategies.
3. 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

1. Fry, R. (2016). 101 smart questions to ask on your interview. U.K.: New Page Books.
2. Cooper, S. (2016). 100 tricks to appear smart in meetings: How to get by without even trying. Andrews McMeel Publishing.

3. Hood, J.H. (2013). How to book of meetings: A complete guide for every business. South Australia: Magill.
4. Carmine, G. (2014). Talk like TED: The 9 public-speaking secret of the world's top minds. New York: St Martins Press.
5. Jason, S.W. (2013). Workplace communication for the 21st century: Tools and strategies that impact the bottom line. California: Praeger.

PRE-REQUISITE
BLLW 2152
ACADEMIC WRITING / PENULISAN AKADEMIK

BLHW 1762
FALSAFAH DAN ISU SEMASA / PHILOSOPHY & CURRENT ISSUE

LEARNING OUTCOMES
1. Menjelaskan isu semasa berlandaskan ilmu falsafah, Falsafah Pendidikan Kebangsaan dan Rukunegara.
2. Menerangkan isu semasa berdasarkan aliran pemikiran utama dalam pelbagai aliran falsafah.
3 Menghuraikan isu semasa melalui perspektif perbandingan falsafah sebagai asas bagi menjalinkan dialog antara budaya.

SYNOPSIS
Kursus ini merangkumi hubungan ilmu falsafah dengan Falsafah Pendidikan Kebangsaan dan Rukunegara. Penggunaan falsafah sebagai alat untuk memurnikan budaya pemikiran dalam kehidupan melalui seni dan kaedah berfikir serta konsep insan. Topik utama dalam falsafah iaitu epistemologi, metafizik dan etika dibincangkan dalam konteks isu semasa. Penekanan diberi kepada falsafah sebagai asas bagi menjalin dialog antara budaya serta memupuk nilai sepunya. Di hujung kursus ini, pelajar akan mampu melihat disiplin-disiplin ilmu sebagai satu badan ilmu yang komprehensif dan terkait antara satu sama lain.

REFERENCES
1. Dzulkifli, A. R. & Rosnani, H (2019). Pentafsiran Baharu Falsafah Pendidikan Kebangsaan dan Pelaksanaannya Pasca 2020. Kuala Lumpur : IIUM Press.
2. Rosnani Hashim (2017). Revitalization of Philosophy and Philosophical Inquiry in Muslim Education. Gombak : Kull of Education, IIUM.
3. Al-Attas, S. M. Naquib (1991). The Concept of Education in Islam. Kuala Lumpur: ISTAC.

BLHW 2772
PENGHAYATAN ETIKA DAN PERADABAN / APPRECIATION OF ETHICS AND CIVILISATION

LEARNING OUTCOMES
Pada akhir kursus ini, pelajar akan dapat:
1. Menjelaskan konsep etika daripada perspektif peradaban yang berbeza.
2. Membandingkan sistem, tahap perkembangan, kemajuan sosial dan kebudayaan merentas bangsa.
3. Membincangkan isu kontemporari berkaitan ekonomi, politik, sosial, budaya dan alam sekitar daripada perspektif etika dan peradaban.

SYNOPSIS
Kursus ini menerangkan tentang konsep etika daripada perspektif peradaban yang berbeza. Ia bertujuan bagi mengenal pasti sistem, tahap perkembangan, kemajuan dan kebudayaan sesuatu bangsa dalam mengukuhkan kesepaduan sosial. Selain itu, perbincangan berkaitan isu-isu kontemporari dalam aspek ekonomi, politik, sosial, budaya dan alam sekitar daripada perspektif etika dan peradaban dapat melahirkan pelajar yang bermoral dan profesional. Penerapan amalan pendidikan berimpak tinggi (HIEPs) yang bersesuaian digunakan dalam penyampaian kursus ini. Di hujung kursus ini pelajar akan dapat menghubungkaitkan etika dan kewarganegaraan berminda sivik.

REFERENCES

1. Harari Y. N. (2017). Homo Deus : A Brief History of Tomorrow. Australia : Harper Collins.
2. MacKinnon, B. (2015). Ethics: Theory and Contemporary Issues (8th) ed).Stamford CT : Cengage Learning.
3. Shamsul Amri Baharuddin (2012). Modul Hubungan Etnik. Selangor: Institut Kajian Etnik Universiti Kebangsaan Malaysia.

BLHW 2752
KEBUDAYAAN MALAYSIA / MALAYSIAN CULTURE

LEARNING OUTCOMES

By the end of the course, students should be able to:
1. Analyse the general issues related to Malaysian culture.
2. Report the scenario of cultural diversity in Malaysia.
3. Explain the comparison between Malaysian culture with their home countries in various aspects.

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

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

BLHC 4032
CRITICAL AND CREATIVE THINKING / PEMIKIRAN KRITIS DAN KREATIF

LEARNING OUTCOMES

At the end of the course, students should be able to:
1. Identify basic principles of critical and creative thinking skills
2. Analyse collected and traceable information to make decisions
3. Form a new concept or idea of a solution

SYNOPSIS

This course is designed to give students an introduction to the principles of critical and creative thinking, and problem-solving. Students will be exposed to the roles of the right brain and left brain, mental determination, elements of critical and creative thinking as well as problem solving. This subject is conducted in accordance with the concept of problem-based learning (PBL).

REFERENCES

1. Aziz Yahya, Aida Nasirah Abdullah, Hazmilah Hasan, Raja Roslan Raja Abd Rahman. (2011) Critical and Creative Thinking Module 2. Melaka. Penerbit UTeM.
2. Buzan, T. & Buzan, B. (2006). The Mind Map Book, Essex: BBC Active, Pearson Education.
3. Claxton, G. & Lucas, B. (2007). The Creative Thinking Plan, London: BBC Books.
4. Reichenbach, W. (2000). Introduction to Critical Thinking, McGraw-Hill College.

GENERAL ELECTIVE COURSES (E)

BLHW 1722
PHILOSOPHY OF SCIENCE AND TECHNOLOGY / FALSAFAH SAINS DAN TEKNOLOGI

HASIL PEMBELAJARAN
Pada akhir kursus ini, pelajar akan dapat:
1. Menilai kepentingan konsep ilmu dan isu-isu falsafah sains dan teknologi serta kepentingan isu dan cabaran berkaitan ilmu, falsafah sains dan teknologi.
2. Membina pemahaman tentang ilmu dan isu falsafah sains dan teknologi dalam kehidupan masyarakat masa kini melalui kerja berpasukan.

SINOPSIS
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.

RUJUKAN
1. Azrina Sobian. (2014). Membina Kekuatan Sains Di Malaysia. Kuala Lumpur: Institut Kefahaman Islam Malaysia.
2. Abdul Rahman Abdullah (2010). Wacana Falsafah Sains Sejarah dan Pemikiran. Pulau Pinang: Pusat Kajian Pengurusan Pembangunan Islam USM
3. Azizan Baharuddin & Maisarah Hasbullah (2010). Pendidikan Sejarah dan Falsafah Sains di Institusi Pengajian Tinggi Awam. Kuala Lumpur: Dewan Bahasa dan Pustaka.
4. Ahmad Ridzwan Mohd Noor, Radzuan Nordin, Norliah Kudus, Nor Azilah Ahmad, Mahadi Abu Hassan, Shahrulanuar Mohamed, Ali Hafizar Mohd Rawi & Ismail Ibrahim. (2008). Modul Falsafah Sains dan Teknologi. Cetakan Dalaman Universiti Teknikal Malaysia Melaka.

BLHC 4012
ORGANIZATIONAL COMMUNICATION / KOMUNIKASI ORGANISASI

HASIL PEMBELAJARAN
Pada akhir kursus ini, pelajar akan dapat:
1. Membincangkan prinsip-prinsip asas kemahiran komunikasi organisasi untuk tujuan interaksi dalam organisasi.
2. Memberikan maklum balas mengenai isu-isu yang berkaitan dengan pembangunan kemahiran komunikasi organisasi.
3. Menyelesaikan masalah komunikasi organisasi berdasarkan konteks persekitaran organisasi sebenar.

SINOPSIS
Kursus ini akan mendedahkan pelajar kepada idea-idea asas organisasi dalam komunikasi umum dan organisasi. Selain itu, pelajar juga akan dapat mengetahui teori-teori yang berkaitan dengan komunikasi organisasi dan memahami elemen-elemen penting dalam organisasi seperti kepimpinan, komunikasi rasmi dan komunikasi tidak rasmi. Selain itu, pelajar akan menyedari halangan, penyelesaian masalah dan membuat keputusan kemahiran dalam komunikasi organisasi. Akhirnya, pelajar akan mempunyai pemahaman iklim organisasi, hubungan teknologi dan organisasi dan komunikasi korporat dalam organisasi

RUJUKAN
1. Miller, K. (2012). Organizational Communication. (4rd. ed). Belmont: Thomson Wadsworth Publishing Company.

2. Dennis K. Mumby (2018). Organizational Communication: A Critical Approach. (2nd ed). SAGE Publications, Incorporated

BLHH 1032
INDUSTRIAL PSYCOLOGY AND ORGANIZATION / PSIKOLOGI INDUSTRI DAN ORGANISASI

HASIL PEMBELAJARAN
Pada akhir kursus ini, pelajar akan dapat:
1. Menghubung kait proses persekitaran dan teori di tempat kerja dalam dunia organisasi dan perindustrian.
2. Mempamerkan ciri-ciri kepimpinan dalam aktiviti tugasan kumpulan.
3. Memberi tindak balas terhadap peranan dan tanggungjawab sebagai seorang bakal pekerja di dalam organisasi.

SINOPSIS
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.

RUJUKAN
1. Schultz & Schultz, Duane (2017). Psychology and Work Today. New York: Prentice Hall.
2. Azlina A. B. (2016). Psikologi Industri dan Pengurusan Sumber Manusia. Terengganu: Penerbit Universiti Malaysia Terengganu.
3. Yukl, G. (2010). Leadership in Organization. New York: Prentice Hall.

BLHC 4022
NEGOTIATION SKILLS / KEMAHIRAN PERUNDINGAN

HASIL PEMBELAJARAN
Pada akhir kursus ini, pelajar akan dapat:
1. Mengenalpasti konsep-konsep asas dalam proses perundingan menggunakan amalan komunikasi berkesan.
2. Membuat kesimpulan terhadap teknik-teknik perundingan yang terbaik berdasarkan pendekatan teori yang pelbagai.
3. Menyelesaikan isu-isu perundingan berdasarkan teknik-teknik kemahiran perundingan yang berkesan berasaskan pelbagai situasi.

SINOPSIS
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.

RUJUKAN
1. Lemiwki, R., Barry, B. & Saunders, D. (2016). Essentials of Negotiation. USA: McGraw Hill Education.
2. Covey, S. (2013) The 3rd Alternative: Solving Life's Most Difficult Problems. New York: Free Press
3. Fisher, R & Ury. (2011). Getting to YES: Negotiating Agreement Without Giving In. Third Edition. Penguin Books

BLHW 2782
INDUSTRIAL SOCIOLOGY / SOSIOLOGI INDUSTRI

HASIL PEMBELAJARAN
Pada akhir kursus ini, pelajar akan dapat:
1. Menerangkan proses transformasi sosial masyarakat dan industri negara,
2. Mengenal pasti terhadap peranan dan tanggungjawab dalam pemantapan hubungan industri.
3. Menghubungkait dasar sosial dengan matlamat pembangunan kelestarian (SDGs).

SINOPSIS
Kursus ini membincangkan tentang proses pembangunan sosial dan industri dalam agenda pembangunan di Malaysia. Pelajar akan didedahkan tentang teori dan model berkaitan perindustrian, strategi, dan impak pembangunan kepada ekonomi dan masyarakat. Kursus ini juga menekankan konsep dan amalan dalam hubungan industri, pasaran dan Akta buruh, Kesatuan Sekerja dan Matlamat Pembangunan Kelestarian (SDGs) juga akan dikaji di dalam kursus ini. Kesedaran aspek sosiologi industri ini penting bagi memastikan Malaysia mampu menghadapi cabaran globalisasi, IR 4.0 dan era digital ekonomi untuk mengekalkan kelangsungan dan daya saing negara.

RUJUKAN
1. Aang Ridwan. (2019). Sosiologi Industri. Bandung, Indonesia: Pustaka Setia. INTAN. (1994).
2. Dasar-Dasar Pembangunan Malaysia. Kuala Lumpur: Institut Tadbiran Awam. Md Yunus, Marzudi. (2019).
3. Konsep Sosiologi Kenegaraan. Kuala Lumpur: ITBM Robin, Theobald. (1994).
4. Understanding Industrial Society Sociological. UK: Bloomsbury Publishing. Syed Ibrahim. (2007). Malaysia Kita. Kuala Lumpur: ILBS

BLHW 2792
KURSUS INTEGRITI DAN ANTI RASUAH/ INTEGRITY & ANTI-CORRUPTION

HASIL PEMBELAJARAN
Pada akhir kursus ini, pelajar akan dapat;
1. Menghuraikan nilai integriti dalam kehidupan seharian.
2. Menilai bentuk pelakuan rasuah dan salah guna kuasa dalam kehidupan dan organisasi.
3. Mempamerkan nilai integriti dan pencegahan rasuah melalui aktiviti masyarakat.

SINOPSIS
Kursus Integriti dan Anti Rasuah (KIAR) ini bertujuan memperkenalkan kepada para pelajar mengenai amalan integriti dan pengurusan pencegahan rasuah dalam masyarakat serta organisasi. Penekanan akan diberikan kepada teori dan amalan berkaitan nilai integriti dan pencegahan rasuah, isu, permasalahan dan cabaran pengurusan jenayah rasuah dalam masyarakat dan organisasi. Aktiviti pembelajaran merangkumi latihan dalam kumpulan, simulasi, penulisan dokumen rasmi dan kerja lapangan dalam masyarakat pelbagai sektor (sektor awam, swasta, NGO, politik dan pelajar).

RUJUKAN
1. Mohamad Tarmize (2014). Nota Pencegahan Rasuah. Penerbit Sahagian Pendidikan Masyarakat, Suruhanjaya Pencegahan Rasuah Malaysia.
2. Akta Suruhanjaya Pencegahan Rasuah Malaysia 2009 (2009).
3. Akta Pencegahan Pengubahan Wang Haram, Pencegahan Pembiayaan Keganasan dan Hasil daripada Aktiviti Haram 2001.
4. Akta Perlindungan Pemberi Maklumat 201o Akta Perlindungan Saksi 2009.
5. Institut Integriti Malaysia (2005). Pelan Integriti Nasional.

6. Rahimah Abdul Rahim (2016). Siri Penyelidikan Pengajian Rasuah: Rasuah, Governans & Integriti.
7. Penerbitan Akademi Pencegahan Rasuah Malaysia.
8. Syed Hussein Alatas (2009). Rasuah: Sifat, sebab dan fungsi. Dewan Bahasa dan Pustaka: Kuala Lumpur Zulkarnian Abdul Rahman, Ahmad Kamal Ariffin Mohd Rus & Noor Ain Mat Noor (2017).
9. Sejarah Perjuangan SPRM Satu Perjalanan. Universiti Malaya, Kuala Lumpur. Syed Hussein Al-Atlas. (1983). Sosiologi Korupsi. Singapura: Delta Press
10. Syed Ibrahim. (2007). Malaysia Kita. Kuala Lumpur: Institut Tadbiran Awam Negara (INTAN.

PROGRAMME CORE COURSES (P)

BELU 1013 TECHNICAL MATHEMATICS / MATEMATIK TEKNIKAL

LEARNING OUTCOMES

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

1. Explain the concepts of matrices, trigonometry, complex number and three dimensional vector operations.
2. Use appropriate methods to solve matrices, trigonometry, complex numbers and three-dimensional vector operations.
3. Solve application problems using appropriate techniques.

SYNOPSIS

This course has four components - matrices, trigonometry, complex numbers and three-dimensional vector operations. In matrices, it covers some fundamental concepts such as determinants, inverses of square matrices and techniques for solving systems of linear equations using matrices. In trigonometry, the use of trigonometric identities to solve trigonometric equations and its applications will be emphasized. In complex numbers, it covers some fundamental concepts of imaginary numbers and its representations on the complex plane, as well as the representations of the polar and exponential forms of the complex numbers. Three-dimensional coordinate system and vectors operations will also be introduced. This includes the concepts of the dot and the cross products of vectors.

REFERENCES

1. Adam bin Samsudin, Mohd Fariduddin bin Mukhtar, Siti Haryanti binti Hj Hairol Anuar, Irianto. (2021). Introductory: Technical Mathematics for Engineering Technology (2nd Edition). Penerbit UTeM.
2. Miller, J., Gerken, D., “College Algebra & Trigonometry”, Mcgraw-Hill Education, 2016.
3. Sullivan, M., “Algebra And Trigonometry, Loose-Leaf Edition”, Pearson Education, 11st Edition, 2019.
4. Lial, M., L., Hornsby, J., Schneider, D., I., Daniels, C., ” College Algebra And Trigonometry”, Global Edition, Pearson Education Limited, 2016.
5. Larson, R., “Algebra And Trigonometry With Calchat And Calview”, 10th Edition, Brooks Cole, 2016.

BELU 1023 CALCULUS FOR TECHNOLOGY / KALKULUS UNTUK TEKNOLOGI

LEARNING OUTCOMES

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

1. Use appropriate methods to find the limits and continuity of a function.
2. Use appropriate methods to differentiate and integrate various functions.
3. Solve application problems using appropriate techniques.

SYNOPSIS

This course introduces the differential and integral calculus of a single variable, with applications. The topics covered are limits and continuity of a function, the derivative with all techniques and methods to differentiate, applications of differentiation such as approximation, related rates, maximum and minimum values, as well as optimization problems. Integration covers methods like substitution, integration by parts, integration by partial fraction decomposition and trigonometric substitution. While its applications cover the area of a bounded region or area between curves as well as the volume of a solid of a revolution.

REFERENCES

1. Ezzatul Farhain Azmi, Nurul Amira Zainal, Khairum Hamzah, and Rahaini Mohd Said, (2020) “Elementary Calculus for Technology, Module for Engineering Technology Degree Programmes, Penerbit UTeM.

2. James, S. (2016). Calculus (8th Ed.), Cengage Learning.
3. Joel, H., Maurice, D.W., & Thomas, G.B. (2016). University Calculus: Early Transcendentals (3rd Ed.). Pearson Education.
4. Zill, D.G. & Dewar, J.M. (2016). Essentials of Precalculus with Calculus Previews. Jones and Bartlett Publishers.
5. Larson, R. & Edwards, B. (2014). Calculus (10th Ed.). Boston, MA Brooks.
6. Komzsik, L. (2014). Applied Calculus of Variations for Engineers. Boca raton, FL CRC Press.

BELU 2033
APPPLIED KALKULUS / KALKULUS GUNAAN

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the basic knowledge of vector functions and multivariable functions to solve the related problems.
2. Use appropriate methods to find the solutions of the differential equations.
3. Solve application problems using appropriate techniques.

SYNOPSIS
This course has two parts. The first part introduces the vector-valued functions which include the derivative, integration, arc length and curvature of vector functions, partial derivatives that include limits and continuity, chain rule, and maximum and minimum values, and multiple integrals which include the double and triple integrals of multivariable functions. The second part of the course covers the solutions of ordinary differential equations. The topics include solving the first order differential equations using the separable, exact differentiation, and linear equations methods. While solutions of the second order equations covers the homogeneous and the non-homogeneous equations using the undetermined coefficients methods and variation parameters.

REFERENCES
1. Muhammad Izzat Zakwan bin Muhammad Zabidi, Iskandar Waini, Najiyah Safwa Khashi'ie, Fadzilah Salim. (2019). Advanced Calculus Workbook for Engineering Technology Students. Penerbit UTeM.
2. Stewart, J., Clegg, D. K., & Watson, S. (2020). Calculus: Early Transcendentals. Cengage Learning.
3. Anton, H., Bivens, I. C., & Davis, S. (2016). Calculus: Late Transcendental. John Wiley & Sons.
4. Stewart, J., Clegg, D. K., & Watson, S. (2021). Multivariable Calculus. Cengage Learning.
5. Zill, D. G. (2016). Differential Equations With Boundary-Value Problems. Nelson Education.
6. James, S. (2016). Calculus (8th Ed.). Cengage Learning.

BELU 2043
STATISTICAL METHODS / KAEDAH STATISTIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the knowledge of probability and statistics to solve the related problems.
2. Solve problems in statistical inferences related to hypothesis testing, regression and ANOVA.
3. Execute some real problems using Microsoft Excel data analysis application

SYNOPSIS
This course covers the concept of probability and statistics and their real application problems. Probability topics include all the basic concepts of probability such as events and probability, mutually exclusive events, independent events, multiplication

rule, addition rule, conditional probability, discrete and continuous random variables. The inferential statistics covers topics like sampling, hypothesis testing, correlation, simple linear regression, chi-square independent test and ANOVA. Students will be exposed to statistical data analysis application in Microsoft Excel to solve real application questions.

REFERENCES

1. Nur Aiman Hanis Hasim, Nor Hafizah Hussin, Aminah Ahmad, and Nor Hamizah Miswan (2022), Statistical Methods for Technology, (Work Book) for Engineering Technology Degree Programs. Penerbit UTeM.
2. Paolella, Marc S. (2018), Fundamental Statistical Inference: A Computational Approach, John Wiley & Sons, Incorporated. ISBN: 9781119417880 (EBook).
3. Steyer, Rolf & Nagel, Werner (2017), Probability and Conditional Expectation: Fundamentals for the Empirical Sciences, John Wiley & Sons, Incorporated. ISBN: 9781119243502 (EBook).
4. Hahn, Gerald J., Meeker, William Q., & Escobar, Luis A. (2017), Statistical Intervals: A Guide for Practitioners and Researchers, 2nd ed., John Wiley & Sons, Incorporated. ISBN: 9781118594957. (EBook).
5. Rohatgi, Vijay K. & Saleh, A. K. Ehsanes (2015), An Introduction to Probability and Statistics, 3rd. ed., John Wiley & Sons, Incorporated. ISBN: 9781118799659 (EBook).

BELU 4053
ENGINEERING ETHICS & OSHE / ETIKA KEJURUTERAAN & KKPP

LEARNING OUTCOMES

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

1. Understand special consideration for societal, health, safety, environment, moral, legal and cultural issues towards becoming engineering technologist.
2. Discuss contemporary engineering technology issues and sustainability development.
3. Analyze critically the moral and ethical principles in developing strong commitment of engineering technologist practice and ethical responsibilities.

SYNOPSIS

This subject introduces the student the rules and standards governing the conduct of engineers in their roles as professionals; professional ethics, engineering code of ethics, ethical theories, ethical problems and problem solving techniques, engineers rights and responsibilities and how to do the right things. At the end of the course, the student will be introduced to OSHE acts, risks, safety, accidents and hazards and environmental issues. Contemporary and sustainability issues will also be enlightened.

REFERENCES

1. Harris, C. E., Michael S. Pritchard, and Michael J. Rabins. Engineering Ethics: Concepts and Cases. Belmont, CA: Wadsworth, Cengage Learning, 6th Ed., 2018.
2. Fleddermann, C. B. (2014). Engineering Ethics (4th ed.). Pearson.
3. Technologist and Technicians Act 2014. National Society of Professional Engineers. Code of Ethics for Engineers, 2007.
4. Board of Engineers Malaysia. Circular No. 3/2005. Guidelines for Code of Professional Conduct.
5. Occupational Safety and Health Act, 1994.
6. Environment Quality Act, 1974.
7. Factories and Machinery Act, 1967.

BELK/BELR/BELT PROGRAMMES
CORE COURSES (P)

BELK and BELR Programme Core Courses (P)

BELR 2061
ENGINEERING SEMINAR I /
SEMINAR KEJURUTERAAN I

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Identify the requirement of electrical engineering technology practices through exposure to the industry operation.
2. Apply the main features of groups and team that affect teamwork or team effectiveness in relation to electrical engineering technology field.
3. Explain the professional experiences gain through industrial visit.

SYNOPSIS
In this subject, students will be equipped with several session of engineering seminar given by the industrialists as well as by professional member of engineering bodies. The context of the seminar will be the general engineering issues and career path for engineering technologists.

REFERENCES
None

BELK 3061
ENGINEERING SEMINAR II /
SEMINAR KEJURUTERAAN II

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Identify the route to professional electrical engineering technology practices requirement.
2. Apply the concept of sustainable engineering development practice in electrical engineering technology field.
3. Explain the professional experiences gain through industrial talk.

SYNOPSIS
This subject presents the procedure and process of route to professional engineer. The students will expose to the concepts an idea of renewable energy and also concepts of sustainability development of electrical engineering and its practice. The subject covered the idea of new requirement of manufacturing process and practice in order to expose student the basic knowledge to apply in real working field. There are various issues of sustainable engineering will be covered and discussed.

REFERENCES
None

BELT, Programme Core Courses (P)

BERE 1013
TECHNICAL PHYSICS / FIZIK TEKNIKAL

LEARNING OUTCOMES
Upon completion of this subject, students should be able to:
1. Apply the physics concept systematically in engineering.
2. Display an ability to follow lab procedure in handling physic experiment through lab session.
3. Work individually or in groups effectively to perform assignments/tasks given.

SYNOPSIS
This course will discuss about Mechanics: Physical Quantities and Measurements, Kinematics of Linear Motion, Force, Momentum and Impulse, Work, Energy and Power, Static, Circular Motion, etc. Properties of Matter: Static, Dynamics, Circular Motion, Simple Harmonic, Moment of Inertia, Density and Specific

Gravity, Hydrostatics, Elasticity, Friction, Viscosity, Osmosis, Diffusion, Acceleration and Newton's Second Law of Motion, Motion with a Changing Velocity and Ohm law. Thermodynamics, Wave, Light & Sound. All topics covered are basic knowledge that essential for engineering programs.

REFERENCES

1. Giancolli DC, "Physics for Scientists and Engineers with Modern Physics", 4th Edition, Pearson Prentice Hall, 2009.
2. "Physics for Scientists and Engineers with Modern Physics", 8th Edition, Cengage learning, 2010.
3. Giambatista A., Richardson B.M and Richardson R.C., "College Physics", 2nd Edition, Mc-Graw Hill, 2007.
4. Walker J.S., "Physics", 3rd Edition, Addison Wesley, 2007.

COURSES DETAILS FOR JTK PROGRAMMES

BELK COURSES CORE DETAILS (K)

BELK Course Core Subjects (K)

SEMESTER 1

BELT 1303
MEASUREMENT & INSTRUMENTATION / PENGUKURAN & INSTRUMENTASI

LEARNING OUTCOMES
At the end of the subject, students should be able to:
1. Apply the knowledge of principles, techniques, components and tools in measurement and instrumentation system.
2. Measure and operate the electrical parameter by using analogue and digital instruments.
3. Explain effectively the knowledge about the measurement and instrumentation tools, techniques and standard.

SYNOPSIS
This subject discuss about units and dimensions, standards, errors and calibration in measurement. It covers the measurement devices such as digital meter, analog meter, oscilloscope, function generator and any device related. This subject also covers on instrumentation elements for complete data acquisition system such as sensors & transducers, signal conditioning & processing, A/D and D/A conversion, interfacing standards and data presentation.

REFERENCES
1. Uday A. Bakshi And Ajay V. Bakshi, Electrical & Electronic Measurement, Technical Publication, 2020.
2. Muhammad Sharil Yahya Et. Al, Pengukuran & Instrumentasi, Penerbit UTeM, 2013.
3. M. R. Mohamad Sapiee Et. Al, Instrumentation System Module, Penerbit UTeM, 2019.
4. Alan S. Moris And Reza Langari, Measurement And Instrumentation: Theory And Application, 3rd Edition, Academic Press, 2020.
5. Hs Kalsi, Electronic Instrumentation, 4th Edition, Mcgraw Hill, 2019.
6. Muhammad Sharil Yahya Et. Al, Asas Dan Konsep Pengukuran, Penerbit UTeM, 2012.

BELR 1304
DIGITAL ELECTRONICS & SYSTEMS / ELEKTRONIK & SISTEM DIGITAL

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the knowledge, basic features and configuration of combinational logic and sequential logic circuit in digital system.
2. Construct experiments and project on combinational, sequential, encoder, decoder and memory logic circuit by using simulation software and digital trainer kit.
3. Explain effectively as an individual and group member for conducted assignment and experiment.

SYNOPSIS
This subject discusses about number systems & codes, Boolean algebra, logic families and the characteristic of logic gates, combinational logic, analysis and design, MSI combinational logic circuit, flip-flops, counter and shift-register, synchronous and asynchronous sequential circuit. Analysis and design of adder, decoder, encoder, multiplexer and de-multiplexer. PLD devices such as ROM, PAL, counter and register.

REFERENCES
1. Thomas Floyd, Digital Fundamentals, Global Edition, 11th Edition, Jan 2015, Pearson New International Edition.
2. Aminurrashid Noordin et. al (2014), Digital Electronics & Systems, Penerbit UTeM.

3. Ronald Tocci, Neal Widmer, Greg Moss, Digital Systems Principles and Applications, 12th Edition, Jul 2017, Pearson New International Edition.
4. Thomas Floyd, Digital Electronics a Systems Approach, CourseSmart eTextBook, 2013, Pearson New International Edition.

BELR 1313
COMPUTER AIDED DESIGN / REKABENTUK TERBANTU KOMPUTER

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Use a standard Computer Aided Design command tools for two-dimensional engineering drawing.
2. Produce three-dimensional solid models using standard Computer Aided Design software.
3. Demonstrate an accurate engineering drawing based on given problem.

SYNOPSIS
This course will be presented by means of lecture, tutorials, labs, lab test assignments and quiz fully in the CAD studio, without a final exam. The course concentrates on how to use Computer Aided Design (CAD) software to produce the basic engineering drawing, for example, geometric, orthographic, isometric, section cut and detail drawing. The students will be exposed to CAD interface, CAD coordinate system, basic drawing command tools, display controls, basic editing commands tools, text, dimensioning, isometric and template preparation in order to produce various types of engineering drawing. This course will introduce the implementation of CAD software in the real electrical engineering drawing. Drawing such as electrical layout, electrical fitting and schematic drawing. The 3D Solid Modelling Object Development drawing will also be covered.

REFERENCES
1. Leach. J., “Autocad 2020 Instructor”, Sdc, 2019
2. Tickoo, “Autocad 2020: A Problem-Solving Approach, Basic and Intermediate (22nd Ed.)”, Cadcim Technologies, 2019.
3. George Omura, Brian C. Benton, “Mastering Autocad 2019 and Autocad Lt 2019”, Wiley, 2018.
4. Fane. B., “Autocad For Dummies. (18th Ed.)”, 2019

BELK 1303
ELECTRIC CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply analytical method and theorem to DC and AC (steady state) circuits in electrical circuit.
2. Conduct experiment on DC and AC (steady state) circuit based on electrical circuit theorem.
3. Participate effectively for any assignment and experiment.

SYNOPSIS
This subject introduces the students to Ohm’s Law, Kircchoff’s Laws and use them to calculate current, voltage and power in DC / AC (steady state) circuits. Following this the students will learn the analytical methods namely mesh and nodal analysis. The use of theorems like Thevenin, Norton, Superposition and the Maximum Power Transfer will follow next. The applications of the above tools will cover both dc and ac circuits. This subject will be supported by laboratory works to impart to the students some basic practical skills.

REFERENCES
1. BELK 1303 Electrical Circuit Fundamental Module
2. K.A. Charles, N.O. Sadiku, Fundamentals of Electric Circuits, 7th Ed. Mcgraw Hill, 2020.
3. Robbins and Miller, Circuit Analysis and Practice, 5th Ed., Thomson and Delmar. 2016.

SEMESTER 2

BELK 1323
ELECTRICAL & MAGNETISM / ELEKTRIK & KEMAGNETAN

LEARNING OUTCOMES

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

1. Apply the concept and application of Electrical Field, Coulombs Law, Gauss Law, Lenz Law and Faradays Law in electrical charge phenomena.
2. Demonstrate electrical concepts, basic magnetic quantities and phenomena to simple devices (DC motor and transformer) in electrical engineering technology.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS

This course will begins with an introduction of static electrical charge including the related law such as coulomb's law and gauss, lenz law concept, conductors, dielectrics, and electric boundary conditions. The magnetism fundamental also will be covered in the syllabus, which includes magnetic shell, magnetic flux, emf and faraday's law, magnetic field produced by direct current, solenoid magnetic field and force produce by more than one current carrying conductor.

REFERENCES

1. John W. Jewett, Jr. Raymond A. Serway, (2018), Physics for Scientists and Engineers, 10th Edition, BROOKS/COLE CENGAGE Learning.
2. Matthew N. O. Sadiku (2018) Principles of Electromagnetics, 7th Edition, Oxford University Press.
3. Ulaby, F. (2020) Electromagnetics for Engineers, Pearson Education, 8th Edition.
4. Hayt, W. and Buck, J., (2018) Engineering Electromagnetics, 9th Edition, McGraw Hill International Edition.

BELK 1333
ADVANCED ELECTRICAL CIRCUIT / LITAR ELEKTRIK LANJUTAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Analyze first order and second order electrical circuit in transient and frequency response.
2. Conduct experiment on frequency response and electrical circuit measurement.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS

These subject exposes students to the application of several tools in analyzing electrical circuits, such as the Laplace transform and two ports network. The students are required to use the tools to analyze transient and frequency response in electrical circuit.

REFERENCES

1. Charles, K.A & Sadiku, N.O (2020). Fundamental of Electric Circuit (7th ed.). McGraw-Hill.
2. Nilsson, J. W. & Riedel, S. (2018). Electric Circuit (11th ed.). Prentice Hall.

PRE-REQUISITE

BELK 1303
ELECTRIC CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

BELK 1453
ELECTRONIC PRINCIPLE / PRINSIP ELEKTRONIK

LEARNING OUTCOMES

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

1. Apply knowledge of semiconductor devices in electronic circuit.
2. Perform the experiment of semiconductor devices using simulation software and electronic components in electronic circuit.

3. Work in group effectively while performing group assignment.

SYNOPSIS

This course explains to students about the electronic principles and concepts. It involves the introduction to four semiconductor devices which are diode, bipolar junction transistor (BJT), field effect transistor (FET) and operational amplifier. Besides, students will be also learned about the types, structures, characteristics, configurations and applications of these devices. In terms of practical skills, students will conduct experiments and simulation works related to the application of electronic devices.

REFERENCES

1. Thomas L. Floyd, Electronic Devices, 10th Edition Pearson, 2018.
2. Robert L. Bolysted, Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, Pearson, 2013.
3. John Bird, Electrical and Electronic Principles and Technlogy, 6th Edition, Routledge, 2017.
4. S. Salivahanan, N. Suresh Kumar, Electronic devices and circuits, 5th Edition, McGraw-Hill, 2022.

BELR 1343 COMPUTER PROGRAMMING / PENGATURCARAAN KOMPUTER

LEARNING OUTCOMES

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

1. Produce computer programming code based on principles, structures and techniques in C++.
2. Construct programming language code by applying suitable C++ programming techniques to solve a given problem.
3. Work in group effectively while performing group assignment.

SYNOPSIS

Throughout the course, students will be introduced with basic principles of computers and software development methodology. The course also consists of 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, and pointer are learnt towards the end of this course.

REFERENCES

1. Abdul Kadir, (2016), C++ Programming A Practical Hands-On For Self Learning, 1st Edition, Penerbit Universiti, Universiti Teknikal Malaysia Melaka.
2. Gaddis, T., (2017), Starting Out With C++. From Control Structures Through Objects, 9th Edition, Global Edition, Pearson Education.
3. Daniel Liang, Y, (2014), Introduction To Programming With C++ 3rd Edition, Pearson Education.
4. Deitel, H.D., (2017), C++ How To Program, 11th Edition, Pearson Education.
5. Nell, D., (2022), Programing And Problem Solving With C++: Comprehensive, 7th Edition, Jones & Bartlett Learning

BELK 1311 ELECTRICAL WORKSHOP I / BENGKEL ELEKTRIK I

LEARNING OUTCOMES

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

1. Apply knowledge in single phase electrical installation for domestic-based application.
2. Perform single phase electrical installation for domestic-based application.
3. Conform each workshop activities based on existing acts, regulations & standard.

SYNOPSIS

This subject is required students to carry out practical works in Electrical Workshop in order to gain learning experience in electrical installation works. Students will experience the electrical installation works such as constructing circuits layout drawing, electrical components, testing equipments, domestic wiring circuit, and relay control circuit work as well as instilling the moral and ethical values throughout the practical works. Students are also emphasized on the safety and regulatory requirements. Assessment will be conducted on student ability in the functionality, wiring, testing, safety awareness, discipline while carry out the practical tasks.

REFERENCES

1. Electrical Workshop I Lab Sheet Module
2. Electrical Act 1990 (Act 447) & Regulations (Amendment 2015), Mdc Publisher, 2015.
3. Malaysian Standard International Electrotechnical Commission (Ms Iec) 60364, Sirim, 2015.
4. Garis Panduan Pendawaian Elektrik Bangunan Kediaman, Suruhanjaya Tenaga, 2015.
5. Electricity Supply Application Handbook, Third Edition (Version 3.1) Tenaga Nasional Berhad, August 2019.
6. Caddick, John, Electrical Safety Handbook, Mcgraw Hill, 2012.
7. Brian Scaddan, 18th Edition Wiring Regulations, Newnes, 2020.

SEMESTER 3

BELK 2342
ELECTRICAL WORKSHOP II /
BENGKEL ELEKTRIK II

LEARNING OUTCOMES

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

1. Apply knowledge in three phase electrical installation and motor starter for industrial-based application.
2. Perform three phase electrical installation and motor starter for industrial-based application.
3. Conform each workshop activities based on existing acts, regulations & standard.

SYNOPSIS

This subject is required students to carry out practical works in Electrical Workshop in order to gain learning experience in three phase wiring system and construct motor starter circuit. Students will experience designing & performing electrical installation in industrial wiring & motor starter circuit following by inspection & testing steps. Students are also emphasized on the safety and regulatory requirements. Assessment will be conducted on student ability in the functionality, wiring, testing, safety awareness, discipline while carry out the practical tasks.

REFERENCES

1. Electrical Workshop II Lab Sheet Module
2. Electrical Act 1990 (Act 447) & Regulations (Amendment 2015), Mdc Publisher, 2015.
3. Malaysian Standard International Electrotechnical Commission (MS IEC) 60364, Sirim, 2015.
4. Garis Panduan Pendawaian Elektrik Bangunan Kediaman, Suruhanjaya Tenaga, Cetakan Ketiga 2016.

5. Electricity Supply Application Handbook, Third Edition (Version 3.1) Tenaga Nasional Berhad, August 2019.
6. Caddick, John, Electrical Safety Handbook, Mcgraw Hill, 2012.
7. Brian Scaddan, 18th Edition Wiring Regulations, Newnes, 2018.

PRE-REQUISITE
BELK 1311
ELECTRICAL WORKSHOP I / BENGKEL ELEKTRIK I

BELK 2364
ELECTRICAL TECHNOLOGY / TEKNOLOGI ELEKTRIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:

1. Analyze basic electrical parameters for AC electrical system.
2. Conduct experiment on electrical parameters for AC electrical system.
3. Participate effectively in AC generation project-based activities.

SYNOPSIS
This subject introduces students to topics such as alternating current circuit analysis, phasor representation, RMS value, average power, reactive power, active power, apparent power, power factor and power factor correction. Magnetic circuit, construction and operation of transformer, generation of three phase voltage, balanced and unbalanced three phase load and also voltage, current, power and power factor calculation.

REFERENCES
1. Hughes, Electrical & Electronics Technology, 12th ed., Prentice Hall, Feb 2016.
2. Bird, J.O., Electrical Circuit Theory and Technology, 7th ed., Routledge, 2021.
3. Bird, J.O., Electrical Principles and Technology for Engineering, Elsevier, 2017.
4. Aminurrashid Noordin et. al, Principles of Electric & Electronics (Part 1), Penerbit UTeM, 2013.
5. Asri Din et, al, Principles Of Electric &Electronics (Part 2), Penerbit UTeM, 2013

BELK 2373
ELECTRICAL MACHINES / MESIN ELEKTRIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:

1. Analyze the differences of physical and electrical construction and working principles of DC and AC electrical machines.
2. Conduct experiments to determine electrical and mechanical parameters and the performance of DC and AC electrical machines.
3. Conform to the safety and legal requirements for DC and AC electrical machines operation.

SYNOPSIS
This subject discuss about introduction to dc and ac type of electrical machines which cover physical construction and equivalent electrical circuit diagram. The machine performances like torque, speed and efficiency are investigated. The starting and control techniques are also investigated for a better machine selection of appropriate application.

REFERENCES
1. Electric Machinery Fundamentals, Stephen J. Chapman, 5th Ed., New York, NY: Mcgraw-Hill, 2012.
2. Fitzgerald & Kingsley's Electric Machinery, Stephen D. Umans., 7th Ed., New York, NY: Mcgraw-Hill Companies, 2014.

3. Electric Machines, D.P. Kothari, I.J. Nagrath., 5th Ed., New Delhi: Tata Mcgraw-Hill, 2017.
4. Linear Electric Machines, Drives, And Maglevs Handbook, Ion Boldea, Boca Raton, FL: CRC Press/Taylor & Francis, 2013.

BELR 2383
CONTROL SYSTEM FUNDAMENTAL / PENGENALAN SISTEM KAWALAN

LEARNING OUTCOMES

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

1. Apply appropriate techniques in describing the characteristics of control systems in time domain.
2. Construct experiments to distinguish system performances of open loop and closed loop systems.
3. Report the analysis of transient and steady state performance for first and second order control systems.

SYNOPSIS

This subject will discuss about the concepts in control system; open and closed loop system; transfer function; signal flow graphs; feedback control system; hydraulic and pneumatic process control systems; modelling for electrical system, mechanical system, electromechanical system, speed control system and process control system such as current, temperature and flow; using scicoslab

REFERENCES

1. Norman S. Nise, Control Systems Engineering, 8th Edition, John Wiley & Sons Inc., 2019.
2. Richard C. Dort, Robert H. Bishop, Modern Control Systems, 14th Edition, Pearson, 2021.
3. Syed Najib Syed Salim, Maslan Zainon, Control Systems Engineering, 2nd Edition, Penerbit UTeM, 2016.
4. Gopal, M, Control Systems: Principles and Design, 4th Edition, Mc Graw Hill, 2012.

SEMESTER 4

BELK 2383
POWER SYSTEM TECHNOLOGY / TEKNOLOGI SISTEM KUASA

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Calculate the power system parameters using power system model, per unit (P.U) quantities and protection system requirements.
2. Conduct experiments on power system components using hardware or simulation software.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS

This subject gives the overall components of power system to the students without going into detail. The power system components will be modelled for the analysis purposes. The topics include per-unit quantities, transmission line, transformer, synchronous generator, power flows, symmetrical components, power protection and power system stability.

REFERENCES

1. Glover & Sarma, Power System Analysis And Design, 7th Edition, Cengage Learning, 2022.
2. P.S.R. Murty, Power System Analysis, 2nd Edition, Butterworth-Heinemann, 2017.
3. Md Salam, Fundamental of Electrical Power System Analysis, Springer, 2020.

BELR 2373
EMBEDDED SYSTEMS / SISTEM TERBENAM

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyze the operation of a microcontroller's architecture, peripherals subsystem.
2. Construct hardware and software of microcontroller based system to solve related problem.
3. Demonstrate business practice and entrepreneurship in microcontroller project development.

SYNOPSIS
This course exposes the basic concept of microcontroller and the difference between microcontroller and microprocessor. Start with understanding of microcontrollers architecture, compiler, programming language and software. All the interrupt available including timer/counter are explained in details. Continue to the analog digital converter and pwm signal are exposed to the integration of dc motor, servo motor, and stepper motor. Student will exposed to the application of programming involve with the input and outputs such as switches and 'light emitting diodes', multiple sensor, serial and i2c devices. Students will apply microcontroller with simple mechatronic system.

REFERENCES
1. Jon Hoffman, Mastering Arduino: A Project-Based Approach To Electronics, Circuits, And Programming, Packt Publishing, 2018.
2. Zach Webber, Arduino: The Complete 3 Books In 1 For Beginners, Intermediate And 19 Sample Designs And Codings And Advance Crash Guide In Arduino Programming, 2018.
3. Rancis Perea, Arduino Essentials, Packt Publing, 2015.
4. Syed Omar Faruk Towaha, Learning C For Arduino, Packt, 2017.

BELK 2463
THERMODYNAMIC & HEAT TRANSFER / THERMODINAMIK & PEMINDAHAN HABA

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Analyze a heat transfer principle and process and energy equilibrium processes in thermodynamics for power system application.
2. Solve problems involving heat in mechanical system and properties in thermodynamics for power system application.
3. Practice the knowledge of heat transfer phenomena, thermodynamics laws, and properties professionally and ethically.

SYNOPSIS
This course introduces the basic concepts heat transfer and engineering thermodynamics. Concept of model heat transfer, one dimensional conduction, one dimensional convective heat transfer, heat transfer by natural convection, heat transfer in boiling and condensation, heat exchangers and evaporators will be covered in heat transfer. In Thermodynamics, topics covered include property of pure substances, energy, work, heat, and the 1st and 2nd Law of Thermodynamics.

REFERENCES
1. Cengel, Y.A. and Boles, M.A., 2018, Thermodynamics: An Engineering Approach, 9th Ed., McGraw-Hill Education.
2. Borgnakke, C. and Sonntag, E.E., 2019, Fundamentals of Thermodynamics, 10th Ed., Wiley.
3. Charles. F.,"Heat Transfer Principles and Applications", Academic Press, 2020

BELK 3413
POWER ELECTRONIC / ELEKTRONIK KUASA

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyze the basic topologies of converters and power supplies for device applications in industrial practices.
2. Conduct experiments on the characteristics and performance of rectifiers, converters choppers and inverters.
3. Work in a team to design rectifiers, choppers, switch-mode power supplies (SMPS) and inverters based on converter topologies.

SYNOPSIS
This course is about the basic principles of semiconductor devices, switching process and the application in rectifier circuit, one and three-phase inverter, switching losses, heat sink, the application of semiconductor devices as AC to DC, DC to AC and DC to DC converters, circuits as DC drives, AC drives, snubbers and harmonic effects, and also the introduction to computer simulation (PESIM).

REFERENCES
1. Rashid, Muhammad H., Power Electronics Handbook, 5th Edition, Elsevier, 2022.
2. Ned Mohan, A First Course: Simulations and Laboratory Implementations, 2nd Edition, John Wiley & Sons, 2022.
3. Ioinovici, Adrian, Power electronics and energy conversion systems, John Wiley & Sons, 2013.
4. Fang Lin Luo, Hong Ye. Power electronics: advanced conversion, 2nd edition, CRC Press, 2020.

SEMESTER 5
BELK 3393
ADVANCED POWER SYSTEM / SISTEM KUASA LANJUTAN

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Analyze power flow, faults and transient stability in power system operation and planning.
2. Perform analysis of power flow, faults and transient stability using simulation software.
3. Present technical investigation results among peers.

SYNOPSIS
This course deals with node equations of power system networks, development of bus admittance and bus impedance matrixes, utilization of bus admittance and bus impedance matrixes in power system analysis, i.e. symmetrical fault analysis, asymmetrical fault analysis, load flow study and transient stability analysis. Furthermore, application of power system analysis software is also useful to the students where they are able to model and investigate the impact on electrical power system.

REFERENCES
1. Glover, J.D., Sarma, M.S. & Overbye, T.J. (2022). Power System Analysis and Design, 7th Edition, Cengage Learning.
2. Kothari, D.P. (2022). Modern Power System Analysis, 5th Edition, McGraw Hill Education.
3. Pai, M.A. (2014). Computer Techniques in Power System Analysis, 3rd Edition, McGraw Hill Education.
4. Ramar, S. (2013). Power System Analysis, Phi Learning Private Limited.
5. Saadat, H. (2011). Power System Analysis, 3rd Edition, PSA Publishing LLC.

PRE-REQUISITE
BELK 2383
POWER SYSTEM TECHNOLOGY / TEKNOLOGI SISTEM KUASA

BELR 3413
PLC & APPLICATIONS / PLC & APLIKASI

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Apply knowledge to solve basic industrial automation system problems using a PLC system.
2. Demonstrate PLC system experiments.
3. Communicate effectively for any assignments and experiments.

SYNOPSIS
This subject will expose students with knowledge and skills of PLC including its definition, main hard components, PLC programming languages, interfacing PLC with computers, integrates PLC hardware and software to design a simple automation system.

REFERENCES
1. Petruzella, F.D.(2022), “Programmable Logic Controllers’, 6th ed, McGraw-Hill Education
2. Bolton, W.(2015), “Programmable Logic Controllers”, 6th ed., Newnes
3. Frank, Lamb (2013), Industrial Automation, McGraw-Hill.

BELK 3474
POWER SYSTEM GENERATION & TRANSMISSION / PENJANAAN DAN PENGHANTARAN SISTEM KUASA

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Evaluate various options available for power generation methods and perform analysis on typical issues effecting different types of transmission lines.
2. Perform experiments related to power system generation and transmission.
3. Conform the power generation and transmission practice according to the related codes, regulations and standards.

SYNOPSIS
This course covers two main aspects of power system which are power system generation and power system transmission. The generation part introduces the students to the conventional and distributed generation methods. Meanwhile, the transmission part looks on the parameters involve as well as the steady-state operation. Delivery methods include lectures, tutorials and practical sessions.

REFERENCES
1. Glover, J.D., Sarma, M.S., Overbye, T.J. Power System; Analysis and Design. 7th Edition, Cengage Learning, 2022.
2. Leonard L. G., Electric Power Generation, Transmission and Distribution, 3rd Edition, CRC Press, 2012.

BELK 3423
ACTUATORS & DRIVES / PENGGERAK & PEMACU

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:

1. Analyze the design of electrical and mechanical actuator and drives in motor drives, pneumatic and hydraulic applications.
2. Conduct the experiment on DC and AC motor

drives, pneumatic/hydraulic and electro pneumatic/hydraulic systems.
3. Present assignment given on various actuators and drives for engineering technology application.

SYNOPSIS

This subject will introduce to the electrical, mechanical, pneumatic and hydraulic electrical actuator & drive system. This subject wills discussion on the definition, symbols, system, circuits, operation and component of the pneumatic, hydraulic and mechanical actuator system. Another part of this subject will covers on the electrical drive for DC and AC motor. It focuses on the fundamental of the electrical drive including element, block diagram, feedback, load characteristics and motor sizing. In addition, special discussion on the four quadrants operation with chopper fed dc driver for DC motor drive and three phase drive system.

REFERENCES

1. Ned M., Electric Machine and Drives, Wiley, 2012.
2. Stefanos N. M., Power Electronics and Motor Drive Systems, Elsevier, 2017
3. Ion B. and Syed A. N. Vector Control of AC Drive, Routledgem, 2017
4. Mohamed E., Fundamental of Electrical Drives, 2nd edition, Cengage Learning, 2018
5. Bimal B., Power Electronics and Motor Drive, 2nd edition, Elsevier Academic Press, 2020

BELK 3403
POWER SYSTEM DISTRIBUTION/
PENGAGIHAN SISTEM KUASA

LEARNING OUTCOMES

Upon completing this subject, the student should be able to

1. Design low voltage distribution system based on problem statement or case study given.
2. Perform testing on protection and metering equipment based on low voltage distribution design drawing.
3. Conform to the safety and legal requirements for designing and testing of low voltage distribution system.

SYNOPSIS

This course outlines the principles and design of electrical distribution system. There are various issues of distribution system that is covered; including regulations and standards related to electrical installation. Characteristic and specification for circuit breakers, cable size selection, and method of earthing and earthing arrangement are described in detail. The students are also exposed to the use of standard design procedures and type of testing and troubleshooting required for low voltage system.

REFERENCES

1. Electricity Supply Acts 1990 (Act 447) and Regulations (Amendment 2019), 2019.
2. Malaysian Standard International Electrotechnical Commission (MS IEC) 60364, 2015.
3. Boca Raton, The Electric Power Engineering Handbook, 3rd Ed., CRC Press, 2018.
4. H.L Wilis, R. R. Schrieber, Aging Power Delivery Infrastructures, 2nd Ed., CRC Press, 2017.
5. U.A Bakshi, M.V Bakshi, Transmission & Distribution, 2nd Ed., India Technical Pub., 2018.

SEMESTER 6

BELU 3764
BACHELOR DEGREE PROJECT I /
PROJEK SARJANA MUDA I

LEARNING OUTCOMES

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

1. Evaluate appropriate methodologies for successful execution of the project.
2. Imitate appropriate existing concepts in engineering technology fields.
3. Demonstrate awareness of societal and global issues (societal/health/safety/legal/cultural issues)
4. Justify tools and procedures involved in the planning of the project for sustainable development
5. Explain the project execution and findings in oral and written forms effectively.
6. Relate previous works and relevant theories using various resources.
7. Propose and manage project using appropriate ideas and resources.

SYNOPSIS

The student needs to plan and implement the project individually that related to the respective engineering technology field. The student should implement a project, do the analysis and apply the theory to solve the problems related to topic. At the end, the student should write a problem based learning report that 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.

REFERENCES

1. Manual Projek Sarjana Muda (PSM), Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

BELK 4833
POWER SYSTEM PROTECTION / PERLINDUNGAN SISTEM KUASA

LEARNING OUTCOMES

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

1. Analyse the differences of function, design, and operation of protection schemes of power system operation.
2. Perform experiments to determine grading studies for radial and systems using IDMT overcurrent relays.
3. Conform to the safety and legal requirements for protection systems of power system operation.

SYNOPSIS

The general aim of this course is to enable students to identify and examine the main concept related to the function, design and operation of protection schemes for power transmission, distribution and (to a lesser extent) generation systems. Upon completion of the course, students should be able to understand the reasons why protection systems are required, the basic philosophies of protection, the components involved and how typical protection systems are designed and configured.

REFERENCES

1. Y.G. Paithankar, S.R. Bhide, Fundamental of Power System Protection, PHI Learning Private Limited, 2013.
2. Paul M. A.,Power System Protection, 2nd Edition, Wiley, 2022.
3. C. R. Mason, The Art and Science of Protective Relaying, General Electric, 2015.
4. Network Protection and Automation Guide, 5th edition, Schneider Electric, 2016.

BELK 4823
HIGH VOLTAGE TECHNOLOGY / TEKNOLOGI VOLTAN TINGGI

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Conform the systematic procedure of handling an experiment of HV AC, DC and impulse generation by considering generation terminology, measurement and safety rules
2. Demonstrate the generation of high voltage AC, DC and impulse signal by organizing specific generation set up, measurement and safety
3. Evaluate the conduction and breakdown criteria in gases, solids and liquids for power system operation.
4. Analyse the effect of overvoltage phenomenon in power system apparatus for insulation coordination.
5. Design the layout of insulation system for testing and diagnostic according to standard requirement before operation

SYNOPSIS
High voltage technology course mainly covers the important knowledge and practice of high voltage engineering and technology concerning on electrical insulation and processes that take place in power systems at operating voltages and overvoltage. This course includes studies of gases as insulating media, ionisation processes, townsend current growth equation and the presence of secondary processes, townsend's criterion for breakdown, breakdown in electronegative gases, streamer theory of breakdown in gases, paschen's law, breakdown in non-uniform field and corona discharges, post breakdown phenomena and applications, conduction and breakdown in liquid dielectrics: pure liquids and commercial liquids, conduction and breakdown in pure liquids, breakdown in solid dielectrics: introduction, intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, generation of high voltage and currents: ac, dc and impulse, measurements of high voltages and currents: ac, dc and impulse, non destructive testing of materials and electrical apparatus: measurement of d.c. resistivity, measurement of dielectric constant and loss factor, partial discharge measurements, high voltage testing of electrical apparatus: testing of insulators and bushings, testing of isolators and circuit breakers, cables, testing of transformers and surge diverter radio interference measurements.

REFERENCES
1. M. S. Naidu and V. Kamaraju, High Voltage Engineering, 6th Edition, Mc Graw Hill, India, 2019.
2. M.S. Naidu, V. Kamaraju, High Voltage Engineering, Tata Mcgraw Hill Education (India) Private Limited, 2013.
3. High Voltage Construction Kit, Heafley, 2018.
4. J. Kuffel, P. Kuffel, E. Kuffle, W. Ziomek, High Voltage Engineering Fundamentals, Elsevier, 2016.

BELU 3803
INTEGRATED DESIGN PROJECT / PROJEK REKABENTUK BERSEPADU

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Design solution by synthesizing electrical engineering technology knowledge that will solve broadly defined engineering technology problem in accordance with relevant standards.
2. Utilize modern engineering technology and IT tools in facilitating solutions to broadly defined engineering technology problem with an understanding of the limitations.

3. Evaluate the impact of the design product, component or processes in term of safety, environmental and sustainability factors.
4. Demonstrate effectively teamwork skill in completing the IDP.
5. Apply project management and financial knowledge effectively in completing the IDP.

SYNOPSIS

Integrated Design Project is a course where students have to design an engineering technology project to solve broadly defined problem. Broadly defined problem is engineering problems which cannot be pursued without a coherent and detailed knowledge of defined aspects of a professional discipline with a strong emphasis on the application of developed technology. The design project activities include 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 engineering 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 electrical engineering knowledge.

REFERENCES

1. Dieter, G.E. & Schmidt, L.C., Engineering Design, 5th Edition, Mcgraw Hill, 2013.
2. International Engineering Alliance, Graduates Attributes And Professional Competencies, Version 3, June 2013.
3. Theodore R. Bosela Ph.D. PE, Electrical Systems Design 1st Edition, 2003.
4. Ulrich, K.T. & Eppinger, S.D. Product Design and Development, 5th Edition, Mcgraw Hill, 2011.
5. Keith H. Sueker, Power Electronics Design: A Practitioner's Guide, Newnes, 2011.
6. Mahesh Patil, Pankaj Rodey, Control Systems for Power Electronics: A Practical Guide. Springer, 2015.
7. Ziyad Salameh, Renewable Energy System Design, 2014 Elsevier Inc.

SEMESTER 7

BELU 4774
BACHELOR DEGREE PROJECT II /
PROJEK SARJANA MUDA II

LEARNING OUTCOMES

After completing the course, students will be able to:

1. (Re) construct solutions of broadly-defined engineering problems using relevant tools and techniques.
2. Complete planned project systematically.
3. Demonstrate project results using appropriate techniques with an understanding of it limitations.
4. Explain the project execution and findings in oral and written form effectively.
5. Display self-reliance in achieving the objectives of the project.

SYNOPSIS

This is the second part of the Bachelor Degree Project. Students are expected to continue the project performed in bachelor degree project (BELU 3764) until completion. At the end of the semester, students are required to submit the bachelor degree project report and present their projects for assessment.

REFERENCES

1. Manual Projek Sarjana Muda (PSM), Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

PRE-REQUISITE

BELU 3764
BACHELOR DEGREE PROJECT I / PROJECT SARJANA MUDA I

BELK 4803
POWER SYSTEMS OPERATION & AUTOMATION / OPERASI & AUTOMASI SISTEM KUASA

LEARNING OUTCOMES

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

1. Describe the power system operation criteria and standards appropriately
2. Recommend asset management strategies through Reliability Centred Maintenance (RCM) properly
3. Use the basic application of Supervisory Control and Data Acquisition (SCADA) and its component in Distribution Automation System (DAS)
4. Practice the knowledge of Distribution Automation System (DAS) professionally and ethically.

SYNOPSIS

This subject discuss about operation criteria and standards use in power system. It also covers the load and operation management, asset management strategies, RCM in power system especially in distribution level. This subject also covers the automation in power system which is focus in basic SCADA system, RTU and it components. Describe RTU, SCADA and master station protocol and communication. Explain about Distribution Management System (DMS) and Energy Management System (EMS).

REFERENCES

1. J. Northcote-Green, R. G. Wilson, Control and Automation of Electrical Power Distribution Systems, CRC Press, 2017.
2. B. Raton, The Electric Power Engineering Handbook, 3rd edition., CRC, 2012.
3. H. L. Wilis, R. R. Schrieber, Aging Power Delivery infrastructures, 2nd edition, CRC Press, 2013.
4. U. A. Bbakshi, M. V. Bakshi, Transmission & Distribution, Technical Publications, 2020
5. M. Cepin, Assessment of Power System Reliability: Methods and Applications, Springer, 2014.
6. M. S. Thomas, J. D. Mcdonald, Power System SCADAD and Smart Grids, CRC Press, 2015.
7. E. Padilla, Substation Automation Systems: Design and Implementation, Wiley, 2015.

BELT 3803
SISTEM TENAGA DIPERBAHARUI/ RENEWABLE ENERGY SYSTEM

LEARNING OUTCOMES

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

1. Classify general principles and technology of Renewable Energy Systems for electrical power generation.
2. Perform experiments of Renewable Energy Systems for system performance.
3. Explain effectively as an individual and group member for conducted assignment and experiment.

SYNOPSIS

This subject is an introductory course for renewable energy system. The material encountered in the subject includes: introduction of energy usage, conventional energy sources, renewable energy sources (e.g PV, Wind, Biomass), basic energy storage, renewable energy case study, and engineering recommendations and generator protection requirements.

REFERENCES

1. Leon Freris & David Infield, Renewable Energy in Power System, 2nd edition, Wiley 2020.
2. Godfrey Boyle, Renewable Energy: Power for Sustainable Future, 4th edition, Oxford University Press, 2018.
3. D.P Kothari, K. C. Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, 3rd edition, PHI Learning, 2022.

BELK 4843
POWER SYSTEMS ELECTROMAGNETIC COMPATIBILITY / KESERASIAN ELEKTROMAGNET SISTEM KUASA

LEARNING OUTCOMES

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

1. Analyse the technical requirements of testing, shielding, grounding and bonding of EMC for power systems operation.
2. Perform experiments to determine suitable types of EMC mitigation approach for a different power systems scenario.
3. Conform to the safety and legal requirements for EMC for power systems operation.

SYNOPSIS

The general aim of this course is to enable students to identify and examine the main concepts related to the function and design of EMC mitigation for power transmission, distribution and (to a lesser extent) generation systems. Upon completion of the course, students should be able to understand the reasons why power systems EMC are required, the basic philosophies of EMC phenomena, shielding, grounding and bonding, the components involved and how typical EMC mitigation are designed and configured.

REFERENCES

1. Clayton R. P, Robert C. Scully, Mark S., Electromagnetic Compatibility, 3rd edition, Wiley, 2022.
2. F. Rachidi, M. Rubinstein, M. Paolone, Electromagnetic Time Reversal: Application to EMC and Power Systems, , Wiley, 2016.
3. K. Amstrong, Getting EMC Design Right First Time, Simplyemc, 2016.
4. J. J. Goedbloed, Electromagnetic Compatibility, Prentice Hall, 2016.

BELR 4813
INDUSTRIAL PROCESS CONTROL / KAWALAN PROSES INDUSTRI

LEARNING OUTCOMES

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

1. Analyze the control system characteristics and instrumentations for appropriate controller application in the process control industries.
2. Apply industrial process control elements and instruments for the process variables in the process control industries.
3. Prepare a design of process control plant.

SYNOPSIS

This subject will cover topic on introduction to industrial process control including basic terms and diagrams. It's also emphasized on process variables, elements, and instruments for temperature, level and flow of process control. The right controllers for process control are discussed and control loops in process control are analyzed. Applications of automation technologies such as SCADA and DCS for process control are also explained.

REFERENCES

1. Dale E. Seborg, Process dynamics and control, 4th edition, Hoboken, NJ: John Wiley & Sons, 2016.
2. Myke King, Process control: a practical approach, 2nd edition, Chichester: John Wiley & Sons, 2016.

BELT 4413
ENERGY EFFICENCY / KECEKAPAN TENAGA

LEARNING OUTCOMES

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

1. Analyze the properties of electrical power management for improving energy efficiency in electrical system.
2. Demonstrate the functionality of important electrical parameters for controlling electrical energy efficiency through experiments in laboratory.
3. Create awareness among colleagues regarding the importance of energy sustainability.

SYNOPSIS

This is an introductory course to the concept of energy efficiency, energy management, energy audit, hvac system, available energy saving equipment as well as green and renewable energy systems. At the beginning of the course, students will learn on the importance of energy management which relates to the needs of an electrical energy manager as required by the efficient management of electrical energy regulations 2008 (emeer 2008). Practical wise, students will be exposed to several ways to perform energy audit on buildings through the usage of different equipment once they have grasp the understanding of load apportioning and building efficiency index (bei). Affective wise, students are required to demonstrate their awareness on the subject matters through the assignment which needs to be presented at the end of the course.

REFERENCES

1. Andreas S., angelo B., Electrical Energy Efficiency: Technologies and Applications, Wiley, 2012.
2. Barney L. C., Wayne C. T. William J. K., Guide to Energy Management, 8th edition, Taylor & Francis Group, 2020.
3. Frank K., D. Yogi G., Handbook of Energy Efficiency and Renewable Energy, 2nd edition, Taylor & Francis Group, 2015.
4. Gilbert M. M., Renewable and Efficient Electric Power Systems, Wiley, 2022.

BELK 4853
EKONOMI SISTEM DAN PASARAN ELEKTRIK / ELECTRICITY MARKET AND SYSTEM ECONOMICS

LEARNING OUTCOMES

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

1. Analyse suitable electricity generation and transmission system to be implemented based on economic factors in power systems.
2. Perform experiments on reliability assessment for power generation and power transfer in power systems.
3. Conform to the safety and legal requirements of different electricity industry regulations in power systems.

SYNOPSIS

This course deals with knowledge and practical related experience on electricity market and system economics within power systems. Student will have the opportunity to experience and be assessed on the economics, trading and pricing of electricity supply and how it is shaped by technical, commercial and regulatory considerations. Student will also be assessed on the understanding of system economics under the environment of multiple suppliers and users, deep appreciation of factors affecting security of supply and how it might be quantified and finally how to put engineering knowledge concerning electricity supply into context.

REFERENCES

1. Daniel S. K., Goran S., Fundamental of Power System Economics, 2nd edition, Wiley, 2018.
2. Wenyuan L., Risk Assessment of Power Systems: Models, Methods, and Applications, 2nd Edition, Wiley, 2014.

BELK 4863
POWER QUALITY/ KUALITI KUASA

LEARNING OUTCOMES

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

1. Evaluate different types of power quality and suggest suitable mitigation techniques for different case given.
2. Perform measurement and power quality monitoring by using power quality analyser.
3. Conform the power quality problems according to the related standards.

SYNOPSIS

This course covers all important aspects of power quality. The main topics are introduction to power quality, power quality characteristics, power quality measurement and monitoring tools, related standards, different types of power quality problem, mitigation techniques as well as relevant issues. Delivery methods include lectures, tutorials and practical sessions.

REFERENCES

1. Roger D., Mark M., Surya S., H. Wayne B., Electrical Power Systems Quality, 3rd edition, McGraw Hill, 2012.
2. R. Sastry V., Mulukutla S. S., Power Quality: VAR Compensation in Power Systems, Taylor & Francis Group, 2017.

BELR 4863
ARTIFICIAL INTELLIGENCE / KEPINTARAN BUATAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Determine the artificial intelligent method to solve engineering problem.
2. Demonstrate ability to compose appropriate artificial intelligent toolbox.
3. Work individually or in groups effectively to perform assignments/tasks given.

SYNOPSIS

Artificial Intelligence (AI) Is A Field Of Study Concerns On Allowing Machines To Imitate Human's Thinking Or Behaviour. By Applying Ai Techniques, Machines Would Be Able To Solve Complex Engineering Problems. In This Course Students Will Be Focusing On Two Popular Subtopics In Artificial Intelligence Area Which Are Fuzzy Logic And Neural Network. Students Will Be Exposed Towards The Concept Of Neural Network And/Or Fuzzy Logic And Its Implementation Methods In Control System Using Appropriate Tools Such As Simulink/Matlab.

REFERENCES

1. Kevin Warwick; Artificial Intelligence: The Basics, Taylor & Francis Group, 2011.
2. Elmer P. Dadios; Fuzzy Logic – Controls, Concepts, Theories and Applications, 2012.

3. Rogerson, Jeremy; Designs and Applied Principles of Artificial Neural Networks, Jersey City, 2015.

BELR 4873
MAINTENANCE TECHNOLOGY & ASSET MANAGEMENT / TEKNOLOGI PENYELENGGARAAN & PENGURUSAN ASET

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Distinguish the method and strategy for maintenance and asset management.
2. Reproduce by using computerized maintenance management system in maintenance problem.
3. Present the best practices of maintenance and asset management.

SYNOPSIS

Students will be introduced to the maintenance strategy, calculating the life of each unit machine and instrument. Identifying maintenance workshop and scheduling, maintenance organisation, effective use of maintenance resources, maintenance system, maintenance best practices, engineering economy such as weibull and pareto analysis,cost estimation, asset replacement analysis, risk analysis and control,application of reliability data, accident prevention, fire protection and cost control.

REFERENCES

1. R.C. Mishra, K. Pathak, 2013, Maintenance Engineering And Management, PHI Learning Pvt. Ltd.
2. José Manuel Torres Farinha, Asset Maintenance Engineering Methodologies, CRC Press, 2018.
3. John D. Campbell, Andrew K.S. Jardine, Joel Mcglynn, Asset Management Excellence: Optimizing Equipment Life-Cycle Decisions, Second Edition, CRC Press, 2016.

SEMESTER 8

BELU 48812
INDUSTRIAL TRAINING / LATIHAN INDUSTRI

LEARNING OUTCOME

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

1. Demonstrate technical competencies and skills gained throughout their internship.
2. Prepare a report on the industrial field daily activities in the logbook systematically.
3. Work effectively with staff, colleagues, and other personnel.
4. Practice professional ethics in accordance with industry rules and regulations.
5. Produce industrial training report.
6. Present report orally on working experience.

SYNOPSIS

All students are required to undergo industrial training as part of their curriculum to complete four (4) years course for the Bachelor of Engineering Technology. The duration of training is 24 weeks, and it will be taken place at the end of the course (semester 8). The students are expected to gain knowledge and enhance their technical skills within industrial environment relevant to their field of study.

REFERENCES

1. UTeM Guideline Handbook for Industrial Training.

BELR COURSES CORE DETAILS (K)

BELR Course Core Subjects (K)

SEMESTER 1

BELT 1303
MEASUREMENT & INSTRUMENTATION /
PENGUKURAN & INSTRUMENTASI

LEARNING OUTCOMES

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

1. Apply the knowledge of principles, techniques, components and tools in measurement and instrumentation system.
2. Measure and operate the electrical parameter by using analogue and digital instruments.
3. Explain effectively the knowledge about the measurement and instrumentation tools, techniques and standard.

SYNOPSIS

This subject discusses about units and dimensions, standards, errors and calibration in measurement. It covers the measurement devices such as digital meter, analog meter, oscilloscope, function generator and any device related. This subject also covers on instrumentation elements for complete data acquisition system such as sensors & transducers, signal conditioning & processing, A/D and D/A conversion, interfacing standards and data presentation.

REFERENCES

1. Uday A. Bakshi and Ajay V. Bakshi, Electrical & Electronic Measurement, Technical Publication, 2020.
2. Muhammad Sharil Yahya et. al, Pengukuran & Instrumentasi, Penerbit UTeM, 2013.
3. M. R. Mohamad Sapiee et. al, Instrumentation System Module, Penerbit UTeM, 2019.
4. Alan S. Moris and Reza Langari, Measurement and Instrumentation: Theory and Application, 3rd Edition, Academic Press, 2020.
5. Hs Kalsi, Electronic Instrumentation, 4th Edition, Mcgraw Hill, 2019.
6. Muhammad Sharil Yahya et. al, Asas dan Konsep Pengukuran, Penerbit UTeM, 2012.

BELR 1313
COMPUTER AIDED DESIGN /
REKABENTUK TERBANTU KOMPUTER

LEARNING OUTCOMES

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

1. Apply a standard Computer Aided Design command tools to draw engineering drawing.
2. Produce two and three-dimensional drawing using standard Computer Aided Design software.
3. Demonstrate understanding on the impact of Computer Aided Design technology towards sustainable development.

SYNOPSIS

This course will be presented by means of lecture, tutorials, labs, laboratory project fully in the CAD studio. The course concentrates on how to use Computer Aided Design (CAD) software to produce the basic engineering drawing, for example, geometric, orthographic, isometric, section cut and detail drawing. The students will be exposed to CAD interface, CAD coordinate system, basic drawing command tools, display controls, basic editing commands tools, text, dimensioning, isometric and template preparation in order to produce various types of engineering drawing.Drawing such as electrical layout, electrical fitting and schematic drawing, the 3D solid modelling object development drawing will also be covered.

REFERENCES

1. Leach. J., “Autocad 2020 Instructor”, Sdc, 2019.
2. Tickoo, “Autocad 2020: A Problem-Solving Approach, Basic And Intermediate (22nd Ed.)”,

Cadcim Technologies, 2019.
3. George Omura, Brian C. Benton, “Mastering Autocad 2019 And Autocad Lt 2019”, Wiley, 2018.
4. Fane. B., “Autocad for Dummies. (18th Ed.)”, 2019.

BELR 1304
DIGITAL ELECTRONICS & SYSTEMS / ELEKTRONIK & SISTEM DIGITAL

LEARNING OUTCOMES

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

1. Apply the knowledge basic features and configuration of combinational logic and sequential logic circuit in digital system.
2. Construct experiments and project on combinational, sequential, encoder, decoder and memory logic circuit by using simulation software and digital trainer kit.
3. Explain effectively as an individual and group members for conducted assignment and experiment.

SYNOPSIS

This subject discusses about number systems & codes, boolean algebra, logic families and the characteristic of logic gates, combinational logic, analysis and design, msi combinational logic circuit, flip-flops, counter and shift-register, synchronous and asynchronous sequential circuits, analysis and design of adder, decoder, encoder, multiplexer, demultiplexer, counter and register. Simulations of digital logic systems are also included.

REFERENCES

1. Thomas Floyd, Digital Fundamentals, Global Edition, 11th Edition, Jan 2015, Pearson New International Edition.
2. Aminurrashid Noordin et. al (2014), Digital Electronics & Systems, Penerbit UTeM.
3. Ronald Tocci, Neal Widmer, Greg Moss, Digital Systems Principles and Applications, 12th Edition, Jul 2017, Pearson New International Edition.
4. Thomas Floyd, Digital Electronics a Systems Approach, CourseSmart eTextBook, 2013, Pearson New International Edition.

BELK 1303
ELECTRICAL CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

LEARNING OUTCOMES

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

1. Apply analytical method and theorem to DC and AC (steady state) circuits in electrical circuit.
2. Conduct experiment on DC and AC (steady state) circuit based on electrical circuit theorem.
3. Participate effectively for any assignment and experiment.

SYNOPSIS

This subject introduces the students to Ohm’s Law, Kircchoff’s Laws and use them to calculate current, voltage and power in DC / AC (steady state) circuits. Following this the students will learn the analytical methods namely mesh and nodal analysis. The use of theorems like Thevenin, Norton, Superposition and the Maximum Power Transfer will follow next. The applications of the above tools will cover both dc and ac circuits. This subject will be supported by laboratory works to impart to the students some basic practical skills.

REFERENCES

1. BELK 1303 Electrical Circuit Fundamental Module.
2. K.A. Charles, N.O. Sadiku, Fundamentals of Electric Circuits, 7th ed. Mcgraw Hill, 2020.
3. Robbins and Miller, Circuit Analysis and Practice, 5th ed., Thomson and Delmar. 2016.

SEMESTER 2

BELK 1323
ELECTRICAL & MAGNETISM / ELEKTRIK & KEMAGNETAN

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the concept and application of Electrical Field, Coulombs Law, Lenz Law and Faradays Law in electrical charge phenomena.
2. Conduct experiment on electrical concepts, basic magnetic quantities and phenomena to simple devices (DC motor and transformer) in electrical engineering technology.
3. Present written communication to document work and experiment results.

SYNOPSIS
This course will begin with an introduction of static electrical charge including the related law such as coulomb's law and gauss, Lenz law concept, conductors, dielectrics, and electric boundary conditions. The magnetism fundamental also will be covered in the syllabus, which includes magnetic shell, magnetic flux, EMF and Faraday's Law, magnetic field produced by direct current, solenoid magnetic field and force produce by more than one current carrying conductor.

REFERENCES
1. John W. Jewett, Jr. Raymond A. Serway, (2018), Physics for Scientists and Engineers, 10th Edition, BROOKS/COLE CENGAGE Learning.
2. Matthew N. O. Sadiku (2018) Principles of Electromagnetics, 7th Edition, Oxford University Press.
3. Ulaby, F. (2020) Electromagnetics for Engineers, Pearson Education, 8th Edition.
4. Hayt, W. and Buck, J., (2018) Engineering Electromagnetics, 9th Edition, McGraw Hill International Edition.

BELK 1333
ADVANCED ELECTRICAL CIRCUIT / LITAR ELEKTRIK LANJUTAN

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Analyze first order and second order electrical circuit in transient and frequency response.
2. Conduct experiment on frequency response and electrical circuit measurement.
3. Present oral communications for given assignment.

SYNOPSIS
These subject exposes students to the application of several tools in analyzing electrical circuits, such as the Laplace transform and two ports network. The students are required to use the tools to analyze transient and frequency response in electrical circuit.

REFERENCES
1. Charles, K.A & Sadiku, N.O (2020). Fundamental of Electric Circuit (7th ed.). McGraw-Hill.
3. Nilsson, J. W. & Riedel, S. (2018). Electric Circuit (11th ed.). Prentice Hall.

PRE-REQUISITE
BELK 1303
ELECTRIC CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

BELK 1453
ELECTRONIC PRINCIPLE / PRINSIP ELEKTRONIK

LEARNING OUTCOMES
At the end of the subject, students should be able to:
1. Apply knowledge of semiconductor devices in electronic circuit.
2. Perform the experiment of semiconductor devices using simulation software and electronic components in electronic circuit.

3. Work in group effectively while performing group assignment.

SYNOPSIS

This course explains to students about the electronic principles and concepts. It involves the introduction to four semiconductor devices which are diode, bipolar junction transistor (BJT), field effect transistor (FET) and operational amplifier. Besides, students will be also learned about the types, structures, characteristics, configurations and applications of these devices. In terms of practical skills, students will conduct experiments and simulation works related to the application of electronic devices.

REFERENCES

1. Thomas L. Floyd, Electronic Devices, 10th Edition Pearson, 2018.
2. Robert L. Bolysted, Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, Pearson, 2013.
3. John Bird, Electrical and Electronic Principles and Technlogy, 6th Edition, Routledge, 2017.
4. S. Salivahanan, N. Suresh Kumar, Electronic devices and circuits, 5th Edition, McGraw-Hill, 2022.

BELR 1343
COMPUTER PROGRAMMING / PENGATURCARAAN KOMPUTER

LEARNING OUTCOMES

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

1. Produce computer programming code based on principles, structures and techniques in C++.
2. Construct programming language code by applying suitable C++ programming techniques to solve a given problem.
3. Work in group effectively while performing group assignment.

SYNOPSIS

Throughout the course, students will be introduced to computer architecture and software development. The course consists of basic programming principles such as introduction to c++ programming syntax, variables, data types, operators, selection, repetition, function, array, pointer, structures and file processing.

REFERENCES

1. Abdul Kadir, (2016), C++ Programming A Practical Hands-On For Self Learning, 1st Edition, Penerbit Universiti, Universiti Teknikal Malaysia Melaka.
2. Gaddis, T., (2017), Starting Out With C++. From Control Structures Through Objects, 9th Edition, Global Edition, Pearson Education.
3. Daniel Liang, Y, (2014), Introduction To Programming With C++ 3rd Edition, Pearson Education.
4. Deitel, H.D., (2017), C++ How To Program, 11th Edition, Pearson Education.
5. Nell, D., (2022), Programing And Problem Solving With C++: Comprehensive, 7th Edition, Jones & Bartlett Learning.

BELK 1311
ELECTRICAL WORKSHOP I / BENGKEL ELEKTRIK I

LEARNING OUTCOMES

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

1. Perform single phase electrical installation for domestic-based application

SYNOPSIS

This subject is required students to carry out practical works in electrical workshop in order to gain learning experience in electrical installation works. Students will experience the electrical installation works such as constructing circuits layout drawing, electrical components, testing equipments, domestic wiring circuit, and relay control circuit work as well as instilling the moral and ethical values throughout the practical works. Students are also emphasized on the safety and regulatory requirements. Assessment will be conducted on student ability in the functionality, wiring, testing, safety awareness, discipline while carry out the practical tasks..

REFERENCES

1. Electrical Workshop I Lab Sheet Module
2. Electrical Act 1990 (Act 447) & Regulations (Amendment 2015), Mdc Publisher, 2015.
3. Malaysian Standard International Electrotechnical Commission (Ms Iec) 60364, Sirim, 2015.
4. Garis Panduan Pendawaian Elektrik Bangunan Kediaman, Suruhanjaya Tenaga, 2015.
5. Electricity Supply Application Handbook, Third Edition (Version 3.1) Tenaga Nasional Berhad, August 2019.
6. Caddick, John, Electrical Safety Handbook, Mcgraw Hill, 2012.
7. Brian Scaddan, 18th Edition Wiring Regulations, Newnes, 2020.

SEMESTER 3

BELK 2373
ELECTRICAL MACHINES / MESIN ELEKTRIK

LEARNING OUTCOMES

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

1. Analyze the differences of physical and electrical construction and working principles of DC and AC electrical machines.
2. Perform experiments to determine electrical and mechanical parameters and the performance of DC and AC electrical machines.
3. Conform to the safety and legal requirements for DC and AC electrical machines operation.

SYNOPSIS

This course deals with knowledge and practical related experience on electrical machines. Students will have the opportunity to experience and beassessed on laboratory activities involving determination of electrical and mechanical parameters and also the performance of dc and ac electricalmachines covering both types; generators, motors & transformer. Students will also be emphasized on the safety and regulatory requirementsonelectrical machines. Students will experience and be assessed on the ability to setup specific laboratory connection which will lead towards acompleteelectrical machine training system to be used for laboratory activities.

REFERENCES

1. Electric Machinery Fundamentals, Stephen J. Chapman, 5th Ed., New York, NY: Mcgraw-Hill, 2012.
2. Fitzgerald & Kingsley's Electric Machinery, Stephen D. Umans., 7th Ed., New York, NY: Mcgraw-Hill Companies, 2014.
3. Electric Machines, D.P. Kothari, I.J. Nagrath., 5th Ed., New Delhi: Tata Mcgraw-Hill, 2017.
4. Linear Electric Machines, Drives, And Maglevs Handbook, Ion Boldea, Boca Raton, FL: CRC Press/Taylor & Francis, 2013.

BELK 2364
ELECTRICAL TECHNOLOGY / TEKNOLOGI ELEKTRIK

LEARNING OUTCOMES

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

1. Analyse single-phase, three-phase and magnetic circuit for alternating current (AC).
2. Conduct experiment on single-phase and three-phase for alternating current (AC).
3. Participate effectively to fulfill assignes task with peers.

SYNOPSIS

This subject introduces students to topics such as alternating current circuit analysis, phasor representation, RMS value, average power, reactive power, active power, apparent power power factor and power factor correction. Magnetic circuit, construction and operation of transformer, generation of three phase voltage, balanced and unbalanced three phase load and also voltage, current, power and power factor calculation.

REFERENCES

1. Hughes, Electrical & Electronics Technology, 12th ed., Prentice Hall, Feb 2016.
2. Bird, J.O., Electrical Circuit Theory and Technology, 7th ed., Routledge, 2021.
3. Bird, J.O., Electrical Principles and Technology for Engineering, Elsevier, 2017.
4. Aminurrashid Noordin et. al, Principles of Electric & Electronics (Part 1), Penerbit UTeM, 2013.
5. Asri Din et, al, Principles Of Electric &Electronics (Part 2), Penerbit UTeM, 2013.

BELK 2342 ELECTRICAL WORKSHOP II / BENGKEL ELEKTRIK II

LEARNING OUTCOMES

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

1. Perform three phase electrical installation and motor starter for industrial-based application.

SYNOPSIS

This subject is required students to carry out practical works in Electrical Workshop in order to gain learning experience in three phase wiring system and construct motor starter circuit. Students will experience designing & performing electrical installation in industrial wiring & motor starter circuit following by inspection & testing steps. Students are also emphasized on the safety and regulatory requirements. Assessment will be conducted on student ability in the functionality, wiring, testing, safety awareness, discipline while carry out the practical tasks.

REFERENCES

1. Electrical Workshop II Lab Sheet Module.
2. Electrical Act 1990 (Act 447) & Regulations (Amendment 2015), Mdc Publisher, 2015.
3. Malaysian Standard International Electrotechnical Commission (MS IEC) 60364, Sirim, 2015.
4. Garis Panduan Pendawaian Elektrik Bangunan Kediaman, Suruhanjaya Tenaga, Cetakan Ketiga 2016.
5. Electricity Supply Application Handbook, Third Edition (Version 3.1) Tenaga Nasional Berhad, August 2019.
6. Caddick, John, Electrical Safety Handbook, Mcgraw Hill, 2012.
7. Brian Scaddan, 18th Edition Wiring Regulations, Newnes, 2018.

PRE-REQUISITE

BELK 1311
ELECTRICAL WORKSHOP 1/ BENGKEL ELEKTRIK 1

BELR 2363 STATIC & MECHANICS / STATIK & MEKANIK

LEARNING OUTCOMES

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

1. Explain the concepts and characteristics of static forces and mechanical systems.
2. Construct the statics and mechanics principles of materials through laboratory experiments.
3. Explain effectively either individually or in group for any assignment and experient in term of basic concept of force and material mechanics.

SYNOPSIS

STATICS

Introduction to basic concepts in statics and mechanics as a study of physical sciences, system of units, scalars and vectors, free body diagram, forces system resultant and moment, equilibrium of particle, equilibrium of rigid body, structural analysis, centre of gravity and centroid.

MECHANICS

Introduction to various type of structures, type of supports, concepts and definition of stress, strain, torsion, shear force and bending moment, theory on axial loading, torsion, pure bending and beam deflection, and combination of loads.

REFERENCES

1. Hibbeler R.C., 2021 Engineering Mechanics – Statics, 15th Edition, Pearson.
2. Beer, F. P. And Johnston Jr., E. R. And Eisenberg, E. R., 2018, Vector Mechanics For Engineers - Statics, 12th Edition, Mcgraw Hill, New York.
3. Gere J. M., 2017, Mechanics Of Materials, 9th Edition, Cengage Learning.
4. Hibbeler R. C., 2022, Mechanics Of Materials, Si Edition, Pearson.

SEMESTER 4

BELR 2373
EMBEDDED SYSTEMS / SISTEM TERBENAM

LEARNING OUTCOMES

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

1. Analyze the operation of a microcontroller's architecture, peripherals subsystem.
2. Construct hardware and software of microcontroller based system to solve related problem.
3. Function effectively as a team in micontroller-based project.

SYNOPSIS

This Course Exposes The Basic Concept Of Microcontroller And The Difference Between Microcontroller And Microprocessor. Start With Understanding Of Microcontrollers Architecture, Compiler, Programming Language And Software. All The Interrupt Available Including Timer/Counter Are Explained In Details. Continue To The Analog Digital Converter And Pwm Signal Are Exposed To The Integration Of Dc Motor, Servo Motor, And Stepper Motor. Student Will Exposed To The Application Of Programming Involve With The Input And Outputs Such As Switches And 'Light Emitting Diodes', Multiple Sensor, Serial And I2c Devices. Students Will Apply Microcontroller With Simple Mechatronic System.

REFERENCES

1. Jon Hoffman, Mastering Arduino: A Project-Based Approach To Electronics, Circuits, And Programming, Packt Publishing, 2018.
2. Zach Webber, Arduino: The Complete 3 Books In 1 For Beginners, Intermediate And 19 Sample Designs And Codings And Advance Crash Guide In Arduino Programming, 2018
3. Rancis Perea, Arduino Essentials, Packt Publising, 2015.
4. Syed Omar Faruk Towaha, Learning C For Arduino, Packt, 2017.

BELR 2383
CONTROL SYSTEM FUNDAMENTAL / PENGENALAN SISTEM KAWALAN

LEARNING OUTCOMES

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

1. Apply appropriate techniques in describing the characteristics of control systems in time domain.
2. Construct experiments to distinguish system performances of open loop and closed loop systems.

3. Report the analysis of transient and steady state performance for first and second order control systems.

SYNOPSIS

This subject will discuss about the concepts in control system; open and closed loop system; transfer function; block diagram reduction and signal flow graphs; modeling for electrical system, mechanical system and electromechanical system; transient and steady-state performance for first and second order systems; Routh Hurwitz criteria for stability; steady-state error analysis; speed and position control system analysis using ScicosLab.

REFERENCES

1. Norman S. Nise, Control Systems Engineering, 8th Edition, John Wiley & Sons Inc., 2019.
2. Richard C. Dort, Robert H. Bishop, Modern Control Systems, 14th Edition, Pearson, 2021.
3. Syed Najib Syed Salim, Maslan Zainon, Control Systems Engineering, 2nd Edition, Penerbit UTeM, 2016.
4. Gopal, M, Control Systems: Principles and Design, 4th Edition, Mc Graw Hill, 2012.

BELK 3413
POWER ELECTRONICS / ELEKTRONIK KUASA

LEARNING OUTCOMES

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

1. Analyze the basic topologies of converters and power supplies for device applications in industrial practices.
2. Conduct experiments on the characteristics and performance of rectifiers, converters choppers and inverters.
3. Work in a team to design rectifiers, choppers, switch-mode power supplies (SMPS) and inverters based on converter topologies.

SYNOPSIS

This course is about the basic principles of semiconductor devices, switching process and the application in rectifier circuit, one and three-phase inverter, switching losses, heat sink, the application of semiconductor devices as AC to DC, DC to AC and DC to DC converters, circuits as DC drives, AC drives, snubbers and harmonic effects, and also the introduction to computer simulation (MULTISIM).

REFERENCES

1. Rashid, Muhammad H., Power Electronics Handbook, 5th Edition, Elsevier, 2022.
2. Ned Mohan, A First Course: Simulations and Laboratory Implementations, 2nd Edition, John Wiley & Sons, 2022.
3. Ioinovici, Adrian, Power electronics and energy conversion systems, John Wiley & Sons, 2013.
4. Fang Lin Luo, Hong Ye. Power electronics: advanced conversion, 2nd edition, CRC Press, 2020.

BMKC 2323
FLUID MECHANICS / MEKANIK BENDALIR

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Apply fluid mechanics concept in solving fluid statics and fluid dynamics problem.
2. Measure related parameter by using appropriate techniques in fluid mechanics application.
3. Function effectively either as a member or leader in group for any assignment or experiment.

SYNOPSIS

Introduction to this subject is about the basic physical properties of fluid. Then it covers the definition of pressure and head. Next it followed by derivation of hydrostatic equation and its application in pressure measurement, static forces analysis on immersed surface and buoyancy analysis. For fluid dynamics, it started with introduction to fluid dynamics and fluid flow analysis. Then it is continued by 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. The last topic for this subject is dimensional analysis and its application.

REFERENCES

1. Cengel, Y. A. And Cimbala, J. M., 2019, Fluid Mechanics: Fundamentals And Applications, 4th Edition, Mcgraw-Hill, India.
2. Munson, B. R., Rothmayer, A. P., Okiishi, T. H. And Huebsch, W. W., 2021, Fundamentals Of Fluid Mechanics, 9th Edition., John Wiley & Sons, Inc, Asia.
3. Cengel, Y. A. And Cimbala, J. M., 2019, Fluid Mechanics: Fundamentals And Applications, 4th Edition, Mcgraw-Hill, India.
4. Kundu, P. K., Cohen, I. M. And Dowling, D. R., 2015, Fluid Mechanics, 6th Edition, Academic Press, Waltham, USA.

SEMESTER 5

BELR 3463
PLC & AUTOMATION / PLC & AUTOMASI

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Apply knowledge to solve basic industrial automation system problems using a PLC system.
2. Demonstrate PLC system experiments.
3. Communicate effectively for any assignments and experiments.

SYNOPSIS

This subject will expose students with knowledge and skills of PLC including its definition, main hard components, PLC programming languages, interfacing PLC with computers, integrates PLC hardware and software to design a simple automation system. Besides, the introduction of production, automation, HMI, SCADA systems and total predictive maintenance are also covered.

REFERENCES

1. Petruzella, F.D.(2022), “Programmable Logic Controllers’, 6th ed, McGraw-Hill Education.
2. Groover, M.P.(2019), “Automation, Production Systems, and Computer Integrated Manufacturing”, 5th ed, Pearson.
3. Bolton, W.(2015), “Programmable Logic Controllers”, 6th ed., Newnes.
4. Frank, Lamb (2013), Industrial Automation, McGraw-Hill.
5. Macaulay, Tyson (2012), “Cybersecurity for Industrial Control Systems:Scada, DCS, PLC, HMI and SIS”, CRC Press.

BELK 2383
POWER SYSTEM TECHNOLOGY / TEKNOLOGI SISTEM KUASA

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Calculate the power system parameters using power system model, per unit (P.U) quantities and protection system requirements.
2. Conduct experiments on power system components using hardware or simulation software.
3. Present written and oral communication to document work and experiment results.

SYNOPSIS

This subject gives the overall components of power system to the students without going into detail. The power system components will be modelled for the analysis purposes. The topics include per-unit quantities, transmission line, transformer, synchronous generator, power flows, symmetrical components, power protection and power system stability.

REFERENCES

1. Glover & Sarma, Power System Analysis And Design, 7th Edition, Cengage Learning, 2022.
2. P.S.R. Murty, Power System Analysis, 2nd Edition, Butterworth-Heinemann, 2017.
3. Md Salam, Fundamental of Electrical Power System Analysis, Springer, 2020.

BELR 3393
CONTROL SYSTEM ENGINEERING / KEJURUTERAAN SISTEM KAWALAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Design the compensators in time domain and frequency domain of control feedback systems using root locus and bode plot techniques
2. Construct experiments using controller designed to achieve desired system performance in time domain and frequency domain.
3. Explain the role of designed controllers by comparing the uncompesated and compensated systems in fulfilling desired specification.

SYNOPSIS

This subject will discuss about the control systems engineering; analysis in time and frequency domain responses; stability in time and frequency domain; design in time domain (root locus) and frequency domain (Bode plot).

REFERENCES

1. Syed Najib Syed Salim, Maslan Zainon, Control Systems Engineering, 2nd Edition, Penerbit UTeM, 2016.
2. Norman S. Nise (2019), Control Systems Engineering, 8th Edition, John Wiley & Sons Inc.
3. Richard C. Dort (2021), Robert H. Bishop, Modern Control Systems, 14th Edition, Pearson.
4. Gopal, M (2012), Control Systems: Principles and Design, 4th Edition, Mc Graw Hill.

PRE-REQUISITE

BELR 2383
CONTROL SYSTEM FUNDAMENTAL /
PENGENALAN SISTEM KAWALAN

BELR 3463
INDUSTRIAL DATA COMMUNICATION / DATA KOMUNIKASI INDUSTRI

LEARNING OUTCOMES

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

1. Apply the principle of a local area network, link layer, data transmission techniques and protocols.
2. Design, configure and troubleshoot network operation of LAN and WAN through experiments.
3. Demonstrate a good practice standard in conducted assignment and experiments.

SYNOPSIS

Topics covered are: Introduction to Computer Network, Data Communications, Network Structure, Local Area Network, Wide Area Network, Interconnection, and Internetworking.

REFERENCES

1. Lawrence M. Thompson, Industrial Data Communications, 5th Edition, Isa, 2015.
2. Behrouz A. Forouzan, Data Communication and Networking, 5th Ed, McGraw Hill, 2013.
3. Douglas E.Corner, Computer Networks and Internets:with Internet Applications, 6th edition, Prentice Hall, 2014.

BELR 3453
MOTION CONTROL SYSTEM/ SISTEM KAWALAN PENGGERAK

LEARNING OUTCOMES

Upon completing this subject, the students should be able to:

1. Analyse the principle of motion control systems including components and system structure.
2. Apply software and hardware packages to set, measure, analyze and program basic motion control parameters as well as simulate and build basic motion control systems
3. Demonstrate hands-on experience of motion control systems.

SYNOPSIS

This subject introduces students to basic principles of motion control which include components and system structure, mechanisms (gearbox, pulley, lead screw and rack/pinion), sensors and encoders (potentiometer, incremental encoder, resolver) and the basic principles of servo motor and stepper motor. Students will be involved in the application of software and hardware packages to set, measure, analyze and program basic motion control parameters as well as simulate and build basic motion control systems. Students are also required to diagnose and resolve equipment problems by utilizing technical assessment skills that include planning, reliability, logical thinking, and ability to use drawings, schematics and documentation.

REFERENCES

1. Terry L.M. Bartelt, Industrial Automated Systems: Instrumentation and Motion Control, Cengage Learning, 2011.

SEMESTER 6

BELU 3764
BACHELOR DEGREE PROJECT I / PROJEK SARJANA MUDA I

LEARNING OUTCOMES

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

1. Evaluate appropriate methodologies for successful execution of the project.
2. Imitate appropriate existing concepts in engineering technology fields.
3. Demonstrate awareness of societal and global issues (societal/health/safety/legal/cultural issues)
4. Justify tools and procedures involved in the planning of the project for sustainable development
5. Explain the project execution and findings in oral and written forms effectively.
6. Relate previous works and relevant theories using various resources.
7. Propose and manage project using appropriate ideas and resources.

SYNOPSIS

The student needs to plan and implement the project individually that related to the respective engineering technology field. The student should implement a project, do the analysis and apply the theory to solve the problems related to topic. At the end, the student should write a problem based learning report that 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.

REFERENCES

1. Manual Projek Sarjana Muda (PSM), Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

BELR 3443
PNEUMATIC & HYDRAULIC / PNEUMATIK & HIDRAULIK

LEARNING OUTCOMES
Upon completing this subject, the students should be able to:
1. Apply the knowledge of basic application circuits of pneumatics/hydraulics and electro-pneumatics/electro-hydraulics systems commonly used in manufacturing industries.
2. Demonstrate the basic application circuits of pneumatics/hydraulics and electro-pneumatics/electro-hydraulics systems commonly used in manufacturing industries.
3. Function effectively as a team in laboratory works and in developing an electro-pneumatics system project.

SYNOPSIS
This Subject Introduces Students To The Fundamentals Physical Principles Of Fluid Power, Which Consists Of Hydraulic And Pneumatic Systems. This Course Is Taught By Practical Applications Approach (Theory And Practice) In The Laboratory Session. Lab Equipment Is Provided That Allows Students To Design, Install, And Test Most Of The Circuits Discussed In Class. Lab Project/Mini Project/Project Oriented Problem-Based Learning Is Incorporated In This Subject.

REFERENCES
1. Esposito A. (2014), "Fluid Power with Applications", 7th Edition, Pearson New International Edition, 2014.
2. Pany M. & Sabine S. (2012), "Pneumatic Basic Level", FESTO.

BELR 3433
INDUSTRIAL ROBOTICS / ROBOTIC INDUSTRI

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Evaluate the forward, inverse & dynamic kinematic equation in robotic configuration in industrial robotics.
2. Construct specific robotic programming & simulation for actual robots used in industrial automation system.
3. Arrange the appropriate robotic technologies considering the impact to industrial environment.

SYNOPSIS
Introduction to robotics, classification of robots, basic components of robot systems, basic concepts of kinematics and dynamics, mechanical structure of robot systems, robot drives and motion control system using stepper motor, servo motor, servo amplifier and pneumatics, sensory devices such as position, force and torque, tactile, basic robot programming, robot simulations and industrial robot applications. Experiments will include application of MATLAB, simple robot development and robot programming and simulation using a real industrial robot.

REFERENCES
1. Craig,J.J, Introduction to Robotic Mechanics and Control, 4th ed, Addison Wesley Longman, 2017
2. Bajd, Tadej, Introduction To Robotics, Springer, 2013.
3. Shah, Suril Vijaykumar, Dynamics of Tree-Type Robotic Systems, Springer, 2013.
4. S Niku, Saeed B, Introduction to Robotics Analysis, System, Applications, 3rd Edition, Prentice Hall, 2019.

BELU 3803
INTEGRATED DESIGN PROJECT / PROJEK REKABENTUK BERSEPADU

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Design solution by synthesizing electrical engineering technology knowledge that will solve broadly defined engineering technology problem in accordance with relevant standards.
2. Utilize modern engineering technology and IT tools in facilitating solutions to broadly defined engineering technology problem with an understanding of the limitations.
3. Evaluate the impact of the design product, component or processes in term of safety, environmental and sustainability factors.
4. Demonstrate effectively teamwork skill in completing the IDP.
5. Apply project management and financial knowledge effectively in completing the IDP.

SYNOPSIS
Integrated Design Project is a course where students have to design an engineering technology project to solve broadly defined problem. Broadly defined problem is engineering problems which cannot be pursued without a coherent and detailed knowledge of defined aspects of a professional discipline with a strong emphasis on the application of developed technology. The design project activities include 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 engineering 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 electrical engineering knowledge.

REFERENCES
1. Dieter, G.E. & Schmidt, L.C., Engineering Design, 5th Edition, Mcgraw Hill, 2013.
2. International Engineering Alliance, Graduates Attributes and Professional Competencies, Version 3, June 2013.
3. Theodore R. Bosela Ph.D. PE, Electrical Systems Design 1st Edition, 2003.
4. Ulrich, K.T. & Eppinger, S.D. Product Design and Development, 5th Edition, Mcgraw Hill, 2011.
5. Keith H. Sueker, Power Electronics Design: A Practitioner's Guide, Newnes, 2011.
6. Mahesh Patil, Pankaj Rodey, Control Systems for Power Electronics: A Practical Guide. Springer, 2015.
7. Ziyad Salameh, Renewable Energy System Design, 2014 Elsevier Inc.

SEMESTER 7

BELU 4774
BACHELOR DEGREE PROJECT II / PROJEK SARJANA MUDA II

LEARNING OUTCOMES

1. (Re) construct solutions of broadly-defined engineering problems using relevant tools and techniques.
2. Complete planned project systematically.
3. Demonstrate project results using appropriate techniques with an understanding of it limitations.
4. Explain the project execution and findings in oral and written form effectively.
5. Display self-reliance in achieving the objectives of the project.

SYNOPSIS

This is the second part of the bachelor degree project. Students are expected to continue the project performed in bachelor degree project (BELU 3764) until completion. At the end of the semester, students are required to submit the bachelor degree project report and present their projects for assessment.

REFERENCES

1. Manual Projek Sarjana Muda (PSM), Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

PRE-REQUISITE

BELU 3764
BACHELOR DEGREE PROJECT I / PROJECT SARJANA MUDA I

BELR 4803
FLEXIBLE MANUFACTURING SYSTEM / SISTEM PEMBUATAN TERANJAL

LEARNING OUTCOMES

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

1. Analyze the manufacturing operations, manufacturing metrics and economics for discrete manufacturing systems as well as the quantitative analysis for Flexible Manufacturing Cells (FMC) and Flexible Manufacturing Systems (FMS).
2. Demonstrate the operations of an advanced manufacturing system's operation and an HMI/SCADA system commonly used in industry.
3. Function effectively as a team in laboratory works and in developing an HMI/SCADA system project.

SYNOPSIS

Introduction to industrial field topics such as production system, manufacturing system, manufacturing operation, production concept and mathematical models as well as manufacturing operation costs besides FMS, CIM, SCADA, HMI, CAD/CAM and TPM systems with the complete descriptions and relevant analysis where those systems are integrated in building modern automated systems in manufacturing industries.

REFERENCES

1. Groover, M. P. (2019), "Automation, Production Systems, and Computer-Integrated Manufacturing", 5th Ed., Prentice Hall.
2. Groover, M. P. (2019), "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", 7th Ed., John Wiley & Sons Inc.

3. Kalpakjian, S. & Schmid, S. R. (2019), "Manufacturing, Engineering, and Technology", 8th Ed., Pearson.
4. Dima I. C. (2013), "Industrial Production Management in Flexible Manufacturing Systems", 1st Ed., IGI Global.

BELR 4813 INDUSTRIAL PROCESS CONTROL / KAWALAN PROSES INDUSTRI

LEARNING OUTCOMES

Upon completing this subject, the student should be able to

1. Analyse the control system characteristics and instrumentations for appropriate controller application in the process control industries.
2. Apply industrial process control elements and instruments for the process variables in the process control industries.
3. Prepare a design of process control plant.

SYNOPSIS

This subject will cover topic on introduction to industrial process control including basic terms and diagrams. It's also emphasized on process variables, elements, and instruments for temperature, level and flow of process control. The right controllers for process control are discussed and control loops in process control are analyzed. Applications of automation technologies such as SCADA and DCS for process control are also explained.

REFERENCES

1. Dale E. Seborg, Process dynamics and control, 4th edition, Hoboken, NJ: John Wiley & Sons, 2016.
2. Myke King, Process control: a practical approach, 2nd edition, Chichester: John Wiley & Sons, 2016.

BELR 4823 MACHINE VISION / PENGLIHATAN MESIN

LEARNING OUTCOMES

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

1. Identify the application areas, restrictions, structure of machine vision system and digital image processing.
2. Implement algorithms using image processing tools and apply the basic machine learning approaches to decision making for machine vision system.
3. Organise effectively in a team for a machine vision project related to industrial automation application.

SYNOPSIS

The aim of this course is to introduce the theory, applications and techniques of machine vision to students, and to provide students with an understanding of the problems involved in the development of machine vision systems. The course begins with low level processing and works its way up to the beginnings of image interpretation. This approach is taken because image understanding originates from a common database of information. The learner will be required to apply their understating of the concepts involved through the process of building applications that manipulate bi-level and greyscale images through the use of suitable packages (e.g. Matlab or OpenCV).

REFERENCES

1. Davis, E. R. (2012), Computer & Machine Vision: Theory, Algorithm, Practicalities, 4th Edition, Academic Press.
2. Bruce, G., (2012), Machine Vision Handbook, London Springer.
3. Sonka, M., (2015), Image Processing, Analysis, and Machine Vision, 4th edition, Cengage Learning.

4. Cipolla, R., (2013), Machine Learning for Computer Vision, Heidelberg Springer.
5. Lesley, M., (2015), Machine Vision and its Applications, Jersey City.
6. Corke, P., (2017), Robotics, Vision and Control: Fundamental Algorithms in Matlab, 2nd Edition, Springer.
7. Fisher, R.B., (2014), Dictionary of Computer Vision and Image Processing, 2nd editon, John Wiley & Sons.

BELR 4833
DISTRIBUTED CONTROL SYSTEM / SISTEM KAWALAN TERAGIH

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyze Distributed Control System (DCS) by knowledge of architechture (software and hardware), communication and engineering drawing.
2. Completes the experiment on DCS hardware and doftware using Distributed Control System (DCS).
3. Explain effectively either individually or in group for subjects's assignment and experiment.

SYNOPSIS
This subject introduces students to distributed control system (DCS). DCS is a technology that provide an automated control to a plant. Student will be exposed to the architecture of dcs, control scheme, configuration, communication protocol and engineering drawing. This subject will be supported by laboratory works to polish students' skill in dcs system.

REFERENCES
1. ABB DCS 800xa Manual.
2. Thomas E. Marlin, Process Control, 2nd Edition, 2015.
3. Dr. Moustafa Elshafei, Modern Distributed Control Systems, 2016.
4. B. R. Mehta, Reddy Y. J, Applying Foundation Fieldbus, 2016.

BELR 4843
MANUFACTURING SYSTEM / SISTEM PEMBUATAN

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyze the manufacturing operations, manufacturing metrics and economics for discrete manufacturing systems.
2. Demonstrate the operations of an advanced manufacturing system's operation and an HMI/SCADA system commonly used in industry.
3. Function effectively as a team in laboratory works and in an HMI/SCADA system task.

SYNOPSIS
Introduction to industrial field topics such as production systems, manufacturing systems, manufacturing operations, manufacturing metrics and economics as well as manufacturing support systems besides FMS, CIM, CNC, HMI, SCADA, QC, CAD/CAM and TPM systems with the complete descriptions and relevant analysis where those systems are integrated in building modern automated systems in manufacturing industries.

REFERENCES
1. Groover, M. P. (2019), "Automation, Production Systems, and Computer-Integrated Manufacturing", 5th Ed., Prentice Hall.
2. Groover, M. P. (2019), "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", 7th Ed., John Wiley & Sons Inc.
3. Kalpakjian, S. & Schmid, S. R. (2019), "Manufacturing, Engineering, and Technology", 8th Ed., Pearson.

4. Rich, N. & Malik, F. T. (2020), "International Standards For Design And Manufacturing: Quality Management And International Best Practice", 1st Ed., Kogan Page Limited.

BELR 4853 ADVANCED CONTROL SYSTEM / SISTEM KAWALAN LANJUTAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to

1. Assess concepts, principals and theories relating to advanced control system.
2. Demonstrate the advanced control systems & strategies in simulation using Labview, Matlab and Simulink.
3. Work effectively either individually or in a group to solve control system problems.

SYNOPSIS

This elective course introduces the fundamental concepts, principles and application of advanced control system techniques and analysis. The course material shall include three general topics. Chapter 1 covers state-space representations, controllability & observability, state variable feedback design and state observer. Sampling & Z transform, stability in Z plane and digital compensator design are included in chapter 2. While chapter 3 comprises artificial intelligence in engineering i.e. Fuzzy Logic System and Neural Network.

REFERENCES

1. Dorf & Bishop; Modern Control System 14th Edition, Pearson, 2021.
2. Elmer P. Dadios; Fuzzy Logic – Controls, Concepts, Theories and Applications, 2012.
3. Robert H. Bishop; Modern Control Systems with LabView, National Technology & Science Press, 2012.
4. Norman S. Nise, Control Systems Engineering, 8th Edition, John Wiley & Sons Inc, 2019.

BELR 4863 ARTIFICIAL INTELLIGENCE / KEPINTARAN BUATAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Determine the artificial intelligent method to solve engineering problem.
2. Demonstrate ability to compose appropriate artificial intelligent toolbox.
3. Work individually or in groups effectively to perform assignments/tasks given.

SYNOPSIS

Artificial Intelligence (AI) Is A Field Of Study Concerns On Allowing Machines To Imitate Human's Thinking Or Behaviour. By Applying Ai Techniques, Machines Would Be Able To Solve Complex Engineering Problems. In This Course Students Will Be Focusing On Two Popular Subtopics In Artificial Intelligence Area Which Are Fuzzy Logic And Neural Network. Students Will Be Exposed Towards The Concept Of Neural Network And/Or Fuzzy Logic And Its Implementation Methods In Control System Using Appropriate Tools Such As Simulink/Matlab.

REFERENCES

1. Kevin Warwick; Artificial Intelligence: The Basics, Taylor & Francis Group, 2011.
2. Elmer P. Dadios; Fuzzy Logic – Controls, Concepts, Theories And Applications, 2012
3. Rogerson, Jeremy; Designs And Applied Principles Of Artificial Neural Networks, Jersey City, 2015.

BELR 4873
MAINTENANCE TECHNOLOGY & ASSET MANAGEMENT / TEKNOLOGI PENYELENGGARAAN & PENGURUSAN ASET

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Distinguish the method and strategy for maintenance and asset management.
2. Reproduce by using computerized maintenance management system in maintenance problem.
3. Present the best practices of maintenance and asset management.

SYNOPSIS

Students will be introduced to the maintenance strategy, calculating the life of each unit machine and instrument. Identifying maintenance workshop and scheduling, maintenance organisation, effective use of maintenance resources, maintenance system, maintenance best practices, engineering economy such as weibull and pareto analysis,cost estimation, asset replacement analysis, risk analysis and control,application of reliability data, accident prevention, fire protection and cost control.

REFERENCES

1. R.C. Mishra, K. Pathak, 2013, Maintenance Engineering And Management, PHI Learning Pvt. Ltd.
2. José Manuel Torres Farinha, Asset Maintenance Engineering Methodologies, CRC Press, 2018
3. John D. Campbell, Andrew K.S. Jardine, Joel Mcglynn, Asset Management Excellence: Optimizing Equipment Life-Cycle Decisions, Second Edition, CRC Press, 2016

SEMESTER 8

BELU 48812
INDUSTRIAL TRAINING / LATIHAN INDUSTRI

LEARNING OUTCOME

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

1. Demonstrate technical competencies and skills gained throughout their internship
2. Prepare a report on the industrial field daily activities in the logbook systematically
3. Work effectively with staff, colleagues, and other personnel
4. Practice professional ethics in accordance with industry rules and regulations
5. Produce industrial training report
6. Present report orally on working experience

SYNOPSIS

All students are required to undergo industrial training as part of their curriculum to complete four (4) years course for the Bachelor of Engineering Technology. The duration of training is 24 weeks, and it will be taken place at the end of the course (semester 8). The students are expected to gain knowledge and enhance their technical skills within industrial environment relevant to their field of study

REFERENCES

1. UTeM Guideline Handbook for Industrial Training.

BELT COURSES CORE DETAILS (K)

BELT Course Core Subjects (K)

SEMESTER 1

BELT1303
MEASUREMENT & INSTRUMENTATION SYSTEM / PENGUKURAN & SISTEM INSTRUMENTASI

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the knowledge of principles, techniques, components and tools in measurement and instrumentation system.
2. Measure electrical parameter by using analogue and digital instruments.
3. Explain effectively the knowledge about the measurement and instrumentation tools, techniques and standard.

SYNOPSIS
This subject discusses about units and dimensions, standards, errors and calibration in measurement. It covers the measurement devices such as digital meter, analog meter, oscilloscope, function generator and any device related. This subject also covers on instrumentation elements for complete data acquisition system such as sensors & transducers, signal conditioning & processing, A/D and D/A conversion, interfacing standards and data presentation.

REFERENCES
1. Uday A. Bakshi and Ajay V. Bakshi, Electrical & Electronic Measurement, Technical Publication, 2020.
2. Muhammad Sharil Yahya et. al, Pengukuran & Instrumentasi, Penerbit UTeM, 2013.
3. M. R. Mohamad Sapiee et. al, Instrumentation System Module, Penerbit UTeM, 2019.
4. Alan S. Moris and Reza Langari, Measurement and Instrumentation: Theory and Application, 3rd Edition, Academic Press, 2020.
5. Hs Kalsi, Electronic Instrumentation, 4th Edition, Mcgraw Hill, 2019.
6. Muhammad Sharil Yahya et. al, Asas dan Konsep Pengukuran, Penerbit UTeM, 2012.

BELR 1313
COMPUTER AIDED DESIGN / REKABENTUK TERBANTU KOMPUTER

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Use a standard Computer Aided Design software command tools for basic two-dimensional drafting and produce geometric, orthographic, isometric, section cut and detail drawing.
2. Construct detailed two-dimensional engineering drawings and basic three-dimensional solid modelling models using standard Computer Aided Design software.
3. Demonstrate an accurate engineering drawing based on given problem.

SYNOPSIS
This course will be presented by means of lecture, tutorials, labs, lab test assignments and quiz fully in the CAD studio, without a final exam. The course concentrates on how to use Computer Aided Design (CAD) software to produce the basic engineering drawing, for example, geometric, orthographic, isometric, section cut and detail drawing. The students will be exposed to CAD interface, CAD coordinate system, basic drawing command tools, display controls, basic editing commands tools, text, dimensioning, isometric and template preparation

in order to produce various types of engineering drawing. However, this course will focus on the electrical engineering drawing type. The 3D Solid Modelling Object Development drawing will also be covered.

REFERENCES

1. Leach. J., "Autocad 2020 Instructor", Sdc, 2019.
2. Tickoo, "Autocad 2020: A Problem-Solving Approach, Basic And Intermediate (22nd Ed.)", Cadcim Technologies, 2019.
3. George Omura, Brian C. Benton, "Mastering Autocad 2019 And Autocad Lt 2019", Wiley, 2018.
4. Fane. B., "Autocad For Dummies. (18th Ed.)", 2019.

BELK 1303
ELECTRICAL CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

LEARNING OUTCOMES

Upon completion of this subject, student should be able to:
1. Apply analytical method and theorem to DC and AC (steady state) circuits in electrical circuit.
2. Conduct experiment on DC and AC (steady state) circuit based on electrical circuit theorem.
3. Participate effectively for any assignment and experiment.

SYNOPSIS

This subject introduces the students to Ohm's Law, Kirchhoff's Laws and use them to calculate current, voltage and power in DC / AC (steady state) circuits. Following this the students will learn the analytical methods namely mesh and nodal analysis. The use of theorems like Thevenin, Norton, Superposition and the Maximum Power Transfer will follow next. The applications of the above tools will cover both dc and ac circuits. This subject will be supported by laboratory works to impart to the students some basic practical skills.

REFERENCES

1. BELK 1303 Electrical Circuit Fundamental Module
2. K.A. Charles, N.O. Sadiku, Fundamentals of Electric Circuits, 7th Ed. Mcgraw Hill, 2020.
3. Robbins and Miller, Circuit Analysis and Practice, 5th Ed., Thomson and Delmar. 2016

SEMESTER 2

BELT 1323
DIGITAL ELECTRONICS & SYSTEM / ELEKTRONIK & SISTEM DIGITAL

LEARNING OUTCOMES

Upon completion of this subject, student should be able to:
1. Apply the knowledge, basic features and configuration of combinational logic and sequential logic circuit.
2. Construct digital system experiments and assignment.
3. Explain effectively either individually or in group for any assignment and experiment.

SYNOPSIS

This subject discusses about number systems & codes, Boolean algebra, logic families and the characteristic of logic gates, combinational logic, analysis and design, MSI combinational logic circuit, flip-flops, counter and shift- register, synchronous and asynchronous sequential circuits, analysis and design of adder, decoder, encoder, multiplexer, demultiplexer, counter and register. Simulations of digital logic systems are also included.

REFERENCES

1. Thomas Floyd, Digital Fundamentals, Global Edition, 11th Edition, Jan 2015, Pearson New International Edition.

2. Aminurrashid Noordin et. al (2014), Digital Electronics & Systems, Penerbit UTeM.
3. Ronald Tocci, Neal Widmer, Greg Moss, Digital Systems Principles and Applications, 12th Edition, Jul 2017, Pearson New International Edition.
4. Thomas Floyd, Digital Electronics a Systems Approach, CourseSmart eTextBook, 2013, Pearson New International Edition.

BELK 1323
ELECTRICS & MAGNETISM / ELEKTRIK & KEMAGNETAN

LEARNING OUTCOMES

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

1. Explain the concept and application of Electrical Field, Coulombs Law, Lenz Law and Faradays Law in electrical charge phenomena.
2. Demonstrate electrical concepts, basic magnetic quantities and phenomena to simple devices (DC motor and transformer) in electrical engineering technology.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS

This course will begin with an introduction of static electrical charge including the related law such as coulomb's law and gauss, Lenz law concept, conductors, dielectrics, and electric boundary conditions. The magnetism fundamental also will be covered in the syllabus, which includes magnetic shell, magnetic flux, EMF and Faraday's Law, magnetic field produced by direct current, solenoid magnetic field and force produce by more than one current carrying conductor.

REFERENCES

1. John W. Jewett, Jr. Raymond A. Serway, (2018), Physics for Scientists and Engineers, 10th Edition, BROOKS/COLE CENGAGE Learning.
2. Matthew N. O. Sadiku (2018) Principles of Electromagnetics, 7th Edition, Oxford University Press.
3. Ulaby, F. (2020) Electromagnetics for Engineers, Pearson Education, 8th Edition.
4. Hayt, W. and Buck, J., (2018) Engineering Electromagnetics, 9th Edition, McGraw Hill International Edition.

BELK 1333
ADVANCED ELECTRICAL CIRCUIT / LITAR ELEKTRIK LANJUTAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Analyze first order and second order electrical circuit in transient and frequency response.
2. Conduct experiment on frequency response and electrical circuit measurement.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS

These subject exposes students to the application of several tools in analyzing electrical circuits, such as the Laplace transform and two ports network. The students are required to use the tools to analyze transient and frequency response in electrical circuit.

REFERENCES

1. Charles, K.A & Sadiku, N.O (2020). Fundamental of Electric Circuit (7th ed.). McGraw-Hill.
2. Nilsson, J. W. & Riedel, S. (2018). Electric Circuit (11th ed.). Prentice Hall.

PRE-REQUISITE
BELK 1303
ELECTRICAL CIRCUIT FUNDAMENTAL / PENGENALAN LITAR ELEKTRIK

BELT 1313
ELECTRONICS WORKSHOP / BENGKEL ELEKTRONIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the knowledge of basic electronic components, circuit simulation, PCB fabrication, soldering, troubleshooting and test verification of an electronic circuitry design.
2. Measure an electrical parameter in troubleshooting and test verification using appropriate tools and equipment.
3. Explain effectively the knowledge about the Health and Safety Regulation.

SYNOPSIS
This subject aims to enable the student to acquire competency in the safe use of electronics laboratory test equipment and to acquire competency in construction and testing electronic assemblies. The practical element of the electronic production is considered to be of great importance. Student gains valuable experience in physical component identification and the use of supplier catalogues in the component identification and ordering procedure. The skills of PCB fabrication, circuit design and simulation, circuit assembly and soldering, debugging and troubleshooting are developed in this subject.

REFERENCES
1. Thomas L. Floyd, Electronic Devices, 10th edition, Pearson Education, 2018.
2. Hughes, John M., Practical Electronics: Components and Techniques, O'Reilly Media, 2015.
3. Occupational safety and health (classification, labelling and safety datasheet of hazardous chemicals) regulations 2013, Department of Occupational safety and health Malaysia.
4. Brian Jepson, Tyle Moskowite, Gregody Hayes, Learn to Solder: Tools and Technique for Assembling Electronics, Make Community, 2012.

SEMESTER 3

BELR 133
COMPUTER PROGRAMMING / PENGATURCARAAN KOMPUTER

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Produce computer programming code based on principles, structures and techniques in C++.
2. Construct programming language code by applying suitable C++ programming techniques to solve a given problem.
3. Work in group effectively while performing group assignment.

SYNOPSIS
Throughout the course, students will be introduced with basic principles of computers and software development methodology. The course also consists of 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, and pointer are learnt towards the end of this course.

REFERENCES
1. Abdul Kadir, (2016), C++ Programming A Practical Hands-On For Self Learning, 1st Edition, Penerbit Universiti, Universiti Teknikal Malaysia Melaka.

2. Gaddis, T., (2017), Starting Out With C++. From Control Structures Through Objects, 9th Edition, Global Edition, Pearson Education.
3. Daniel Liang, Y, (2014), Introduction To Programming With C++ 3rd Edition, Pearson Education.
4. Deitel, H.D., (2017), C++ How To Program, 11th Edition, Pearson Education.
5. Nell, D., (2022), Programing And Problem Solving With C++: Comprehensive, 7th Edition, Jones & Bartlett Learning

REFERENCES

1. Thomas L. Floyd, Electronic Devices, 10th Edition Pearson, 2018.
2. Robert L. Bolysted, Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, Pearson, 2013.
3. S. Salivahanan, N. Suresh Kumar, Electronic devices and circuits, 5th Edition, McGraw-Hill, 2022.
4. Atul P. Godse, Uday A. Bakshi, Electronic devices & circuits, Technical Publication Pune, 2020.

BELT 2343
ELECTRONIC DEVICES / PERANTI ELEKTRONIK

LEARNING OUTCOMES

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

1. Apply knowledge of semiconductor devices in electronic circuit.
2. Perform the experiment of semiconductor devices using simulation software and electronic components in electronic circuit.
3. Explain effectively either individually or in group for any assignment and experiment

SYNOPSIS

This subject introduces students to semiconductor devices. There are four semiconductor devices involve which are diode, bipolar junction transistor (BJT), field effect transistor (FET) and operational amplifier. Students will learn the types of these four devices, structure characteristic, configuration and application. In term of circuit analysis, student will learn how to calculate current and voltage in a circuit contain these semiconductor devices and draw output voltage waveform for diode application circuit. This subject will be supported by laboratory works and assignment to impart the students some basic practical skills.

BELT 2333
ELECTRICAL INSTALLATION I / PEMASANGAN ELEKTRIK I

LEARNING OUTCOMES

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

1. Design single phase electrical installation based on domestic application.
2. Perform single phase electrical installation based on domestic application.
3. Conform to single phase electrical installation based on existing acts, regulations and standards.

SYNOPSIS

This course outlines the principles, design and application of single phase electrical installation system. The course covers various matters of single phase electrical installation system such as electrical requirements by i.e Public Works Department, consultants and electrical utility companies. This would also involve relevant acts, regulations, standards and safety to be complied with the existing legal requirement by the Energy Commission of Malaysia and electrical utility companies. Students will carry out their learning activities on single phase electrical installation involving planning (sizing of circuit breakers and cables), application designing (electrical drawing, single line diagram, commissioning (cable installation) and troubleshooting.

REFERENCES

1. Electrical Workshop I Lab Sheet Module
2. Electrical Act 1990 (Act 447) & Regulations (Amendment 2015), Mdc Publisher, 2015.
3. Malaysian Standard International Electrotechnical Commission (Ms Iec) 60364, Sirim, 2015.
4. Garis Panduan Pendawaian Elektrik Bangunan Kediaman, Suruhanjaya Tenaga, 2015.
5. Electricity Supply Application Handbook, Third Edition (Version 3.1) Tenaga Nasional Berhad, August 2019.
6. Caddick, John, Electrical Safety Handbook, Mcgraw Hill, 2012.
7. Brian Scaddan, 18th Edition Wiring Regulations, Newnes, 2020.

BELT 2361 ELECTRICAL ENGINEERING TECHNOLOGY CAREER / KERJAYA TEKNOLOGI KEJURUTERAAN ELEKTRIK

LEARNING OUTCOMES

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

1. Identify the requirement of electrical engineering technology practices in terms of engineering ethics, economy, finance and law and route to professional engineering technologist.
2. Apply the main features of groups and team that affect teamwork or team effectiveness in relation to electrical engineering technology field.
3. Explain the professional experiences gain through industrial talk and industrial visit.

SYNOPSIS

In this subject, students will be equipped with several session of engineering seminar given by the industrialists as well as by professional member of engineering bodies. The context of the seminar will be the general engineering issues and career path for engineering technologists.

BELT 2353 ELECTRICAL TECHNOLOGY / TEKNOLOGI ELEKTRIK

LEARNING OUTCOMES

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

1. Analyze single-phase, three-phase and magnetic circuit for alternating current (AC).
2. Conduct experiment on single-phase and three-phase system for alternating current (AC).
3. Participate effectively to fulfil experimentation task with peers.

SYNOPSIS

This subject introduces students to topics such as alternating current circuit analysis, phasor representation, RMS value, average power, reactive power, active power, apparent power, power factor and power factor correction. Furthermore, this subject also includes the topics of magnetic circuit, construction and operation of transformer, generation of three phase voltage, balanced and unbalanced three phase load and also voltage, current, power and power factor calculation.

REFERENCES

1. Hughes, Electrical & Electronics Technology, 12th ed., Prentice Hall, Feb 2016.
2. Bird, J.O., Electrical Circuit Theory and Technology, 7th ed., Routledge, 2021.
3. Bird, J.O., Electrical Principles and Technology for Engineering, Elsevier, 2017.
4. Aminurrashid Noordin et. al, Principles of Electric & Electronics (Part 1), Penerbit UTeM, 2013.
5. Asri Din et, al, Principles Of Electric &Electronics (Part 2), Penerbit UTeM, 2013.

SEMESTER 4

BELR 2353
ANALOG ELECTRONICS / ELEKTRONIK ANALOG

LEARNING OUTCOMES

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

1. Analyze the operation of analog electronic circuit based on the component characteristics.
2. Conduct experiment on analog electrical circuit by using measurement equipment and simulation software.
3. Explain effectively in group for assignment.

SYNOPSIS

This course is about the basic principle of analog electronic circuits mostly performing the concepts of amplification. The course subjects contain the concepts of amplifier, BJT as one of devices usually used in amplifiers, small signal amplifier, power amplifiers (class A and class AB), oscillator, active filters and voltage regulators (shunt and series).

REFERENCES

1. Bolysted, R., Nashelsky, L., Electronic Devices and Circuit Theory, 11th Edition, Prentice Hall, 2012.
2. Thomas L. Floyd, Electronic Devices, 10th Edition Pearson, 2018.
3. Giovanni Saggio, Principles of Analog Electronics, CRC Press, 2014
4. Atul P. Godse, Uday A. Bakshi, Electronic circuits, Technical Publications, 2020.

BELR 2373
EMBEDDED SYSTEM / SISTEM TERBENAM

LEARNING OUTCOMES

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

1. Analyze the operation of a microcontroller's architecture, peripherals subsystem.
2. Construct hardware and software of microcontroller based system to solve related problem.
3. Demonstrate business practice and entrepreneurship in microcontroller project development.

SYNOPSIS

This course exposes students to the basic concept of microcontroller and microprocessor. It starts with understanding microcontrollers architecture, compiler, programming language and software. All the interrupt available including timers and counters are explained in details. Then, it continues with the analog digital converter and PWM signal. Students are exposed to the integration of DC motor, servo motor, stepper motor and to the application of programming including the input and output such as switches and 'Light Emitting Diodes', multiple sensors, serial and i2c devices. Students will apply microcontroller to simple mechatronic system.

REFERENCES

1. Jon Hoffman, Mastering Arduino: A Project-Based Approach To Electronics, Circuits, And Programming, Packt Publishing, 2018.
2. Zach Webber, Arduino: The Complete 3 Books In 1 For Beginners, Intermediate And 19 Sample Designs And Codings And Advance Crash Guide In Arduino Programming, 2018
3. Rancis Perea, Arduino Essentials, Packt Publising, 2015.
4. Syed Omar Faruk Towaha, Learning C For Arduino, Packt, 2017.

BELR 2383
CONTROL SYSTEM FUNDAMENTAL / PENGENALAN SISTEM KAWALAN

LEARNING OUTCOMES

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

1. Apply appropriate techniques in describing the characteristics of control systems in time domain.
2. Construct experiments to distinguish system performances of open loop and closed loop systems.
3. Report the analysis of transient and steady state performance for first and second order control systems.

SYNOPSIS

This subject will discuss about the concepts in control system; open and closed loop system; transfer function; block diagram reduction and signal flow graphs; modeling for electrical system, mechanical system and electromechanical system; transient and steady-state performance for first and second order systems; Routh Hurwitz criteria for stability; steady-state error analysis; speed and position control system analysis using ScicosLab.

REFERENCES

1. Norman S. Nise, Control Systems Engineering, 8th Edition, John Wiley & Sons Inc., 2019.
2. Richard C. Dort, Robert H. Bishop, Modern Control Systems, 14th Edition, Pearson, 2021.
3. Syed Najib Syed Salim, Maslan Zainon, Control Systems Engineering, 2nd Edition, Penerbit UTeM, 2016.
4. Gopal, M, Control Systems: Principles and Design, 4th Edition, Mc Graw Hill, 2012.

BELT 2373
ELECTRICAL INSTALLATION II / PEMASANGAN ELEKTRIK II

LEARNING OUTCOMES

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

1. Design three phase electrical installation and motor starter circuit based on industrial application.
2. Perform three phase electrical installation and motor starter circuit based on industrial application.
3. Conform to three phase electrical installation and motor starter circuit based on existing acts, regulations and standards.

SYNOPSIS

This course outlines the principles, design and application of three phase electrical installation system and electrical motor control. The course covers various matters of three phase electrical installation system such electrical requirements by
i.e Public Works Department, consultants and electrical utility companies. This would also involve relevant acts, regulations, standards and safety to be complied with the existing legal requirement by the Energy Commission of Malaysia and electrical utility companies. Students will carry out their learning activities on three phase electrical installation and motor control involving planning (sizing of circuit breakers and cables), application designing (electrical drawing, single line diagram, main circuit and control circuit), commissioning (cable installation) and troubleshooting.

REFERENCES

1. Electrical Workshop II Lab Sheet Module
2. Electrical Act 1990 (Act 447) & Regulations (Amendment 2015), Mdc Publisher, 2015.

3. Malaysian Standard International Electrotechnical Commission (MS IEC) 60364, Sirim, 2015.
4. Garis Panduan Pendawaian Elektrik Bangunan Kediaman, Suruhanjaya Tenaga, Cetakan Ketiga 2016.
5. Electricity Supply Application Handbook, Third Edition (Version 3.1) Tenaga Nasional Berhad, August 2019.
6. Caddick, John, Electrical Safety Handbook, Mcgraw Hill, 2012.
7. Brian Scaddan, 18th Edition Wiring Regulations, Newnes, 2018.

SEMESTER 5

BELK 2383
POWER SYSTEM TECHNOLOGY / TEKNOLOGI SISTEM KUASA

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Calculate the power system parameters using power system model, per unit (P.U) quantities and protection system requirements.
2. Conduct experiments on power system components using hardware or simulation software.
3. Present written and oral communications to document work and experiment results.

SYNOPSIS
This subject gives the overall information on components of power system to the students. The power system components will be modelled for analysis purposes. The topics covered are including per-unit quantities, transmission lines, transformer, synchronous generator, power flows, symmetrical components, power protection and power system stability.

REFERENCES
1. Glover & Sarma, Power System Analysis And Design, 7th Edition, Cengage Learning, 2022.
2. P.S.R. Murty, Power System Analysis, 2nd Edition, Butterworth-Heinemann, 2017.
3. Md Salam, Fundamental of Electrical Power System Analysis, Springer, 2020.

BELT 3404
INDUSTRIAL AUTOMATION / AUTOMASI INDUSTRI

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply knowledge of production, automation and Programmable logic controller systems to solve basic industrial automation system problems.
2. Demonstrate competencies in programmable logic controller system experiments and basic industrial automation system applications.
3. Function effectively as a member or a leader in group experiments and assignments.

SYNOPSIS
This subject is intended to expose students with knowledge and skills of basic industrial automation systems consist of automation in production systems, basic elements of an automated system, types and levels of automation, industrial control systems, hardware components for automation and process control, a PLC system, PLC programming languages, PLC interfacing, a basic HMI/SCADA system, and integration of a basic PLC-HMI/SCADA system with hardware components as well as to design and develop a basic industrial automation system.

REFERENCES
1. Groover, M.P.(2019), “Automation, Production Systems, and Computer Integrated Manufacturing”, 5th ed, Pearson.

2. Manesis, S. & Nikolakopoulos, G. (2018), "Introduction to Industrial Automation", CRC press.
3. Petruzella, F.D. (2022), "Programmable Logic Controllers', 6th ed, McGraw-Hill Education.
4. Bolton, W. (2015), "Programmable Logic Controllers", 6th ed., Newnes.
5. Frank, Lamb (2013), Industrial Automation, McGraw-Hill.
6. Macaulay, Tyson (2012), "Cybersecurity for Industrial Control Systems:Scada, DCS, PLC, HMI and SIS", CRC Press.

BELK 2373
ELECTRICAL MACHINES / MESIN ELEKTRIK

LEARNING OUTCOMES

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

1. Analyze the differences of physical and electrical construction and working principles of DC and AC electrical machines.
2. Perform experiments to determine electrical and mechanical parameters and the performance of DC and AC electrical machines.
3. Conform to the safety and legal requirements for DC and AC electrical machines operation.

SYNOPSIS

This course deals with knowledge and practical related experience on electrical machines. Students will have the opportunity to experience and be assessed on laboratory activities involving determination of electrical and mechanical parameters and also the performance of DC and AC electrical machines covering both types; generators and motors. Students will also be emphasized on the safety and regulatory requirements on electrical machines. On top of that, students will also experience and be assessed on the ability to setup specific laboratory connection which will lead towards a complete electrical machine training system to be used for laboratory activities.

REFERENCES

5. Electric Machinery Fundamentals, Stephen J. Chapman, 5th Ed., New York, NY: Mcgraw-Hill, 2012.
6. Fitzgerald & Kingsley's Electric Machinery, Stephen D. Umans., 7th Ed., New York, NY: Mcgraw-Hill Companies, 2014.
7. Electric Machines, D.P. Kothari, I.J. Nagrath., 5th Ed., New Delhi: Tata Mcgraw-Hill, 2017.
8. Linear Electric Machines, Drives, And Maglevs Handbook, Ion Boldea, Boca Raton, FL: CRC Press/Taylor & Francis, 2013.

BELT 3383
POWER ELECTRONICS DEVICES / PERANTI ELEKTRONIK KUASA

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Analyze the characteristics power electronic devices and performance of uncontrolled rectifier, DC-DC converter and single-phase inverter.
2. Design an uncontrolled rectifier, DC-DC converter and single-phase inverter for various engineering application.
3. Report the analysis on basic power electronics circuitry.

SYNOPSIS

This course covers the basic principles of power electronics devices such as MOSFET, IGBT and thyristor, and its application in uncontrolled rectifier circuit, DC to DC converter and single-phase inverter. It covers aspects such as switching methods, analysis on switching losses, heat dissipation, snubbers and harmonic effects. Students are also introduced to the design aspect of various converter and inverter through computer simulation (PSIM, MATLAB or Pspice) as well as lab practical.

REFERENCES
1. Rashid, Muhammad H., Power Electronics Handbook, 5th Edition, Elsevier, 2022.
2. Ned Mohan, A First Course: Simulations and Laboratory Implementations, 2nd Edition, John Wiley & Sons, 2022.
3. Ioinovici, Adrian, Power electronics and energy conversion systems, John Wiley & Sons, 2013.
4. Fang Lin Luo, Hong Ye. Power electronics: advanced conversion, 2nd edition, CRC Press, 2020.

BELT 3803
SISTEM TENAGA DIPERBAHARUI / RENEWABLE ENERGY SYSTEM

LEARNING OUTCOMES

Upon completion of this subject, student should be able to:
1. Classify general principles and technology of Renewable Energy Systems for electrical power generation.
2. Perform experiments of Renewable Energy Systems for system performance.
3. Explain effectively as an individual and group member for conducted assignment and experiment.

SYNOPSIS

This subject is an introductory course for renewable energy system. The material encountered in the subject includes: introduction of energy usage, conventional energy sources, renewable energy sources (e.g PV, Wind, Biomass), basic energy storage, renewable energy case study, and engineering recommendations and generator protection requirements.

REFERENCES
1. Leon Freris & David Infield, Renewable Energy in Power System, 2nd edition, Wiley 2020.
2. Godfrey Boyle, Renewable Energy: Power for Sustainable Future, 4th edition, Oxford University Press, 2018.
3. D.P Kothari, K. C. Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, 3rd edition, PHI Learning, 2022

BELT 3813
PENGENALAN KEPADA SISTEM PENGANGKUTAN ELEKTRIK / INTRODUCTION TO ELECTRIC TRANSPORTATION SYSTEM

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:
1. Analyze the principle operation of various types of road, railway and elevation electric transportation systems.
2. Construct lab experiment load estimation and energy requirement of electrical transportation.
3. Demonstrate practical competence on basic electric vehicle system.

SYNOPSIS

This subject will discuss on principle aspect of electric transportation systems, covering on railway electrification system, electric & electronic system, data communication, suspension and aerodynamic. Practical lab sessions will expose student on such topics.

REFERENCES
1. Brenna, M. (2018), Electrical Railway Transportation Systems, Wiley.
2. Rajamani, R. (2012). Vehicle Dynamics and Control. Springer Science & Business media.
3. Georg, R. (2016). Road Vehicle Dynamics: Fundamental and Modelling, World Scientific Publishing Company

BELT 3823
TEKNOLOGI PENYIMPANAN TENAGA / ENERGY STORAGE TECHNOLOGY

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Analyse the performance characteristics of conventional energy storage technologies applied in renewable energy and electrical transportation application.
2. Construct battery management system used in renewable energy and electrical transportation application.
3. Demonstrate understanding on the operation principles of various alternative energy storage technologies.

SYNOPSIS
The first part of the course introduces the students on the need for energy storage in the field of renewable energy and electrical transportation. It will then cover on the basics of battery terminologies, components and its operation principles. After that, analysis will be made on different type of batteries in terms of its characteristics and performances. In this course, students will also learn on the basic construction of battery management system using PSCAD software. Finally, students will be exposed as well on the alternative energy storage technologies such as super capacitor, flywheel, caes etc.

REFERENCES
1. Bruno Scrosati, Jurgen Garche and Werner Tilmetz, Advances in Battery Technologies for Electric Vehicles, Woodhead Publishing, 2015.
2. John G. Hayes & G. Abas Goodarzi, Electric Powertrain: Energy Systems, Power Electronics and Drives, Wiley, 2018.
3. Muhammad H. Rashid, Power Electronics Handbook, 5th edition., Butterworth-Heinemann, 2022.

SEMESTER 6

BELU 3764
BACHELOR DEGREE PROJECT I / PROJEK SARJANA MUDA I

LEARNING OUTCOMES
At the end of the subject, students should be able to:
1. Evaluate appropriate methodologies for successful execution of the project.
2. Imitate appropriate existing concepts in engineering technology fields.
3. Demonstrate awareness of societal and global issues (societal/health/safety/legal/cultural issues)
4. Justify tools and procedures involved in the planning of the project for sustainable development
5. Explain the project execution and findings in oral and written forms effectively.
6. Relate previous works and relevant theories using various resources.
7. Propose and manage project using appropriate ideas and resources.

SYNOPSIS
The student needs to plan and implement the project individually that related to the respective engineering technology field. The student should implement a project, do 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 engineering 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 electrical engineering knowledge.

REFERENCES

1. Dieter, G.E. & Schmidt, L.C., Engineering Design, 5th Edition, Mcgraw Hill, 2013.
2. International Engineering Alliance, Graduates Attributes And Professional Competencies, Version 3, June 2013.
3. Theodore R. Bosela Ph.D. PE, Electrical Systems Design 1st Edition, 2003.
4. Ulrich, K.T. & Eppinger, S.D. Product Design and Development, 5th Edition, Mcgraw Hill, 2011.
5. Keith H. Sueker, Power Electronics Design: A Practitioner's Guide, Newnes, 2011.
6. Mahesh Patil, Pankaj Rodey, Control Systems for Power Electronics: A Practical Guide. Springer, 2015.
7. Ziyad Salameh, Renewable Energy System Design, 2014 Elsevier Inc.
8. Malaysian Standard Guidelines. (Can be access via UTeM's Library, Guideline: Http://Bit.Ly/2bcwuvi).

BELT 4393
POWER ELECTRONICS SYSTEMS / SISTEM ELEKTRONIK KUASA

LEARNING OUTCOMES

Upon completing this subject, the students should be able to:

1. Analyze the principle operation, characteristics and performance parameters of three phase inverter and multilevel inverter.
2. Construct a design process appropriate switching technique to improve converters performances using simulation / IT tools.
3. Complete the assignment and experiment in group effectively for the given works related to basic power electronics systems.

SYNOPSIS

This subject will cover the principle operation of three-phase uncontrolled/controlled rectifier, isolated dc-dc converter, three phase inverter and multilevel inverter. It also includes the design and analysis of various switching/modulation techniques and performance analysis of the converter circuits. The design and performance improvement of converters with selection of appropriate switching techniques will be verified via simulation tools (e.g. Pspice and Matlab).

REFERENCES

BELT 3843
REKABENTUK SISTEM PV / PV SYSTEM DESIGN

LEARNING OUTCOMES

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

1. Perform the design and sizing of PV system that includes inverter, solar cable and protection components.
2. Integrate the design of the PV system's Balance of System (BOS) that includes inverter, solar cable and protection components.
3. Explain the impact of PV system towards sustainable development.

SYNOPSIS

This subject introduces students on basic solar engineering and the design and operation principles of solar cells. The students will also learn the design and sizing of PV systems components that include inverter, solar cable and protection devices. System design will focus on grid-connected application, but the design principles of stand-alone PV system will be discussed. Finally, student will evaluate solar PV system's performance using key performance indicator. The course will utilize actual system data available.

REFERENCES
1. SEDA Malaysia, "Grid-Connected Photovoltaic Systems Design Course", 2015.
2. SEDA Malaysia, "Procedure for the Testing and Commissioning of Grid-Connected Photovoltaic Systems in Malaysia, 2015.
3. Global Sustainable Energy Solutions, "Grid-Connected PV Systems Design and Installation", 2013.

BELT 3853
APLIKASI ELEKTRONIK KUASA /
POWER ELECTRONICS APPLICATION

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the application of power electronics in renewable energy, industrial appliances, consumer goods, transportation and power system.
2. Execute the function and interaction between components and sub-system used in power electronic applications with their limitation.
3. Complete the assignment and experiment on basic power electronics application.

SYNOPSIS
This course covers on various power electronics application such as variable speed drive, renewable energy generation and high voltage direct current (HVDC) system. Students are exposed on the integration and interaction of sub-systems within a larger and complex system. Various case studies are also introduced through lectures and lab demonstration.

REFERENCES
1. Ali Emadi, Abdolhosein Nasiri, Stoyan B. Bekiarov, Uninterrruptible Power Supplies and Active Filters, CRC Press, 2017.
2. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Taylor & Francis, 2018.
3. Bjarne R. Andersen, Stig L. Nilsson, Flexible AC Transmission Systems, Springer International Publishing, 2020
4. Muhammad H. Rashid, Power Electronics Handbook, 5th edition., Butterworth-Heinemann, 2022.
5. Hirofumi Akagi, Edson Hirokazu Watanabe, Mauricio Aredes, Instantaneous Power Theory and Applications to Power Conditioning, 2nd edition, Wiley-IEEE Press, 2017.
6. Chris Mi and M. Abul Masrur, Hybrid Electric Vehicles: Principle and Application with Practical Perspectives, Wiley, 2017

BELT 3863
PEMACU MOTOR DAN SISTEM TARIKAN /
MOTOR DRIVE AND TRACTION SYSTEM

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Evaluate power electronics converters and control strategies for DC and AC motor drive system.
2. Conduct the investigation on the performance of DC and AC motor drives in various operating condition.
3. Demonstrate application of DC and AC drives in modern electrified traction system.

SYNOPSIS
This course aims to provide an overview of variable speed drive system employing power electronic control of DC and AC motor. The topics cover the DC motor drive system from a variable DC chopper supply and a fully controlled bridge supply. The AC induction motor, and its operation from a variable frequency variable voltage inverter are also investigated. The students are also exposed on the application of these drives mechanism in the electrified traction systems.

REFERENCES

1. I. Boldea, Syed A. Nasar and S.A. Nasar, Electric drives, 3rd edition, CRC Press, 2022.
2. Haitham Abu-Rub, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with Matlab/Simulink, 2nd edition, Wiley, 2021
3. Andre Veltman, Duco W. J. Pulle, R. W. A. A. De Doncker, Fundamentals of Electrical Drives, Springer, 2016.

BELT 3843
REKABENTUK SISTEM PV / PV SYSTEM DESIGN

LEARNING OUTCOMES

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

4. Perform the design and sizing of PV system that includes inverter, solar cable and protection components.
5. Integrate the design of the PV system's Balance of System (BOS) that includes inverter, solar cable and protection components.
6. Explain the impact of PV system towards sustainable development.

SYNOPSIS

This subject introduces students on basic solar engineering and the design and operation principles of solar cells. The students will also learn the design and sizing of PV systems components that include inverter, solar cable and protection devices. System design will focus on grid-connected application, but the design principles of stand-alone PV system will be discussed. Finally, student will evaluate solar PV system's performance using key performance indicator. The course will utilize actual system data available.

REFERENCES

1. SEDA Malaysia, "Grid-Connected Photovoltaic Systems Design Course", 2015.
2. SEDA Malaysia, "Procedure for the Testing and Commissioning of Grid-Connected Photovoltaic Systems in Malaysia, 2015.
3. Global Sustainable Energy Solutions, "Grid-Connected PV Systems Design and Installation", 2013.

BELT 3853
APLIKASI ELEKTRONIK KUASA / POWER ELECTRONICS APPLICATION

LEARNING OUTCOMES

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

1. Apply the application of power electronics in renewable energy, industrial appliances, consumer goods, transportation and power system.
2. Execute the function and interaction between components and sub-system used in power electronic applications with their limitation.
3. Complete the assignment and experiment on basic power electronics application.

SYNOPSIS

This course covers on various power electronics application such as variable speed drive, renewable energy generation and high voltage direct current (HVDC) system. Students are exposed on the integration and interaction of sub-systems within a larger and complex system. Various case studies are also introduced through lectures and lab demonstration.

REFERENCES

1. Ali Emadi, Abdolhosein Nasiri, Stoyan B. Bekiarov, Uninterrruptible Power Supplies and Active Filters, CRC Press, 2017.
2. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Taylor & Francis, 2018.

3. Bjarne R. Andersen, Stig L. Nilsson, Flexible AC Transmission Systems, Springer International Publishing, 2020
4. Muhammad H. Rashid, Power Electronics Handbook, 5th edition., Butterworth-Heinemann, 2022.
5. Hirofumi Akagi, Edson Hirokazu Watanabe, Mauricio Aredes, Instantaneous Power Theory and Applications to Power Conditioning, 2nd edition, Wiley-IEEE Press, 2017.
6. Chris Mi and M. Abul Masrur, Hybrid Electric Vehicles: Principle and Application with Practical Perspectives, Wiley, 2017

BELT 3863
PEMACU MOTOR DAN SISTEM TARIKAN / MOTOR DRIVE AND TRACTION SYSTEM

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:
1. Evaluate power electronics converters and control strategies for DC and AC motor drive system.
2. Conduct the investigation on the performance of DC and AC motor drives in various operating condition.
3. Demonstrate application of DC and AC drives in modern electrified traction system.

SYNOPSIS

This course aims to provide an overview of variable speed drive system employing power electronic control of DC and AC motor. The topics cover the DC motor drive system from a variable DC chopper supply and a fully controlled bridge supply. The AC induction motor, and its operation from a variable frequency variable voltage inverter are also investigated. The students are also exposed on the application of these drives mechanism in the electrified traction systems.

REFERENCES

1. I. Boldea, Syed A. Nasar and S.A. Nasar, Electric drives, 3rd edition, CRC Press, 2022.
2. Haitham Abu-Rub, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with Matlab/Simulink, 2nd edition, Wiley, 2021
3. Andre Veltman, Duco W. J. Pulle, R. W. A. A. De Doncker, Fundamentals of Electrical Drives, Springer, 2016.
4. Haitham Abu-Rub, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with Matlab / Simulink Models, 2nd edition, Wiley, 2021.
5. Ioinovici, Adrian, Power Electronics and Energy Conversion Systems, John Wiley & Sons, 2013.
6. Fang Lin Luo, Hong Ye. Power Electronics: Advanced Conversion Technologies, 2nd edition, CRC Press, 2020.

BELK 4853
EKONOMI SISTEM DAN PASARAN ELEKTRIK / ELECTRICITY MARKET AND SYSTEM ECONOMICS

LEARNING OUTCOMES

Upon completion of this subject, student should be able to:
1. Analyse suitable electricity generation and transmission system to be implemented based on economic factors in power systems.
2. Perform experiments on reliability assessment for power generation and power transfer in power systems.
3. Conform to the safety and legal requirements of different electricity industry regulations in power systems.

SYNOPSIS

This course deals with knowledge and practical related experience on electricity market and system economics within power systems. Student will have the opportunity to experience and be assessed on the economics, trading and pricing of electricity supply and how it is shaped by technical, commercial and regulatory considerations. Student will also be assessed on the understanding of system economics under the environment of multiple suppliers and users, deep appreciation of factors affecting security of supply and how it might be quantified and finally how to put engineering knowledge concerning electricity supply into context.

REFERENCES

1. Daniel S. K., Goran S., Fundamental of Power System Economics, 2nd edition, Wiley, 2018
2. Wenyuan L., Risk Assessment of Power Systems: Models, Methods, and Applications, 2nd Edition, Wiley, 2014
3. J. Pachl, Railway Operation and Control, 4th edition, VTD Rail Publishing, Mountlake Terrace (USA), 2016.
4. Marshall Roy, Practical Railway Engineering, Murphy & Moore Publishing, 2022
5. Gregor Theeg, Sergej Vlasenko, Railway Signalling & Interlocking, PMC Media House, 2019.

SEMESTER 7

BELU 4774
BACHELOR DEGREE PROJECT II / PROJEK SARJANA MUDA II

LEARNING OUTCOMES

After completing the course, students will be able to:
1. Complete planned project systematically.
2. (Re)construct solutions of broadly-defined engineering problems using relevant tools and techniques.
3. Display self-reliance in achieving the objectives of the project.
4. Demonstrate project results using appropriate techniques with an understanding of it limitations.
5. Explain the project execution and findings in oral and written form effectively.

SYNOPSIS

This is the second part of the bachelor degree project. Students are expected to continue the project performed in bachelor degree project (BEEU 3764) until completion. At the end of the semester, students are required to submit the bachelor degree project report and present their projects for assessment.

REFERENCES

1. Manual Projek Sarjana Muda (PSM), Fakulti Teknologi Kejuruteraan, Universiti Teknikal Malaysia Melaka.

PRE-REQUISITE

BEEU 3764
BACHELOR DEGREE PROJECT I / PROJECT SARJANA MUDA I

BELT 4413
ENERGY EFFICIENCY / KECEKAPAN TENAGA

LEARNING OUTCOMES

Upon completion of this subject, student should be able to:
1. Analyze the properties of electrical power management for improving energy efficiency in electrical system.
2. Demonstrate the functionality of important electrical parameters for controlling electrical energy efficiency through experiments in laboratory.
3. Create awareness among colleagues regarding the importance of energy sustainability.

SYNOPSIS

This is an introductory course to the concept of energy efficiency, energy management, energy audit, HVAC system, available energy saving equipment as well as green and renewable energy systems. At the beginning of the course, students will learn on the importance of energy management which relates to the needs of an electrical energy manager as required by the efficient management of electrical energy regulations 2008 (EMEER 2008). practical wise, students will be exposed to several ways to perform energy audit on buildings through the usage of different equipment once they have grasp the understanding of load apportioning and building efficiency index (BEI). Affective wise, students are required to demonstrate their awareness on the subject matters through the assignment which needs to be presented at the end of the course.

REFERENCES

1. Andreas S., angelo B., Electrical Energy Efficiency: Technologies and Applications, Wiley, 2012.
2. Barney L. C., Wayne C. T. William J. K., Guide to Energy Management, 8th edition, Taylor & Francis Group, 2020
3. Frank K., D. Yogi G., Handbook of Energy Efficiency and Renewable Energy, 2nd edition, Taylor & Francis Group, 2015.
4. Gilbert M. M., Renewable and Efficient Electric Power Systems, Wiley, 2022.

BELK 3403
POWER DISTRIBUTION SYSTEM DESIGN / REKA BENTUK SISTEM PENGAGIHAN KUASA

LEARNING OUTCOMES

Upon completing this subject, the student should be able to

1. Design low voltage distribution system based on problem statement or case study given
2. Perform testing on protection and metering equipment based on low voltage distribution design drawing.
3. Conform to the safety and legal requirements for designing and testing of low voltage distribution system.

SYNOPSIS

This course outlines the principles and design of electrical distribution system. There are various issues of distribution system that is covered; including regulations and standards related to electrical installation. Characteristic and specification for circuit breakers, cable size selection, and method of earthing and earthing arrangement are described in detail. Students will also exposed to the use of standard design procedures and type of testing and troubleshooting required for low voltage system.

REFERENCES

1. Electricity Supply Acts 1990 (Act 447) and Regulations (Amendment 2019), 2019.
2. Malaysian Standard International Electrotechnical Commission (MS IEC) 60364, 2015.
3. Boca Raton, The Electric Power Engineering Handbook, 3rd Ed., CRC Press, 2018.
4. H.L Wilis, R. R. Schrieber, Aging Power Delivery Infrastructures, 2nd Ed., CRC Press, 2017.
5. U.A Bakshi, M.V Bakshi, Transmission & Distribution, 2nd Ed., India Technical Pub., 2018.

BELR 4863
ARTIFICIAL INTELLIGENCE / KEPINTARAN BUATAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to

1. Determine the artificial intelligent method to solve engineering problem.
2. Demonstrate ability to compose appropriate artificial intelligent toolbox.
3. Work individually or in groups effectively to perform assignments/tasks given.

SYNOPSIS

Artificial Intelligence (AI) Is A Field Of Study Concerns On Allowing Machines To Imitate Human's Thinking Or Behaviour. By Applying Ai Techniques, Machines Would Be Able To Solve Complex Engineering Problems. In This Course Students Will Be Focusing On Two Popular Subtopics In Artificial Intelligence Area Which Are Fuzzy Logic And Neural Network. Students Will Be Exposed Towards The Concept Of Neural Network And/Or Fuzzy Logic And Its Implementation Methods In Control System Using Appropriate Tools Such As Simulink/Matlab.

REFERENCES

1. Kevin Warwick; Artificial Intelligence: The Basics, Taylor & Francis Group, 2011.
2. Elmer P. Dadios; Fuzzy Logic – Controls, Concepts, Theories And Applications, 2012.
3. Rogerson, Jeremy; Designs And Applied Principles Of Artificial Neural Networks, Jersey City, 2015.

BELK 4863
POWER QUALITY/ KUALITI KUASA

LEARNING OUTCOMES

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

1. Evaluate different types of power quality and suggest suitable mitigation techniques for different case given.
2. Perform measurement and power quality monitoring by using power quality analyser.
3. Conform the power quality problems according to the related standards.

SYNOPSIS

This course covers all important aspects of power quality. The main topics are introduction to power quality, power quality characteristics, power quality measurement and monitoring tools, related standards, different types of power quality problem, mitigation techniques as well as relevant issues. Delivery methods include lectures, tutorials and practical sessions.

REFERENCES

1. Roger D., Mark M., Surya S., H. Wayne B., Electrical Power Systems Quality, 3rd edition, McGraw Hill, 2012.
2. R. Sastry V., Mulukutla S. S., Power Quality: VAR Compensation in Power Systems, Taylor & Francis Group, 2017.

BELK 4843
KESERASIAN ELEKTROMAGNETIK SISTEM KUASA/ POWER SYSTEMS ELECTROMAGNETIC COMPATIBILITY

LEARNING OUTCOMES

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

1. Analyse the technical requirements of testing, shielding, grounding and bonding of EMC for power systems operation.
2. Perform experiments to determine suitable types of EMC mitigation approach for a different power systems scenario.
3. Conform to the safety and legal requirements for EMC for power systems operation.

SYNOPSIS

The general aim of this course is to enable students to identify and examine the main concepts related to the function and design of EMC mitigation for power transmission, distribution and (to a lesser extent) generation systems. Upon completion of the course, students should be able to understand the reasons why power systems EMC are required, the basic philosophies of EMC phenomena, shielding, grounding and bonding, the components involved and how typical EMC mitigation are designed and configured.

REFERENCES
1. Clayton R. P, Robert C. Scully, Mark S., Electromagnetic Compatibility, 3rd edition, Wiley, 2022.
2. F. Rachidi, M. Rubinstein, M. Paolone, Electromagnetic Time Reversal: Application to EMC and Power Systems, Wiley, 2016.
3. K. Amstrong, Getting EMC Design Right First Time, Simplyemc, 2016.
4. J. J. Goedbloed, Electromagnetic Compatibility, Prentice Hall, 2016.

BELT 4903
SISTEM PEMACU MODEN / MODERN DRIVE SYSTEM

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the principle of vector-controlled and DTC-controlled drive systems in AC machine.
2. Construct the experiment of three phase AC drive system.
3. Demonstrate practical competence on modern AC drive systems.

SYNOPSIS
This course will discuss the electric drives components, machine reference frame principle, vector transformation, direct vector control of synchronous motor and induction motor drives, dynamic modeling of AC motors, three-phase PWM Voltage Source Inverter fed AC motor drives and direct torque induction motor drives. Closed-loop speed control, current control and voltage control strategies including hysteresis current control, ramp-comparison and space-vector modulation. Students will experience POPBL approach in this course.

REFERENCES
1. I. Boldea, Syed A. Nasar and S.A. Nasar, Electric Drives, 3rd edition, CRC Press, 2022.
2. Haitham Abu-Rub, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with Matlab/Simulink, 2nd edition, Wiley, 2021
3. Austin Hughes, Electric Motor and Drives: Fundamentals, Types, and Application, Newnes, 5th edition, 2019.
4. Zachary R. Gordon, Control of Electric Machine Drive Systems, CreateSpace Independent Publishing Platform, 2015
5. Andre Veltman, Duco W. J. Pulle, R. W. A. A. De Doncker, Fundamentals of Electrical Drives, 2nd edition, Springer, 2016.

BELT 4913
KENDERAAN ELEKTRIK HIBRID / HYBRID ELECTRIC VEHICLE

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Accessing the various architectures and working principle of hybrid electric vehicles in term of energy storage and conversion, transmission, and control subsystems.
2. Assemble various component of hybrid electrical vehicle energy management through simulation.
3. Function effectively as a team in analyzing hybrid electric vehicle performances

SYNOPSIS
Introduction to architectures and technologies associated with hybrid electric vehicles including their components and working principle. Specific topics include electric and hybrid electric drive trains, energy storage (batteries/ ultracapacitors, fuel cells), electromechanical energy conversion (induction and permanent magnet motors and generators), power electronics, vehicle-level modeling and control, and optimization.

REFERENCES

1. I. Boldea, Syed A. Nasar and S.A. Nasar, Electric Drives, 3rd edition, CRC Press, 2022.
2. C. Mi, M. Abul Masrur. Hybrid Electric Vehicle: Principles and Applications with Practical Perspectives, 2nd edition, Wiley, 2017
3. S. Onori, L. Serrao, G. Rizzino. Hybrid Electric Vehicles: Energy Management Strategies, Springer, 2016

SEMESTER 8

BELU 48812
INDUSTRIAL TRAINING / LATIHAN INDUSTRI

LEARNING OUTCOME

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

1. Demonstrate technical competencies and skills gained throughout their internship
2. Prepare a report on the industrial field daily activities in the logbook systematically
3. Work effectively with staff, colleagues, and other personnel
4. Practice professional ethics in accordance with industry rules and regulations
5. Produce industrial training report
6. Present report orally on working experience

SYNOPSIS

All students are required to undergo industrial training as part of their curriculum to complete four (4) years course for the Bachelor of Engineering Technology. The duration of training is 24 weeks, and it will be taken place at the end of the course (semester 8). The students are expected to gain knowledge and enhance their technical skills within industrial environment relevant to their field of study.

REFERENCES

1. Guideline Handbook for Industrial Training

BACHELOR PROGRAMME
BACHELOR TECHNOLOGY

PROGRAMME LEARNING OUTCOMES (PLO)

PLO1	Apply knowledge of technology fundamentals to broadly-defined procedures processes, systems and methodologies in electrical system maintenance.
PLO2	Able to suggest and apply latest tools and techniques to solve broadly-defined problems.
PLO3	Demonstrate strong analytical and critical thinking skills to solve broadly-defined problems in electrical system maintenance.
PLO4	Able to communicate and articulate effectively in both verbal and written among technologist communities and society at large.
PLO5	Demonstrate understanding of the societal related issues and the consequent responsibilities relevant to broadly-defined technology practices.
PLO6	Recognize the needs for professional development and to engage independent lifelong learning in specialist technologists.
PLO7	Demonstrate an awareness of management and technopreneurship practices in real perspective.
PLO8	Demonstrate professionalism and social and ethical consideration.
PLO9	Demonstrate leadership quality, mentoring and work effectively in diverse teams.

BACHELOR TECHNOLOGY OF ELECTRICAL SYSTEM MAINTENANCE WITH HONOURS (BELS)

CURRICULUM STRUCTURE BELS

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 1	BELS1114	Electrical System Drafting and Simulation Draf dan Simulasi Elektrik	P	4	
	BELS1124	Technical Reporting Pelaporan Teknikal	P	4	
	BELS1135	Electrical System Measurement & Testing Pengukuran & Pengujian Sistem Elektrik	P	5	
	BTMW1112	Basic Intepreneurship Asas Keusahawanan	W	2	
	BLLW 1142	English for Academic Purposes Bahasa Inggeris Untuk Tujuan Akademik	W	2	
	BLHW 1762	Philosophy and Current Issues Falsafah & Isu Semasa	W	2	
TOTAL CREDITS THIS SEMESTER				**19**	
SEMESTER 2	BELS1245	Solar PV Installation and Maintenance Pemasangan dan Penyelenggaraan PV Solar	P	5	
	BELS1255	Switchboard Maintenance and Calibration Penyelenggaraan dan Kalibrasi Papan Pensuisan	P	5	
	BELS1263	Professional Practices Amalan Profesional	P	3	
	BLLW2152	Academic Writing Penulisan Akademik	W	2	
	BKKXXXX1	Co-Curriculum 1 Ko-kurikulum 1	W	1	
	BLLW1XX2	Third Language Bahasa Ketiga	W	2	
INTERNATIONAL STUDENT				**18**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 3	BELS2375	Building Electrical System Maintenance Penyelenggaraan Sistem Elektrik Bangunan	P	5	
	BELS2385	Renewable Energy System Maintenance Penyelenggaraan Sistem Tenaga boleh Diperbaharui	P	5	
	BELS2395	Generator System Maintenance Penyelenggaraan Sistem Penjana	P	5	
	BLHW 2772	Appreciation of Ethics and Civilisations Penghayatan Etika & Peradaban	W	2	
	BKKXXXX1	Co-Curriculum 2 Ko-kurikulum 2	W	1	
TOTAL CREDITS THIS SEMESTER				**18**	
SEMESTER 4	BELS2405	Electrical Machine & Drive System Integration Integrasi Mesin Elektrik & Sistem Penggerak	P	5	
	BELS2415	Energy Efficiency Optimization Pengoptimunan Kecekapan Tenaga	P	5	
	BELS2423	Collegiality Interaction and Management Pengurusan & Interaksi Rakan Sejawat	P	3	
	BTMW2124	Technopreneur Capstone I Capstone Teknousahawan I	P	4	
	BLLW 3162	English for Professional Interaction Bahasa Inggeris Untuk Interaksi Profesional	W	2	
TOTAL CREDITS THIS SEMESTER				**19**	
SEMESTER 5	BELS3535	Industrial Machinery Control System Design Rekabentuk Sistem Kawalan Pemesinan Industry	P	5	
	BELS3545	Monitoring System Integration Integrasi Sistem Pemantauan	P	5	
	BELS3554	Industrial Data Analysis Analisis data Perindustrian	P	4	
	BTMW3134	Technopreneur Capstone II Capstone Teknousahawan II	P	4	
TOTAL CREDITS THIS SEMESTER				**18**	

	CODE	SUBJECT	CATEGORY	CREDIT	PRE-REQUISITE
SEMESTER 6 (WBL)	BELS3664	Maintenance Management System (MMS) Sistem Pengurusan Penyelenggaraan	P	4	
	BELS3674	Project Planning and Execution Perancangan Projek dan Perlaksanaan	P	4	
	BELS3684	Final Year Project I Projek Tahun Akhir I	P	4	
TOTAL CREDITS THIS SEMESTER				**12**	
SHORT SEMESTER (WBL)	BELS3696	Final Year Project II Projek Tahun Akhir II	P	6	**BELS3684
TOTAL CREDITS THIS SEMESTER				**6**	
SEMESTER 7 (WBL)	BELP 41112	Industrial Training Latihan Industri	P	12	
TOTAL CREDITS THIS SEMESTER				**12**	
TOTAL CREDITS				**122**	

** Pre-requisite subject
**** Courses that will be implemented as Work Based Learning (WBL)

Notes:

Definition of WBL:

'Work-based learning is the term being used to describe a class of university programmes that bring together universities and work organizations to create new learning opportunities in workplaces.' (Source: Guidelines To Good Practices: Workbased Learning (GGP: WBL, MQA)

Besides the aforementioned curriculum, the Programme offers professional certificate subjects as an added value for the students to increase their employability. Students may choose any ONE (1) subject from the following list.

No.	CODE	SUBJECT
1	BITS 2610	Cisco Certified Network Associate Routing & Switching (Preparation)
2	BEEC 2210	IoT Fundamentals: Connecting Things Professional Certification
3	BEEC 2220	IoT Fundamentals: Big Data & Analytics Professional Certification
4	BEEE 3210	Programmable Logic Controller (PLC) Level 1 and Level 2
5	BEEE 4210	SMCT MT1 – Practical Mechatronics 1

Number of credit hours regarding to course category is represented in the table below.

W = university compulsory subjects
P = program core subjects

University Compulsory	W	16
Programme	P	94
Industrial Training	P	12
		122

SUBJECT DETAILS FOR BACHELOR TECHNOLOGY PROGRAMME

BELS COURSES CORE DETAILS (K)

BELS Course Core Subjects (K)

SEMESTER 1

BELS 1114
ELECTRICAL SYSTEM DRAFTING AND SIMULATION/ DRAF DAN SIMULASI ELEKTRIK

LEARNING OUTCOMES

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

1. Apply general characteristic of electrical installation into the concepts of Computer Aided Drafting and Orcad drawing.
2. Design electrical installation apparatus for low voltage application.
3. Analyse actual working drawings of electrical project.

SYNOPSIS

The main objective of this course is to expose the Bachelor Technology students with skills of Computer Aided Drafting and its application. This course provides the student an exposure of electrical installation design for low voltage application. It introduces the student for electrical symbol, design lighting and switch socket outlet (S/S/O) required and design schematic diagram for DB, SSB and MSB.

REFERENCES

1. Scott Onstott, AutoCAD 2017 and AutoCAD LT 2017, Wiley Publishing.
2. Panduan Teknik Rekabentuk Elektrik, JKR Elektrik (Edisi 4).
3. OrCAD® CAPTURE Second Edition 31 May 2000, CADENCE PCB Systems Division.
4. Lab Module OrCAD, Engineering Skills (ECT111), UniMAP.

BELS 1124
TECHNICAL REPORTING/ PELAPORAN TEKNIKAL

LEARNING OUTCOMES

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

1. Read, interpret, analyse, and evaluate complex technical and professional documents and visuals.
2. Produce reports and proposal that inform, persuade and provide information.
3. Apply the value of good writing and presenting communications.

SYNOPSIS

Technical reporting course is learning about a formal report designed to convey technical information in a clear an d easily accessible format. Technical report is a document describes the process, progress or result of technical or state of technical problem. It also learns how to make recommendation and conclusions of a project. Technical report is a review process; it is often limited to within the originating organization. Students compose, design, revise, and edit effective reports, descriptions, instructions, and employment documents. Emphasizes precise use of language and graphics to communicate complex technical and procedural information safely, legally and ethically.

REFERENCES

1. Wayne, L. W. (2016). Microsoft Excel 2016. Data Analysis and Bussiness Modeling. Microsoft Press
2. Holman, J. P. and Holman, B. K. (1996). What Every Engineer Should Know About Excel. CRC Press.
3. Kvaternik, P. (2014). Engineering Calculation Using Microsoft Excel: Learn How to Write Your Own Customized Calculations in Minutes. Primoz Kvaternik, Grsoft Structural Engineering.

5. Mamishev, A. and Surgent, M. (2014). Creating Research and Scientific Documents Using Microsoft Word. Microsoft Press.
6. Vesilind, P. A. (2007). Public Speaking and Technical Writing Skills for Engineering Students. Lakeshore Press.
7. Sobek II, D. K. (2011). Understanding A3 Thinking: A Critical Component of Toyota's PDCA Management System. CRC Press.
8. Duffy, G. L. (2013). Modular Kaizen: Continuous and Breakthrough Improvement. ASQ Quality Press.

BELS 1135
ELECTRICAL SYSTEM MEASUREMENT & TESTING/ PENGUKURAN & PENGUJIAN SISTEM ELEKTRIK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Demonstrate proper safety procedures industrial project.
2. Evaluate the problem of electrical devices with standard tests and measurements.
3. Analyse the relevant parameter measurement.

SYNOPSIS
This course covers the fundamentals circuit analysis such as Kirchoff's laws, parallel and series circuits. This course provides an introduction to the fundamentals of measurement standards, measurement errors, operation of electrical measuring instruments and their testing and calibration. In addition, this course also covers the used of potentiometer for measurement of resistance and voltmeter and ammeter calibrations. Measuring earth resistance for electrical grounding systems as well as insulation resistance and leakage current test are among the topics that will be covered in this course. Overall, it emphasizes the principles and analytical models used by engineers and technologists to design develop and test electrical systems.

REFERENCES
1. Helfrick, W.D. & Cooper, A.D. (2015). Modern Electronic Instrumentation And Measurement Technology: Pearson India.
2. Khurana, R. (2017). Electronic Instrumentation and Measurement: Vikas Publishing House.
3. Makarov, S. N., Ludwig, R.B, Stephen J.(2016). Practical Electrical EngineeringPractical Electrical Engineering: Springer Publications.

SEMESTER 2

BELS 1245
SOLAR PV INSTALLATION AND MAINTENANCE/ PEMASANGAN DAN PENYELENGGARAAN PV SOLAR

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Apply the principles of solar PV system technology.
2. Construct PV system configuration.
3. Analyze appropriate system configuration based on solar PV system.

SYNOPSIS
This course will introduce students with terminologies used in photovoltaic (PV) system technology. It will enable student to assess, install and maintain solar PV system configuration for stand-alone and grid-connected power generation based on standard requirement by the agencies involved.

REFERENCES
1. Sulaiman Shaari (2009). Solar Photovoltaic Power: Design and Installation of Stand-Alone Systems. Sustainable Energy Development Authority (SEDA), Second Published (2018). Pemasangan dan

2. Penyenggaraan Sistem Solar Fotovolta Tersambung Grid. ISBN: 978-967-10942-6-6.
3. Sustainable Energy Development Authority (SEDA) (2012). Basic Solar Photovoltaic Experiment. ISBN: 978-967-10942-3-5.
4. Sustainable Energy Development Authority (SEDA) (2013). Sistem Solar Fotovolta Tersambung Grid. ISBN: 978-967-10942-5-9.

BELS 1255 SWITCHBOARD MAINTENANCE AND CALIBRATION/ PENYELENGGARAAN DAN KALIBRASI PAPAN PENSUISAN

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:

1. Analyze basic principle of operation, construction and connections of a switchboard components and related equipment.
2. Demonstrate the calibration procedures on switchboard equipment using specific parameters.
3. Demonstrate proper safety procedures in maintenance work of switchboard equipment.

SYNOPSIS
The course provides students with knowledge of the functions and operations of circuit breakers and switchboards as well as maintenance of switchboards and associated instruments and relays in order for safe operation of switchboard.

REFERENCES
1. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001.

BELS 1263 PROFESSIONAL PRACTICES/ AMALAN PROFESIONAL

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:

1. Apply the issues and challenges of engineering and technology ethics.
2. Analyse hazards, the function of risk management and occupational safety and health (OSHA).
3. Practice the aspects and procedures of legal on engineering and technology issues.

SYNOPSIS
This course aims to explain the main concepts in engineering and technology ethics, risk management and occupational safety and health as well as to expose the students to basic of law in the engineering and technology context.

REFERENCES
1. Van De Poel, I and Royakkers, L. (2011) Ethics, Technology, and Engineering: An Introduction, Wiley-Blackwell.
2. Winston, M.E., and Edelbach, R.D (2014) Society, Ethics and Technology, 5th Edition, Cengage Learning.
3. Harrington, J.L. (2008) Technology And Society, Jones & Bartlett Learning.
4. Lee Mei Peng, Detta, I.J. (2005) General Principles of Malaysian Law, Fifth Edition, Oxforf Fajar.
5. Martin, M. and Schinzinger, R. (2004). Ethics in Engineering, McGraw-Hill.
6. Fleddermann, C.B. (2011) Engineering Ethics, 4th Edition, Prentice Hall.
7. Alcorn, P. A. (2001). Practical Ethics for a Technological World. Upper Saddle River, NJ: Prentice Hall.

SEMESTER 3

BELS 2375
BUILDING ELECTRICAL SYSTEM MAINTENANCE/ PENYELENGGARAAN SISTEM ELEKTRIK BANGUNAN

LEARNING OUTCOMES

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

1. Describe and demonstrate safe practice of electrical systems used in buildings to perform common maintenance tasks.
2. Identify and perform basic preventive and reactive maintenance procedures for residential homes, apartments, and appliances.
3. Apply quantitative methods to common building maintenance tasks.

SYNOPSIS

Tools and Maintenance Tasks introduces and develops knowledge of basic building maintenance tools and materials, applied skills and techniques, industry health and safety standards, and preventive maintenance and troubleshooting practices in the building trades and facilities maintenance fields.

REFERENCES

1. Building Maintenance & Construction,Clifford Rutherford, 2018.
2. The Illustrated Guide to Electrical Building Services, Third Edition, Peter Tse & David Bleicher, 2014
3. Mechanical & Electrical Building Services Engineering Guidelines for Post Primary School Buildings, TGD 003, First Edition, February 2004

BELS 2385
RENEWABLE ENERGY SYSTEM MAINTENANCE/ PENYELENGGARAAN SISTEM TENAGA BOLEH DIPERBAHARUI

LEARNING OUTCOMES

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

1. Describe the fundamentals, main characteristics and main components of different renewable energy sources and systems.
2. Perform maintenance activities in a cost effective manner so that meet specific energy demands and have a minimal impact on the environment.
3. Perform simple techno-economical assessments and compare environmental assessments of renewable energy systems.

SYNOPSIS

This course will introduce student to the renewable energy technology sources and sources, main characteristics and main components of the systems. The topics to be covered including Wind Energy, Solar Energy, Hydropower and Fuel cell. Apart of the course implementation, there will be seminar organised related to these renewable energy technology (industrial talk).

REFERENCES

1. Godfrey Boyle, Renewable Energy - Power for a Sustainable Future (3rd Edition). Oxford University Press, 2012.
2. Principles of Sustainable Energy Systems 3rd Edition, Charles F. Kutscher, Jana B. Milford & Frank Krieth, CRC Press, New York, 2019.
3. Photovoltaics: Design and Installation Manual by Solar Energy International, 2007.
4. Wind Energy Handbook 3rd Edition by Tony Burton, Nick Jenkins Published by Wiley, 2021.

5. Fuel Cells: Principles and Applications by B. Viswanathan, M. Aulice Scibioh Published by CRC Press, 2008.

BELS 2395
GENERATOR SYSTEM MAINTENANCE/ PENYELENGGARAAN SISTEM PENJANA

LEARNING OUTCOMES
Upon completing this subject, the student should be able to:
1. Operate generator system in term of governing, load sharing and synchronizing.
2. Perform maintenance strategy for diesel generator system according to standard.
3. Perform servicing method for diesel generator component parts.

SYNOPSIS
This course consists of three learning section of diesel generator which are system operation, maintenance and service. Before going into the detailed system operation, students will be introduced with what is diesel generator and its function in electrical system. For maintenance section, students will be involved with strategy implemented in maintenance system which consists of preventive maintenance and condition based maintenance. Students also will be exposed to detailed servicing method of diesel generator which is related to fault diagnosis.

REFERENCES
1. Diesel Generator Handbook, LLJ Mahon, 1992.
2. Hydropower advancement project, revision 1.0 12/02/2011 - machine condition monitoring.
3. Synchronous generator (Electric generator handbook), 2015.

SEMESTER 4

BELS 2405
ELECTRICAL MACHINE & DRIVE SYSTEM INTEGRATION/ INTEGRASI MESIN ELEKTRIK & SISTEM PENGGERAK

LEARNING OUTCOMES
Upon completion of this subject, student should be able to:
1. Explain the concepts and techniques used in electrical machines drive system.
2. Build control algorithm of programmable logic control (PLC), microcontroller, and Variable Frequency Drive (VFD).
3. Analyse different approach of drives systems using software tools and the dynamic response and performance.

SYNOPSIS
This course is designed to introduce the student the principles of DC and AC motors drive control. This includes studying the concept of control modes for motor drives, connections and applications. The integration practices among PLC, microcontroller, motors, software, drives, computers, and other industrial equipment will be provided. Lectures and labs will place emphasis on the above items will allow the student to build a working integrated motor drive system throughout the semester.

REFERENCES
1. Frank Petruzella, Programmable Logic Controllers, 5th Edition, USA: McGraw Hill Education., 2017.
2. Muhammad H. Rashid, Power Electronics: Circuit, Devices and Application. 4th Edition. USA: Prentice Hall International., 2013.
3. Austin Hughes, Electric Motor and Drives: Fundamentals, Types and Application. 4th Edition. USA: Newnes., 2013.

4. Jens Weidauer, Electrical Drives: Principles, Planning, Application, Solutions. 5th Edition. UK: Publicis., 2014.
5. Ned Mohan, Electric Machines and Drives. 1st Edition. UK: Wiley., 2012.
6. Theodore Wildi. Electrical Machines, Drives and Power Systems. 6th Edition. UK: Pearson Education Limited.
7. S. K. Pillai. Basics of Electrical Drives. 4th Edition. UK: New Academic Science., 2014.
8. Bimal K. Bose, Power Electronics and Variable Frequency Drives: Technology and Applications. 1st Edition. UK: Wiley IEEE Press., 1997.
9. FRENIC Mini (C2) Series User's Manual.

BELS 2415
ENERGY EFFICIENCY OPTIMIZATION/ PENGOPTIMUMAN KECEKAPAN TENAGA

LEARNING OUTCOMES

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

1. Understand energy management, standards and safety aspect of efficient electrical energy utilization.
2. Demonstrate the instrument and measurement tools of efficient electrical energy utilization.
3. Evaluate energy saving solution of energy efficient equipment.

SYNOPSIS

This course exposes the students to national and world economic perspectives on energy in term of economics, problems and current status of energy. In addition, safety aspect of electrical equipment's will also be exposed to the student to create awareness and safe working practice. Through plans and operation for energy management and energy efficient equipment's, student will learn on how efficient energy utilization can be achieved. At the end of this course, students will be exposed to the techniques for energy audit such as analysing energy consumptions and identify a solution for energy saving programs.

REFERENCES

1. Frank Kreith & D. Yogi Goswami, "Handbook of Energy Efficiency and Renewable Energy, 2nd Edition", CRC Press, 2016.
2. Gilbert M. Masters, "Renewable and Efficient Electric Power Systems", Wiley-Interscience, 2004.
3. Joel N. Swisher, Gilberto de Martino Jannuzi, and Robert Y. Redlinger, 'Tools and methods for Integrated Resource Planning: Improving Energy efficiency and protecting the Environment", UNEP Collaborating Centre on Energy and Environment, 2012
4. Wayne C. Turner, 'Energy Management Handbook', Fairmont Press Inc, 2005.
5. Frank Kreith and D. Yogi Goswami, Energy Management and Conservation Handbook, CRC Press, 2008.
6. The Energy Efficiency and Conservation Guidelines Part 1: Electrical Energy - use Equipment, Kementerian Tenaga, Teknologi Hijau dan Air, 2011.

BELS 2423
COLLEGIALITY INTERACTION AND MANAGEMENT/ PENGURUSAN DAN INTEGRASI RAKAN SEJAWAT

LEARNING OUTCOMES

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

1. Prepare pedagogical aids including advance organizers.
2. Demonstrate managerial practice and application exercise.

3. Report proper case studies and sample interactions are presented to illustrate concepts and principles.

SYNOPSIS

This subject is required students to carry out practical works in Electrical Workshop in order to gain learning experience in three phase wiring system and construct motor starter circuit. Students will experience designing & performing electrical installation in industrial wiring & motor starter circuit following by inspection & testing steps. Students are also emphasized on the safety and regulatory requirements. Assessment will be conducted on student ability in the functionality, wiring, testing, safety awareness, discipline while carry out the practical tasks.

REFERENCES

1. Friend, Marilyn; Cook, Lynne.(1992) Interactions: Collaboration Skills for School Professionals.
2. Pifer, Meghan J.; Baker, Vicki L.(2013). Managing the Process: The Intradepartmental Networks of Early-Career Academics
3. Robert E. Cipriano (2011). Facilitating a Collegial Department in Higher Education: Strategies for Success 1st Edition
4. Nadja Bieletzki (2018) The Power of Collegiality: A Qualitative Analysis of University Presidents' Leadership in Germany (Organization & Public Management)
5. Franklin H. Silverman (2003). Collegiality and Service for Tenure and Beyond: Acquiring a Reputation as a Team Player.

BTMW 2124
CAPSTONE TECHNOPRENEUR 1/ CAPSTONE TEKNOUSAHAWAN I

LEARNING OUTCOMES

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

1. Apply various financial indicators & tools to prepare for financial information for a new business venture.
2. Acquire skills to analyse financial statements.
3. Display the art of negotiation with investors.

SYNOPSIS

Entrepreneurs need money to start and to grow their business. It is important to understand how revenue is generated, how to source for funds, how to control cash flow, how to assess the succes of the company in monetary terms, and how to value a company for various purposes. The course exposes students to the various financial aspects relating to new ventures. These include approaches to secure start-up capital and venture financing. Students learn about the basic accounting, essential financial indicators, the types of funds available, the different categories of investors, the importance of intellectual property in securing finance, the financial details to be included in a business plan required for investment purpose, valuation of company and the art of negotiation with investors.

REFERENCES

1. NTU (2013). Entrepreneurship & Innovation Asia. Overview. Nanyang Technological University, Singapore: Nanyang Technopreneurship Center.
2. Cremades, A. (2016). The Art of Startup Fundraising. Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know. Hoboken, NJ: John Wiley & Sons.

3. McKinsey & Co., Koller, T., Goedhart, M. & Wessels, D. (2015). Valuation. Measuring and Managing the Value of Companies, 6th edn. Hoboken, NJ: John Wiley & Sons.
4. Stowe, J. D., Robinson, T. R., Pinto, J. E. & McLeavey, D. W. (2007). Equity Asset Valuation. Hoboken, NJ: John Wiley & Sons.
5. Pereiro, L. E. (2002). Valuation of Companies in Emerging Markets. A Practical Approach. New York: John Wiley & Sons.
6. OECD (2015). Boosting Malaysia's National Intellectual Property System for Innovation. Paris: OECD Publishing.

SEMESTER 5

BELS 3535
INDUSTRIAL MACHINERY CONTROL SYSTEM DESIGN/ REKABENTUK SISTEM KAWALAN PEMESINAN INDUSTRI

LEARNING OUTCOMES

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

1. Select appropriate the PLC central processing unit, input-output system, programming and peripheral devices with respect to designed project and application.
2. Analyse control system problems by utilizing control ler system such as P, PI, PID and Ziegler-nichols into water level & flow, temperature and servo motor.
3. Evaluate appropriate input and output devices for selected microcontroller, control system and programmable logic control.

SYNOPSIS

One of the aspects of a good technologies is to have the capability of integrating the hardware and the software, thus an electrical technologist should be competence in programming. This course introduces basic programming using high level language (C language) includes study of PIC microcontroller architecture, its programming using C language and interfacing with input and output devices. This knowledge is gathered and applied to design microcontroller based system. Applying and analyse control system problems by utilizing controller system such as P, PI, PID and Ziegler-Nichols into water level & flow, temperature and servo motor. The course also to understanding of the PLC central processing unit, input-output system, programming and peripheral devices, and programming languages and will developed skills in programming PLC (Omron and Siemens) and applying in industrial PLC.

REFERENCES

1. Deitel and Deitel, Sudin, S., Ahmad, R.B. and Yacob, Y., (2006). C How To Program. Pearson-Prentice Hall.
2. H.W Huang. (2009). PIC Microcontroller: An Introduction to Software and Hardware Interfacing. Thomson & Delmar Learning.
3. Nise, N. S., Control Systems Engineering. 6th Edition. UK: John Wiley., 2010.
4. Ogata, K., Modern Control Systems. 5th Edition. USA: Addison-Wesley Company., 2009.
5. Frank D. Petruzella, Programmable Logic Controller, 4th Edition, McGRAW-HILL Int., 2010.

BELS 3545
MONITORING SYSTEM INTEGRATION/ INTEGRASI SISTEM PEMANTAUAN

LEARNING OUTCOMES

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

1. Apply the components and concept used in SCADA system.
2. Construct Human Machine Interface (HMI) in SCADA system and their network communication.
3. Propose the IoT concepts in applications.

SYNOPSIS

The course provides an introduction to the fundamentals of Supervisory Control and Data Acquisition (SCADA), the architecture, the components, Human Machine Interface (HMI) and the applications of SCADA. Students also introduced to the concept of Internet of Things (IoT), network communications and the applications. Lectures and labs will place emphasis on the above items will allow the student to operate the monitoring system and make data analysis throughout the semester.

REFERENCES

1. Ovidiu Vermesan, Peter Friess,Internet of Things – From Research and Innovation to Market Deployment.Denmark: River Publishers.,2014.
2. Practical SCADA system for Industry.Australia: IDC Technologies Pty Ltd., 2011.
3. Product Catalog.Version 1.2: Makina., 2018.
4. IOT SCADA Software Installation and User Manual.Pontedera: Alleantia., 2014.
5. INTERNET OF THINGS: tutorials point (I)., 2016.

BELS 3554
INDUSTRIAL DATA ANALYSIS/ ANALISIS DATA PERINDUSTRIAN

LEARNING OUTCOMES

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

1. Apply knowledge of data analysing technology.
2. Analyse statistical data technology.
3. Evaluate data with graphical analysing method.

SYNOPSIS

The course provides an introduction for Microsoft excel & R software and how to use for statistic academic purposes.

REFERENCES

1. Hothorn, T., & Everitt, B. (2009). A Handbook of Statistical Analyses Using R, Second Edition. A Handbook of Statistical Analyses Using R.
2. Vemuri, V. K. (2018). A first course in statistical programming with R, Second Edition. Journal of Information Technology Case and Application Research, 1–3.
3. Carlberg, C. (2011). Statistical analysis - Microsoft Excel 2010. Pearson.
4. Hansen, M. A. E. (2007). Data Analysia with Excel. Metabolome Analysis - An introduction (Vol. 47).
5. Alfred P.Rovai. (2016). Statistical Fundamental Using Microsoft Excel for Univariate and Bivariate Analysis, Third Edition. Watertree Press LLC.
6. Rohatgi, V. K., & Saleh, A. K. M. E. (2015). An Introduction to Probability and Statistics: Third Edition. An Introduction to Probability and Statistics: Third Edition.
7. Pandis, N. (2016). Correlation and linear regression. American Journal of Orthodontics and Dentofacial Orthopedics.
8. Kerns. (2005). Introduction to Probability and Statistics using R. Technometrics, 47(3), 378–378.
9. Roxy, P., Chris, O., & Jay, D. (2016). Introduction to Statistics & Data Analysis, Fifth Edition. California University of Pennsylvania, California, PA.

BTMW 3134
CAPSTONE TECHNOPRENEUR II/ CAPSTONE TEKNOUSAHAWAN II

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Make use of the business model canvas incorporating human and financial elements.
2. Write a convincing business plan.
3. Motivate all stakeholders and build a cohesive venture team.

SYNOPSIS

The start-up and growth of an enterprise invariably involves both human and financial capital. To manage the increasing pool of human resources and to convince venture capitalists to invest become two main issues especially for growing venture. This course consists of two parts: in the first part, organization and human resource management are introduced; in the second part, the focus is on writing a convincing business plan to attract venture capital investment. When enterprise starts to take shape and grow, more people will be hired, proper organization, team building and human resource management will become important issues. In this course, students will be exposed to the various organizational aspects relevant to new ventures and established companies. These include the pros and cons of the different organization structures, conflicts that may arise among employees, and approaches to building strong teams. Human resource management techniques will also be introduced and discussed.

In the second part of the course, the business model canvas will be described listing the connections among the different components of a business. The value of a business plan and the techniques of writing a business plan will be introduced.

REFERENCES

1. NTU (2013). Entrepreneurship & Innovation Asia. Overview. Nanyang Technological University, Singapore: Nanyang Technopreneurship Center.
2. Cremades, A. (2016). The Art of Startup Fundraising. Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know. Hoboken, NJ: John Wiley & Sons.
3. McKinsey & Co., Koller, T., Goedhart, M. & Wessels, D. (2015). Valuation. Measuring and Managing the Value of Companies, 6th edn. Hoboken, NJ: John Wiley & Sons.
4. Stowe, J. D., Robinson, T. R., Pinto, J. E. & McLeavey, D. W. (2007). Equity Asset Valuation. Hoboken, NJ: John Wiley & Sons.
5. Pereiro, L. E. (2002). Valuation of Companies in Emerging Markets. A Practical Approach. New York: John Wiley & Sons.
6. OECD (2015). Boosting Malaysia's National Intellectual Property System for Innovation. Paris: OECD Publishing.

SEMESTER 6

BELS 3664
MAINTENANCE MANAGEMENT SYSTEM (MMS)/ SISTEM PENGURUSAN PENYELENGGARAAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Demonstrate competency in manage and developing the maintenance activities in industrial environment.
2. Perform maintenance activities in a cost effective manner using appropriate software.
3. Apply of contemporary maintenance management practices.

SYNOPSIS

This course will introduce student to principle of maintenance management system. The topics to be covered including Introduction to Maintenance Management, Reliability performance of production plants, Total Productive Maintenance (TPM), Maintenance methods and techniques and Maintenance Software Application. Apart of the course implementation, there will be an industrial visit to related industries in order to expose student to the actual practices of maintenance management system.

REFERENCES

1. Allan Wilson Asset Maintenance Management; Industrial Press, 2002.
2. Mobley, RK, ed. Maintenance engineering handbook. 8th ed. New York: McGraw-Hill, 2014. ISBN 9780071826617.

3. Total Productive Maintenance, S Borris, McGraw-Hill (2006).
4. Assets maintenance management A guide to developing strategies and improving performance, A Wilson (2007)
5. Reliability-Centred Maintenance, S Moubray, Butterworth and Heinemann (1997).
6. Reliability-Centred Maintenance: Management and Engineering Methods, Anderson, R.T and Neri, L (1990).
7. Introduction to Total Productive Maintenance, S Nakajima, Productivity Press (1988).

BELS 3674
PROJECT PLANNING AND EXECUTION/ PERANCANGAN PROJEK DAN PERLAKSANAAN

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Create a project budget, control project plan and handle a technical work.
2. Built a team project, create a project and identify the project scope, task, and project schedule by using a Gantt Chart.
3. Evaluate project critical path, analyse the project problems, solve the problems, make decision and complete a report.

SYNOPSIS

The course provides an introduction to the key concepts of planning and executing projects that will identify a factors that lead to project success, and learn how to plan, analyse, and manage projects. Students will be exposed to various challenges to complete their projects.

REFERENCES

1. Rod Baxter (2016), Project Management for Success Handbook: Manage the Project -Ensure the Results – Celebrate Success.Lulu.com.
2. Kory Kogon, Suzette Blakemore, James Wood (2015), Project Management for the Unofficial Project Manager. BenBella Books.
3. Paul Whatley (2014). Project Planning Handbook. Troubador Publishing Ltd.
4. Parviz F. Rad, Vittal S. Anantatmula (2005). Project Planning Techniques. Berrett-Koehler Publishers, Inc.
5. Gregory T. Haugan PhD, PMP (2001). Project Planning and Scheduling. Berrett-Koehler Publishers, Inc.

BELS 3684
FINAL YEAR PROJECT I/ PROJEK TAHUN AKHIR I

LEARNING OUTCOMES

Upon completing this subject, the student should be able to:

1. Identify issues or problems in industrial technology and propose solutions.
2. Provides proposal for the implementation of Final Year Project.
3. Presents ideas related to research to panel evaluators in more systematic.

SYNOPSIS

This course is for fulfil students with knowledge in conducting research methods, particularly in the field of technical and vocational education in Malaysia. It is important in providing human capital development equivalent with global developments.

REFERENCES

1. Rowena, M., How to write a thesis. 3rd Edition. England: Open University Press, 2011.
2. J S Graustein , How to Write an Exceptional Thesis or Dissertation: A Step-By-Step Guide from Proposal to Successful Defense, Atlantic Publishing Group, 2014.

3. David Evans, Paul Gruba, Justin Zobel, How to write better thesis,Springer, 2014.
4. Jurnal-jurnal akademik.

SHORT SEMESTER

BELS 3696
FINAL YEAR PROJECT II/ PROJEK TAHUN AKHIR II

LEARNING OUTCOMES

After completing the course, students will be able to:
1. Identify issues or problems in industrial technology and propose solutions.
2. Provides proposal for the implementation of Final Year Project.
3. Presents ideas related to research to panel evaluators in more systematic.

SYNOPSIS

This course is for fulfil students with knowledge in conducting research methods, particularly in the field of technical and vocational education in Malaysia. It is important in providing human capital development equivalent with global developments.

REFERENCES

1. Rowena, M., How to write a thesis. 3rd Edition. England: Open University Press, 2011.
2. J S Graustein , How to Write an Exceptional Thesis or Dissertation: A Step-By-Step Guide from Proposal to Successful Defense, Atlantic Publishing Group,2014.
3. David Evans, Paul Gruba, Justin Zobel, How to write better thesis, Springer, 2014.
4. Jurnal-jurnal akademik.

SEMESTER 7

BELP 41112
INDUSTRIAL TRAINING/ LATIHAN INDUSTRI

LEARNING OUTCOME

At the end of the subject, students should be able to:
1. Organizes productive work schedule.
2. Presents communication skills and interact effectively in the organization.
3. Practices self -discipline and responsibility attitude working in a team.

SYNOPSIS

This course is to expose students about the real environment working in engineering field. Understand the work culture in the industry and developing students' technical and interpersonal skills as a preparation when serving in industrial environment.

REFERENCES

1. University Industrial Training Guidelines.
2. Faculty Industrial Training Guidelines.
3. University Academic Regulations.

APPENDIX

APPENDIX A: STUDENT AUDIT FORM - DEL PROGRAM

INSTRUCTIONS TO STUDENTS (COMPULSARY FOR EACH SEMESTER)

1. Students are required to keep record of their obtained grades for a given course for graduation purpose.
2. Refer to SMP system to fill in your grades, GPA & CGPA.

ACADEMIC ADVISOR NAME :	
STUDENT NAME :	
MATRIX NO. :	
COHORT/YEAR OF ENTRY :	
HP CONTACT :	
EMAIL :	

CATEGORY	COURSE STATUS	STATUS HW	CREDIT HOURS		TO BE FILLED IN BY STUDENTS IN EACH SEMESTER						
					KHAS 0	1	2	KHAS 1	3	4	5
E	-	-	6	6							
P	-	-	60	68							
	LI	HW	8								
W	-	-	14	16							
	KK	-	2								
		Total credit	90								

LIST OF COURSE GRADES

SEMESTER	CODE	COURSE	CATEGORY	CREDIT	TO BE FILLED IN BY STUDENTS GRADE	STATUS (UM)	GPA	CGPA
SPECIAL SEMESTER 0	DLLW 1112	FOUNDATION ENGLISH	W	2				
	DLHW 1742	LEADERSHIP	W	2				
	DLHW 2772	APPRECIATION OF ETHICS AND CIVILISATIONS	W	2				
			TOTAL	6				
SEMESTER 1	DELA 1212	ALGEBRA	P	2				
	DELA 1113	PHYSICS	P	3				
	DELP 1111	BASIC ELECTRICAL SKILL	P	1				
	DELE 1113	PRINCIPAL OF ELECTRICAL AND ELECTRONICS	P	3				
	DELE 1123	DIGITAL ELECTRONICS	P	3				
	DELC 1113	INSTRUMENTATION & MEASUREMENT	P	3				

					TO BE FILLED IN BY STUDENTS			
SEMESTER	CODE	COURSE	CATEGORY	CREDIT	GRADE	STATUS (UM)	GPA	CGPA
	DLLW 2122	ENGLISH FOR EFFECTIVE COMMUNICATION	W	2				
	DKKX 1XX1	CO-CURRICULUM I	W	1				
			TOTAL	18				
SEMESTER 2	DEKA 1222	CALCULUS	P	2				
	DEKP 1213	ELECTRICAL CIRCUIT I	P	3				
	DMKU 1323	INTRODUCTION TO MECHANICAL SYSTEM	P	3				
	DELG 1113	COMPUTER PROGRAMMING	P	3				
	DEKE 1213	ANALOGUE ELECTRONICS	P	3				
	DEKP 1211	ELECTRICAL WORKSHOP	P	1				
	DLLW 3132	ENGLISH FOR MARKETABILITY	W	2				
	DKKX 2XX1	CO-CURRICULUM I	W	1				
			TOTAL	18				
SPECIAL SEMESTER I	DEKA 1312	SAFETY AND HEALTH FOR ENGINEERS	P	2				
	DEKC 1313	MICROPROCESSOR	P	3				
	DTMW 1012	FUNDAMENTALS OF ENTREPRENEURSHIP ENCULTURATION	W	2				
			TOTAL	7				
SEMESTER 3	DEKA 2333	DIFFERENTIAL EQUATIONS	P	3				
	DEKE 2123	POWER ELECTRONICS	P	3				
	DEKC 2113	CONTROL SYSTEM ENGINEERING	P	3				
	DEKE 2113	ELECTRICAL MACHINE	P	3				
	DEKP 2113	ELECTRIC CIRCUIT II	P	3				
	DEKC 2123	AUTOMATION	P	3				
			TOTAL	18				
SEMESTER 4	DEKA 2342	ENGINEERING MATHEMATICS	P	2				
	DEKP 2213	POWER SYSTEM	P	3				
	DEKP 2214	DIPLOMA PROJECT	P	4				
		CHOOSE ONLY TWO (2) COURSES						
	DEKP 2223	RENEWABLE ENERGY AND APPLICATION	E	3				
	DEKP 2233	BUILDING MAINTENANCE AND MANAGEMENT	E	3				
	DEKC 2213	INDUSTRIAL ROBOTICS	E	3				
			TOTAL	15				
SEMESTER 5	DEKU 3118	INDUSTRIAL TRAINING	P (HW)	8				
			TOTAL	8				
			MINIMUM TOTAL CREDIT	90				

APPENDIX B: STUDENT AUDIT FORM - BELG PROGRAM

INSTRUCTIONS TO STUDENTS (COMPULSARY FOR EACH SEMESTER)

Instructions for the student :	1. Fill in the **YELLOW HIGHLIGHTED SPACES** - your details and grade obtained for each subjects up the current. 2. Fill in "EXEMPTED" for credit exempted subjects, "PASS" or "FAIL" for BELU3695 INDUSTRIAL TRAINING and BLHC 4032 CRITICAL AND CREATIVE THINKING and left "INSERT GRADE" for subjects not yet taken. 3. Return the completed form to your academic advisor.
Instructions for the academic advisor :	1. Double confirm the information trough the SMP system (Maklumat Kohort Pelajar). 2. Report the results/highlights any problem in regards to the audit to the program owner (HOD/TDA).

ACADEMIC ADVISOR NAME :	
STUDENT NAME :	
MATRIX NO. :	
COHORT/YEAR OF ENTRY :	
HP CONTACT :	
EMAIL :	

SYARAT MINIMUM KREDIT UNTUK KBA				
KATEGORI MP	**STATUS MP**	**STATUS HW**	**JUMLAH DIPERLUKAN**	**JUMLAH TERKINI DIPEROLEHI**
E (ELEKTIF)	**PROGRAM**	-	9	
	UNIVERSITY	-	4	
P (PROGRAM)	**OTHERS**	-	96	
	ENGINEERING SEMINAR	HW	1	
	LI	HW	5	
	PSM	-	6	
W	-	-	12	
	KURIKULUM	-	2	
JUMLAH KESELURUHAN			135	

LIST OF COURSE GRADES

SEMESTER OF STUDY	CODE	COURSES	CATEGORY	CREDIT	GRADE	CREDIT OBTAINED	REMARK BY PA
SEMESTER 1	BLLW 1XX2	ELECTIVE 1 (UNIVERSITY)	E	2	INSERT GRADE	0	
	BKKX 1XX1	CO-CURRICULUM I	W	1	INSERT GRADE	0	
	BMIG 1313	ENGINEERING MATHEMATICS 1	P	3	INSERT GRADE	0	
	BITG 1233	COMPUTER PROGRAMMING	P	3	INSERT GRADE	0	
	BELG 1123	PRINCIPLES OF ELECTRICAL AND ELECTRONICS	P	3	INSERT GRADE	0	
	BMIG 1213	ENGINEERING MATERIALS	P	3	INSERT GRADE	0	
	BELU 1131	ENGINEERING PRACTICE I	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**16**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**16**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 2	BLHW 1762	PHILOSOPY AND CURRENT ISSUES	W	2	INSERT GRADE	0	
	BLLW 1142	ENGLISH FOR ACADEMIC PURPOSES	W	2	INSERT GRADE	0	
	BKKX 1XX1	CO-CURRICULUM II	W	1	INSERT GRADE	0	
	BMKC 1013	DIFFERENTIAL EQUATIONS	P	3	INSERT GRADE	0	
	BERG 1413	DIGITAL ELECTRONICS	P	3	INSERT GRADE	0	
	BELU 1123	ELECTRICAL CIRCUIT I	P	3	INSERT GRADE	0	
	BELG 1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	P	3	INSERT GRADE	0	
	BELU 1231	ENGINEERING PRACTICE II	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**18**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**34**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 3	BLLW 2152	ACADEMIC WRITING	W	2	INSERT GRADE	0	
	BELG 2443	ENGINEERING MATHEMATICS 2	P	3	INSERT GRADE	0	
	BMKU 1313	ENGINEERING GRAPHICS AND CAD	P	3	INSERT GRADE	0	
	BELE 2333	ANALOGUE ELECTRONICS	P	3	INSERT GRADE	0	
	BELC 2433	SIGNALS AND SYSTEMS	P	3	INSERT GRADE	0	
	BELU 2333	ELECTRICAL CIRCUIT II	P	3	INSERT GRADE	0	
	BELU 2331	ELECTRICAL ENGINEERING LABORATORY I	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**18**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**52**	**CUMULATIVE CREDITS OBTAINED**	**0**	

SEMESTER 4	#BLHW 2772 *BLHW 2752	APPRECIATION OF ETHICS AND CIVILISATIONS MALAYSIAN CULTURE	W	2	INSERT GRADE	0	
	BERN 2143	ENGINEERING STATISTICS	P	3	INSERT GRADE	0	
	BELG 2433	ELECTRICAL SYSTEMS	P	3	INSERT GRADE	0	
	BELP 2453	ELECTROMAGNETIC THEORY	P	3	INSERT GRADE	0	
	BELC 2453	COMMUNICATION SYSTEMS	P	3	INSERT GRADE	0	
	BMKU 2432	INTRODUCTION TO MECHANICAL ENG	P	2	INSERT GRADE	0	
	BELU 2431	ELECTRICAL ENGINEERING LABORATORY II	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**17**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**69**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 5	BLLW3162	ENGLISH FOR PROFESIONAL INTERACTION	W	2	INSERT GRADE	0	
	BELE 3533	ELECTRICAL MACHINE	P	3	INSERT GRADE	0	
	BELC 3523	CONTROL SYSTEM ENGINEERING	P	3	INSERT GRADE	0	
	BELC 3543	MICROPROCESSOR	P	3	INSERT GRADE	0	
	BELP 3673	POWER SYSTEM ANALYSIS	P	3	INSERT GRADE	0	
	BELE 3543	POWER ELECTRONICS	P	3	INSERT GRADE	0	
		TOTAL CREDITS		**17**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**86**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 6	BELX XXX3	ELECTIVE 1 (PROGRAM)	E	3	INSERT GRADE	0	
	BELE 3653	ELECTRICAL DRIVES	P	3	INSERT GRADE	0	
	BELC 3663	CONTROL AND INSTRUMENTATION	P	3	INSERT GRADE	0	
	BELP 3693	HIGH VOLTAGE ENGINEERING	P	3	INSERT GRADE	0	
	BELG 3673	INTEGRATED DESIGN PROJECT	P	3	INSERT GRADE	0	
	BELU 3551	ELECTRICAL ENGINEERING LABORATORY III	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**16**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**102**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SPECIAL SEMESTER	BELU 3695	INDUSTRIAL TRAINING		5	PASS/FAIL	0	
		TOTAL CREDITS		**5**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**

		CUMULATIVE TOTAL CREDITS		**107**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 7	BELU 4861	ENGINEERING SEMINAR	P	1	PASS/FAIL	0	
	BELU 4792	FINAL YEAR PROJECT I	P	2	INSERT GRADE	0	
	BELP 4843	RENEWABLE ENERGY	P	3	INSERT GRADE	0	
	BMIU 3213	ENGINEERING ECONOMY AND MANAGEMENT	P	3	INSERT GRADE	0	
	BLHW 2792	INTEGRITY AND ANTICORRUPTION	E	2	INSERT GRADE	0	
	BELX XXX3	ELECTIVE II (PROGRAM)	E	3	INSERT GRADE	0	
		TOTAL CREDITS		**14**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**121**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 8	BTMW 4012	TECHNOLOGY ENTREPRENEURSHIP	W	2	INSERT GRADE	0	
	BERN 3322	ENGINEER AND SOCIETY	P	2	INSERT GRADE	0	
	BELU 4894	FINAL YEAR PROJECT II	P	4	INSERT GRADE	0	
	BELP 4853	ENERGY UTILIZATION AND CONSERVATION	P	3	INSERT GRADE	0	
	BELX XXX3	ELECTIVE III (PROGRAM)	E	3	INSERT GRADE	0	
		TOTAL CREDITS		**14**	**TOTAL CREDITS OBTAINED**	**0**	
		CUMULATIVE TOTAL CREDITS		**135**	**CUMULATIVE CREDITS OBTAINED**	**0**	

APPENDIX C: STUDENT AUDIT FORM - BELM PROGRAM

INSTRUCTIONS TO STUDENTS (COMPULSARY FOR EACH SEMESTER)

Instructions for the student :	1. Fill in the **YELLOW HIGHLIGHTED SPACES** - your details and grade obtained for each subjects up the current. 2. Fill in "EXEMPTED" for credit exempted subjects, "PASS" or "FAIL" for BELU3695 INDUSTRIAL TRAINING and BLHC 4032 CRITICAL AND CREATIVE THINKING and left "INSERT GRADE" for subjects not yet taken. 3. Return the completed form to your academic advisor.
Instructions for the academic advisor :	1. Double confirm the information through the SMP system (Maklumat Kohort Pelajar). 2. Report the results/highlights any problem in regards to the audit to the program owner (HOD/TDA).

ACADEMIC ADVISOR NAME :	
STUDENT NAME :	
MATRIX NO. :	
COHORT/YEAR OF ENTRY :	
HP CONTACT :	
EMAIL :	

SYARAT MINIMUM KREDIT UNTUK KBA				
KATEGORI MP	**STATUS MP**	**STATUS HW**	**JUMLAH DIPERLUKAN**	**JUMLAH TERKINI DIPEROLEHI**
E (ELEKTIF)	**PROGRAM**	**-**	**6**	
P (PROGRAM)	**OTHERS**	**-**	**99**	
	ENGINEERING SEMINAR	**HW**	**1**	
	LI	**HW**	**5**	
	PSM	**-**	**6**	
	-	**-**	**16**	
W	**KURIKULUM**	**-**	**2**	
	135			
JUMLAH KESELURUHAN			**135**	

LIST OF COURSE GRADES

SEMESTER OF STUDY	CODE	COURSES	CATEGORY	CREDIT	GRADE	CREDIT OBTAINED	REMARK BY PA
SEMESTER 1	BLLW 1142	ENGLISH FOR ACADEMIC PURPOSES	W	2	INSERT GRADE	0	
	BKKX XXX1	CO-CURRICULUM I	W	1	INSERT GRADE	0	
	BMIG 1313	ENGINEERING MATHEMATICS 1	P	3	INSERT GRADE	0	
	BELG 1123	PRINCIPLES OF ELECTRICAL AND ELECTRONICS	P	3	INSERT GRADE	0	
	BMIG 1213	ENGINEERING MATERIALS	P	3	INSERT GRADE	0	
	BELM 2342	INTRODUCTION TO MECHATRONICS	P	2	INSERT GRADE	0	
	BELU 1131	ENGINEERING PRACTICE I	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**15**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**15**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 2	BKKX XXX1	CO-CURRICULUM II	W	1	INSERT GRADE	0	
	BMKC 1013	DIFFERENTIAL EQUATIONS	P	3	INSERT GRADE	0	
	BERG 1413	DIGITAL ELECTRONICS	P	3	INSERT GRADE	0	
	BMKU 1313	ENGINEERING GRAPHICS AND CAD	P	3	INSERT GRADE	0	
	BELU 1123	ELECTRICAL CIRCUIT I	P	3	INSERT GRADE	0	
	BMKU 1123	STATICS & MECHANICS OF MATERIAL	P	3	INSERT GRADE	0	
	BELU 1231	ENGINEERING PRACTICE II	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**17**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**32**	**CUMULATIVE CREDITS OBTAINED**	**0**	

SEMESTER 3	BELG 2443	ENGINEERING MATHEMATICS 2	P	3	INSERT GRADE	0	
	BITG 1233	COMPUTER PROGRAMMING	P	3	INSERT GRADE	0	
	BELU 2333	ELECTRICAL CIRCUIT II	P	3	INSERT GRADE	0	
	BELG 1233	PRINCIPLES OF INSTRUMENTATION AND MEASUREMENT	P	3	INSERT GRADE	0	
	BMKU 1253	DYNAMICS & MECHANISM	P	3	INSERT GRADE	0	
	BMKU 2372	FLUID MECHANICS	P	2	INSERT GRADE	0	
	BELB 1231	ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**18**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**50**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 4	BLHW 2452	ACADEMIC WRITING	W	2	INSERT GRADE	0	
	BERN 2143	ENGINEERING STATISTICS	P	3	INSERT GRADE	0	
	BELC 2433	SIGNAL & SYSTEMS	P	3	INSERT GRADE	0	
	BELE 2422	ANALOGUE ELECTRONICS APPLICATIONS	P	2	INSERT GRADE	0	
	BELC 3533	INTRODUCTION TO CONTROL SYSTEM	P	3	INSERT GRADE	0	
	BELC 3543	MICROPROCESSOR	P	3	INSERT GRADE	0	
	BELM 2321	MECHANICAL ENGINEERING LABORATORY	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**17**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**67**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 5	BLLW 3162	ENGLISH FOR PROFESSIONAL INTERACTION	W	2	INSERT GRADE	0	
	BMIU 3213	ENGINEERING ECONOMY AND MANAGEMENT	P	3	INSERT GRADE	0	
	BELG 2433	ELECTRICAL SYSTEMS	P	3	INSERT GRADE	0	
	BELM 3453	MICROCONTROLLER TECHNOLOGY	P	3	INSERT GRADE	0	
	BELM 3543	ELECTROMECHANICAL SYSTEMS	P	3	INSERT GRADE	0	
	BELC 3643	CONTROL SYSTEM ENGINEERING	P	3	INSERT GRADE	0	
	BELC 2421	CONTROL SYSTEMS LABORATORY	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**18**	**TOTAL CREDITS OBTAINED**	**0**	
		CUMULATIVE TOTAL CREDITS		**85**	**CUMULATIVE CREDITS OBTAINED**	**0**	

SEMESTER 6	#BLHW 1762 *BLHW 1742	PHILOSOPY AND CURRENT ISSUES MALAYSIAN STUDIES	W	2	INSERT GRADE	0	
	BELM 3653	INTEGRATED DESIGN PROJECT	P	3	INSERT GRADE	0	
	BELC 4753	PLC & AUTOMATION	P	3	INSERT GRADE	0	
	BMKU 3643	HYDRAULIC & PNEUMATIC SYSTEMS	P	3	INSERT GRADE	0	
	BMKU 3653	THERMODYNAMICS & HEAT TRANSFER	P	3	INSERT GRADE	0	
	BELM 3641	MECHATRONICS SYSTEM ENGINEERING LABORATORY I	P	1	INSERT GRADE	0	
		TOTAL CREDITS		**15**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**100**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SPECIAL SEMESTER II	BELU 3695	INDUSTRIAL TRAINING	P	5	PASS/FAIL	0	
		TOTAL CREDITS		**5**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**105**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 7	BLLW 1XX2	ELECTIVE I (UNIVERSITY)	E	2	INSERT GRADE	0	
	BELU 4792	FINAL YEAR PROJECT I	P	2	INSERT GRADE	0	
	BELM 4763	ROBOTICS	P	3	INSERT GRADE	0	
	BELC 2453	COMMUNICATION SYSTEMS	P	3	INSERT GRADE	0	
	BELM 4751	MECHATRONICS SYSTEM ENGINEERING LABORATORY II	P	1	INSERT GRADE	0	
	BELU 4861	ENGINEERING SEMINAR	P	1	PASS/FAIL	0	
	BELM 4783/ BELC 4873	ELECTIVE I (PROGRAM): MACHINE VISION / ARTIFICIAL INTELLIGENCE	E	3	INSERT GRADE	0	
		TOTAL CREDITS		**15**	**TOTAL CREDITS OBTAINED**	**0**	**REMARK BY PA**
		CUMULATIVE TOTAL CREDITS		**120**	**CUMULATIVE CREDITS OBTAINED**	**0**	
SEMESTER 8	BMIU 3213	TECHNOPRENEURSHIP	W	2	INSERT GRADE	0	
	BLHW 2772	APPRECIATION OF ETHICS AND CIVILISATIONS	W	2	INSERT GRADE	0	
	BERN 3322	ENGINEER AND SOCIETY	P	2	INSERT GRADE	0	
	BELU 4894	FINAL YEAR PROJECT II	P	4	INSERT GRADE	0	
	BLHW 2792	INTEGRITY AND ANTI CORRUPTION	W	2	INSERT GRADE	0	
	BELC 4683/ BELC 4883/ BELM 4823	ELECTIVE I (PROGRAM): DIGITAL CONTROL SYSTEMS/ ADVANCED MANUFACTURING SYSTEMS/ DATA COMMUNICATIONS & COMPUTER NETWORKING	E	3	INSERT GRADE	0	
		TOTAL CREDITS		**15**	**TOTAL CREDITS OBTAINED**	**0**	
		CUMULATIVE TOTAL CREDITS		**135**	**CUMULATIVE CREDITS OBTAINED**	**0**	

PO ATTAINMENT CALCULATION

PO ATTAINMENT

The Program Outcomes (PO) are the qualities that must be attained in the graduates by the time of completion of their program. At the end of each semester, the PO attainment by cohort is calculated to see the current performance of the cohort. At the end of the program, the accumulated PO attainment of all curriculum components is assessed to see the overall performance of the cohort. The indicator of each PO attainment for all programs in FTKE is defined by more than 60% of the students get above 50% of allocation marks in the assessment.

Calculation method of PO attainment: Weighted Average Method

Let j, $j \in \{1,2, \dots ,12\}$ represents number of POs and t defines the cohort of the FTKE students. The PO_j^t attainment is calculated by

$$PO_j^t = \frac{\sum_{i=1}^{N_j} w_i c_i p_{i,j}}{\sum_{i=1}^{N_j} w_i c_i}$$

where N_j is the total number of courses mapping to the PO_j^t, $p_{i,j}$ is a percentage of course i for each PO attainment, $i \in \{1,2, \dots , N_j\}$, w_i represents a weightage component of PO_i^t and c_k denotes the credit hour for course k.

EXAMPLE: PO1 CALCULATION OF COHORT X

COURSE	PERCENTAGE, p_i	WEIGHTAGE, w_i	CREDIT, c_i	Formula
A	67.46	1	3	$$N_1 = n = 8$$ $$\mathbf{PO1} = \frac{\sum_{i=1}^{n} w_i c_i p_i}{\sum_{i=1}^{n} w_i c_i}$$ $$\mathbf{PO1} = \frac{(67.46 \times 1 \times 3) + (67.46 \times 1 \times 3) \ldots + (67.46 \times 1 \times 3)}{(1 \times 3) + (0.5 \times 2) \ldots + (0.75 \times 3)}$$ $$\mathbf{PO1} = 67.70\%$$
B	70.06	0.5	2	
C	98.06	1	3	
D	83.43	0.2	3	
E	20.45	0.5	3	
F	34.25	0.25	3	
G	100	0.4	1	
H	59.2	0.75	3	

MESYUARAT JK PERANCANGAN AKADEMIK DAN PERLAKSANAAN OBE BIL. 1/2019

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